

## Der Herrgott würfelt nicht!

The main task of this website is to suggest a new, [Relative Scale theory of gravity](#) based on a hypothetical [Arrow of Space](#) which springs from [God](#) (Luke 17:21).

The basics of Quantum Theory are spelled out [here](#), starting from a well-known task, since [1929](#). The latest entry is from 20 October 2013 at [20:05 GMT](#).

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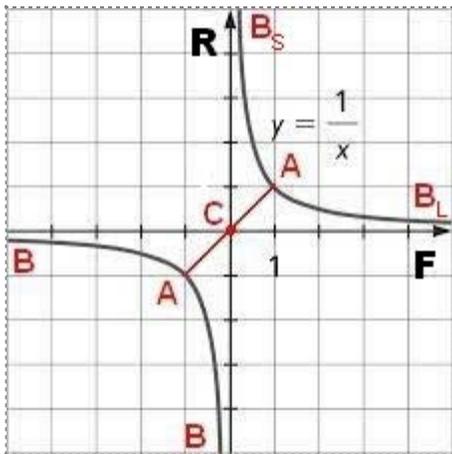
### [Indefinable Boundary: Point I and Points II](#)

#### **Abstract**

At every instant '[now](#)' the spacetime points are determined by [matter](#), and have [dual structure](#): the spacetime it is *both* irreversibly fixed in the past *and*

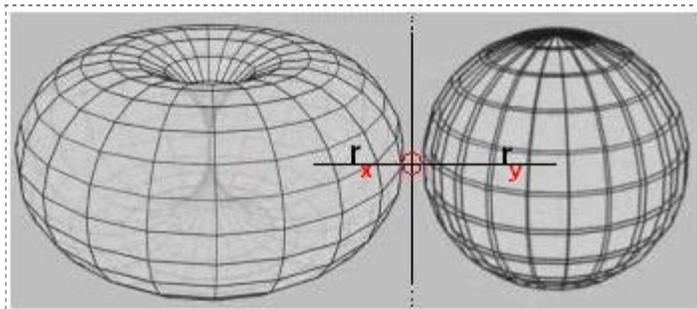
**indefinable** in the future. At every instant 'now' points emerge, and have structure (**FR = 1**) exhibited with Point **I** and Points **II**.

Every point is emerging -- one-at-a-time -- in the Arrow of Space as **dual** object: it is *both* irreversibly fixed in the past by Points **II** and "open" (*indefinable* by matter) in Point **I** (global mode of spacetime). The "separator" between Point **I** and Points **II** is the instant 'now'. The Cauchy limit is the final endpoint **C** (Point **I**) from which Points **II** emerge in the irreversible past as *perfect* continuum (called local mode of spacetime) in which **dt/ds** is effectively non-existent, while at the same instant 'now' the initial Point **I** offers the **next** 'open set' of re-created Points **II** to be chosen from the *potential* future of the Arrow of Space in the **next** elementary step **dt/ds**. Because every point is **dual** object, it is also suggested that the logic of propositions and truth statements must be YAIN (Yes **A**nd ne**IN**).



**FR = 1**

The Universe has indefinable boundary at **C**. No function can be defined on the very endpoint **C** (Point **I**). In the Cauchy limit Ansatz  $[\epsilon(\dots)\epsilon]$ , the untraceable endpoint **C** is excluded by using *open* intervals only. Surely with *actual* infinity we can think like bartenders and obtain the *physical* Points **II** (always in plural), but **never** the endpoint **C** (Point **I**) itself.



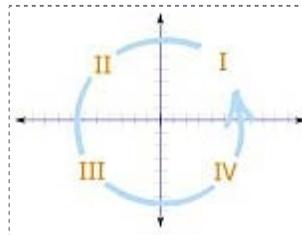
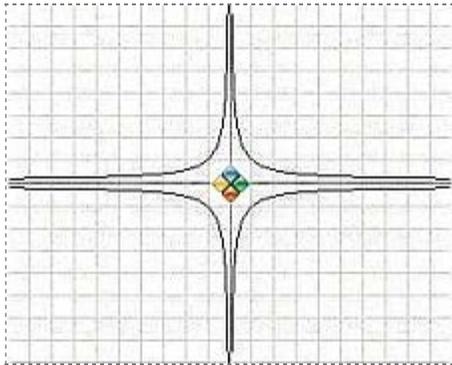
$r_x r_y = 1$  (multiplicative identity)

---  --- > **C** < ---  ---

Perfectly smooth torus-sphere transition *via* endpoint **C** in the so-called global mode of spacetime of Point **I** (the Universe as [ONE](#)).

The small red circle contains the [Dedekind cut](#) **C** in *the infinite*, unphysical, and non-Archimedean spacetime (Point **I**) of the loop 'now' (see [below](#)), obtained with **actual** infinity. An *asymptotically* flat spacetime (called [flash](#) or [slice](#)) corresponds to the local (physical) mode of spacetime. It is made of physical Points **II** which can be individuated with **matter** (the [Cheshire cat](#)) and hence obtain point-like numbers, included *imprecise* ones from [irrationals](#).

The four quadrants below are [mirror images](#) obtained by replacing (t) with (-t) and 'left' with 'right' (not shown). The [atemporal loop 'now'](#) is nested *within* Point **I** (endpoint **C**) in the non-Archimedean global mode of spacetime.



[Atemporal loop 'now'](#)

Spacetime quadrants in Relative Scale gravity (the favicon of this website is inserted as decoration only)

## Outline

In [Relative Scale \(RS\) gravity](#), the *emergence* of asymptotic boundaries of spacetime in the Large (**B**) and the *emergence* of physical points in the Small (**B**) are produced [en bloc](#) by Point **I**, with Points **II**. We shall introduce Point **I**: a non-Archimedean, *uncountably* infinite, *purely* geometrical (a grin [without the Cheshire cat](#)), and potential (*yet-to-become physicalized*) entity inhabiting the so-called global mode of spacetime from which the [Cauchy limit](#) and [Dedekind Schnitt](#) (**C**) are projected in the local (physical) mode of spacetime by Points **II** -- one-at-a-time along the [Arrow of Space](#). In [RS gravity](#), the whole local (physical) mode of spacetime (called also [flash](#)) is being [re-created en bloc](#) in two directions, toward the Large (**B**) and the Small (**B**), starting from **A** ([multiplicative identity](#)) in null "directions".

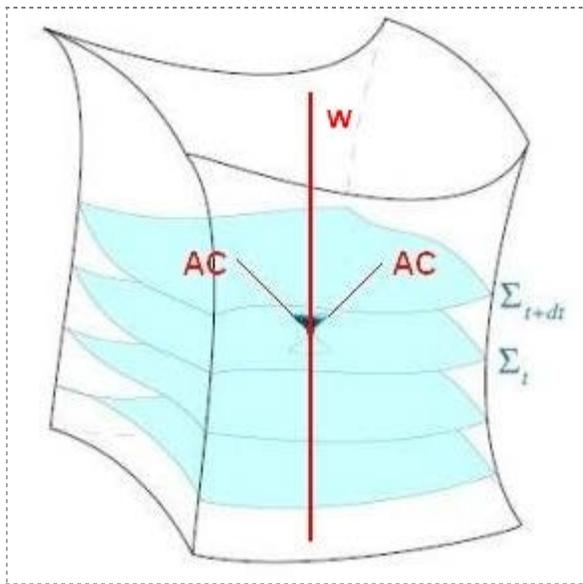
In a nutshell, our Ansatz explains the limit/cutoff (**C**) by replacing the options '*either finite or zero*' in [Archimedean geometry](#) with **emergence** (always with [unit probability](#)) of unique [flashes](#) from the global mode of spacetime -- one-[flash](#)-at-a-time along the [Arrow](#)

of Space. With Archimedean geometry only, the [Cauchy limit](#) and [Dedekind Schnitt](#) (C) bring two alternatives: either (i) always **finite** (hence never zero) **dt/ds** increments in spacetime, or (ii) always **zero**. The solution is to include non-Archimedean geometry as well, and use the instant '**now**' in the Arrow of Space as **separator**: option (i) belongs to '**potential reality**' (Point I), while option (ii) pertains to **ever-increasing past** (Points II).

Stated differently, Point I is yet-to-be-physicalized Macavity state ([Adam Helfer](#)) of *potential* negative-positive mass pairs (Belletête and Paranjape, [pp. 6-7](#)), called here **pure dark energy**, while Points II are individuated *only* by positive matter (Brill and Jang, 1980; [Hans Ohanian](#)).

Thus, the Universe remains in **indefinable** ONE state at Point I, to allow for its **potential future**, and at the same time (Sic!) is **fixed** by Points II in its **ever-increasing past**.

This is *the* only possible solution to the problems of [set theory](#) and Continuum Hypothesis: the "**carrier**" acting *within dt/ds* has been set to **zero** (*perfect* continuum) **by the "speed" of light**, hence producing an **ever-increasing past** by Points II, while at the same time the potential, *yet-to-become physical* state of the universe is presented with uncountably infinite (no metric can be defined on [null surfaces](#)) and purely geometrical Point I (the grin [without the cat](#)) residing in the **indefinable non-Archimedean** global mode of spacetime.



The Aristotelian Connection (AC) along the **w**-axis of the Arrow of Space

Taking the risk to be terribly boring again, I will introduce an example for '**potential reality**' from General Relativity (GR): the [reference fluid](#) and 'individuating field'. For reasons which I haven't been able to understand in the past 40 years, people frantically believe that GR were 'classical theory'. But it isn't, because it **can't**. Surely GR is not quantum theory, but is not classical theory either. In addition to the arguments from Erich Kretschmann (Über den physikalischen Sinn der Relativitätspostulate, *Annalen der Physik* **53** (1917) 575-614), in GR "fixation of a frame of reference and gauge transformations are intertwined in a manner not encountered in any other area of

physics" ([Peter Bergmann](#), 1988), which brings insurmountable problems to the [reference fluid](#) and 'individuating field'. As John Stachel explained in 1993 ([pp. 139-140](#)), "there is no structure on the differentiable manifold that is **both** independent of the metric tensor **and** able to serve as an individuating field", in order to **uniquely identity** "the points of the manifold by some property or properties that characterize(s) each of the points."

So, where and how does '[potential reality](#)' fit in this century old debate?

As [Clifford Will et al.](#) put it, "the principle of general covariance, upon which general relativity is built, implies that coordinates are simply labels of spacetime events that can be assigned completely arbitrarily (subject to some conditions of smoothness and differentiability). The only quantities that have physical meaning – the measurables – are those that are invariant under coordinate transformations. One such invariant is the number of ticks on an atomic clock giving the proper time between two events."

The first two sentences from the excerpt above are clear: an object will remain 'the same' if we look at it from different directions, just as a house remains invariant under different coordinates from different maps, say. These are **invariants**. But are they 'observables'?

**NB:** [Not in GR, ladies and gentlemen](#). The **invariant** objects in GR resemble [Platonic ideas](#), which are UNSpeakable and *physically indefinable*. If we say, for example, '[when it rains it pours](#)', we apply particular "coordinates" (words) to express an entity that can be equally well expressed with many different "coordinates" (languages), because it will always remain an **invariant object**, called here '[potential reality](#)'. In GR, the same phenomenon is called '[reference fluid](#)' and 'individuating field', thanks to which we have an **exact** 'one meter' and **exact** 'one second' as **invariant objects**. Just like [Platonic ideas](#), these invariants cannot be directly observed -- we can *physically* observe only their "shadows" cast with different "coordinates", and of course require that "coordinates are simply labels".

But look at the last sentence in the excerpt above: "One such invariant is the number of ticks on an atomic clock giving the proper time between two events." I strongly disagree: the phenomenon which creates time as **dt** cannot be temporal. Same tallies to space.

We can only try to *reproduce* these **invariants** in metrology, and inevitably use a [finite number of physical constituents](#). We cannot use *physical* Points **II** cast from *the* invariant 'one second' residing as 'potential reality' at Point **I**. The claim that an atomic clock "gives" the proper time is tantamount to saying that your morning coffee is hot because it contains many tiny little and very hot "particles".

These **invariants** produce the *physical* spacetime of Points **II** (local mode of spacetime). In [Relative Scale gravity](#), we further postulate that these **invariants** are **dual**. Namely, they "expand" toward the Small (**B**) and "contract" toward the Large (**B**), starting from **A** in [null "directions"](#), yet a co-moving observer will always observe [one and the same](#) 'meter', be it an electron or a galaxy; see [below](#).

To cut the long story short, gravity does *not* produce "[curvature](#)". It only "shrinks" the **invariant** 'one meter', after which bodies moves by the [principle of least action](#), and hence are "[attracted](#)" until they become neutralized by the opposite [centrifugal force](#): dynamical equilibrium. At scales larger than our solar system we encounter gravitational "[dark](#)" [effect](#) and further at Hubble scale its **mirrored** effect, called "[dark energy](#)".

This is how gravity builds up the physical universe. Simple, no?

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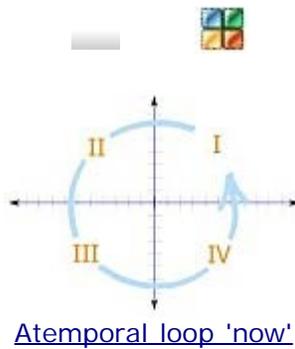
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Whether you believe you can do a thing or believe you can't, you are right, said [Henry Ford](#). Hence the only way to "predict" the future is to create it; see my first paper about *biocausality* from [January 1990](#).

Please follow the links below, and feel free to ask questions.



[Asymptotic boundary](#)



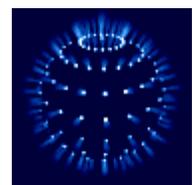
Origin of [light](#)



[Entanglement](#)



[Wilson chamber](#)



Torsion & [rotation](#)

**Relative Scale (RS) Theory of Gravity**



to the fixed observer A at the length scale of tables and chairs, the spacetime is indeed [Archimedean](#), while relative to the co-moving observers B *the same* spacetime undergoes mutual fusion by keeping *invariant length* of all objects toward the ends of the above drawing.

Who has 'the right scale'? Nobody, according to RSP, because all contradictory estimates of length, *relative* to observers A and B, are **in fact correct** -- the *scale* itself is **dual**. Namely, an object at Hubble scale will indeed be "large" and an elementary particle will be "small" to observer A and its [Archimedean](#) geometry, while at *the same time* the "two" (in fact, one) object(s) B will be **entangled** and will keep its invariant RS-size 'one and the same' in their respective domains pertaining to "two" (in fact, one) observer(s) B. In their respective domain(s) 'out there', an RS-large object does **not** contain many RS-small objects: both a galaxy and an electron are made of *one and the same* [uncountably infinite](#) "number" of geometrical points ([Georg Cantor](#)). Stated differently, the "two" RS-templates, cast in opposite "directions" with respect *only* to observer A, are in fact **one** entangled object with invariant RS "size". Hence the universe itself does **not** change its size but its metric, and *evolves* along the Arrow of Space as ONE bootstrapped self-regulated entity endowed with *self-acting* faculty from its [Aristotelian First Cause](#). The fact that we can think *about* our brain, **by** our brain, makes our brain 'self-acting'. Physically, we cannot observe our mind **in** the brain -- just a *self-acting* brain. In the case of 'the universe as [ONE brain](#)', simply replace *self-acting* brain with '[sufficient conditions](#) for spacetime'.

According to Relative Scale (RS) theory of gravity, there is *one and only one* "direction" which begins at the macroscopic world with [Archimedean](#) geometry (fixed observer A), with two **dual** presentations toward the Small and the Large, cast in the local (physical) mode of spacetime. This **dual** "direction" is denoted in the [Arrow of Space](#) with **w-axis**, and is being **nullified** by the "[speed](#)" of light -- one-instant-*now*-at-a-time. There is no background resembling some "canvas" ([John Baez](#)), but a **re-created** "back bone" of the whole universe *at all length scales*, made by matter **itself** -- [one-point-at-a-time](#).

The main applications of RSP are to suggest two *presentations* of entanglement, [quantum](#) and [gravitational](#), which do *not* occur in the spacetime of a fixed macroscopic observer A -- the underlying phenomenon of entanglement occurs in the **fused** spacetime with [non-Archimedean](#) geometry toward the Small and the Large, and the **dual** RS-distance controlled by entanglement remains *one and the same*. And secondly, the fundamental object which facilitates the entanglement is 'the universe as [ONE](#)', as explained with [Kochen-Specker Theorem](#) and [Wilson chamber](#). Thus, the RS theory of gravity explains the phenomenon of [curvature-and-rotation](#) as *alteration* of spacetime metric **by** 'the universe as [ONE](#)' (cf. [sufficient conditions](#) for spacetime): the so-called "dark matter" and "dark energy" are interpreted as [tug-of-war](#) and *time-symmetric* presentations of RS gravity, corresponding to "shrinking" and "expanding" of the metric *with respect to* a macroscopic observer A, while the *actual* distance between all point in the **fused** spacetime remains *one and the same* with respect to observers B. Stated differently, the cases of RS-shrunk or RS-expanded metric (viz. positive or negative [curvature-and-rotation](#)) are explained without any localized *physical* "dark matter" or "dark energy", just as in the case of '[spin](#)'.

Bear in mind that the [current interpretation](#) of gravity inevitably leads to "the worst theoretical prediction in the history of physics!" ([Wiki](#)). In particular, the radius of the universe "could not even reach to the moon," as calculated by [Wolfgang Pauli](#). To understand how we produced such staggering *reductio ad absurdum*, recall the tacit idea 'only matter can *interact* with matter'. Namely, if we observe "anomalous" gravitational effects at length scales exceeding the size of our [Solar System](#), we claim that such effects can only be caused by matter. Fine, but *what* matter, and *how*?

The [phenomenon of transience](#), exhibited in the [Heraclitean flow of time](#) (cf. option YAIN (iii) [below](#)), can exist *only and exclusively only* in a [self-acting](#) universe: **it** is produced by 'the universe as [ONE](#)' (cf. [sufficient conditions](#) for spacetime), which *acts on itself* by

virtue of the Aristotelian [First Cause](#). In RS theory of gravity, this *self-acting* action is called Aristotelian Connection, and is presented with an infinitesimal "[displacement](#)" **dt** in the [Arrow of Space](#). Its source ([Luke 17:21](#)) cannot be traced back from its *physical* effects, just as we cannot detect the human mind in its brain -- physically, we can only observe a *self-acting* brain. And because the universe is modeled as 'ONE [brain](#)', its self-action is facilitated by *alteration* of geometry and topology of the whole universe, which affects the distribution and dynamics of matter localized at all **entangled** spacetime points, *en bloc*. Which is why the so-called "[cold dark matter](#)" and "dark energy of ([you-name-it](#))" do **not** exist, just like the *physical* basis of '[spin](#)'. Such Machian effects may be caused by 'all matter in the whole universe', but their **quasi-local** implementation by 'the universe as [ONE](#)' is with two *purely geometrical* cases of [curvature-and-rotation](#), such as RS-shrunk or RS-expanded metric. We should just forget about [supermassive black holes](#), "[280 million solar masses](#) per particle," etc., and focus our efforts on [Einstein's theory](#) of 'total field of [as yet unknown structure](#)'.

Last but not least, the alteration of spacetime metric, according to RS theory of gravity, is an effortless phenomenon, because it requires alteration of the *phase* of [gravitational waves](#). The energy release (e.g.,  $10^{54}$  ergs/pulse in [GRBs](#)) is produced by the "engine" of the universe -- the [Arrow of Space](#). Similar to the "[quantum waves](#)", the gravitational waves do not possess intrinsic energy and can be [manipulated](#) effortlessly, just like we drive our *thoughts* in our brains. The same effortless action is performed jointly by 'the universe as a [brain](#)' and its *complementary* ([Wolfgang Pauli](#)) Universal Mind ([Henry Margenau](#)). As Max Planck stated in [1944](#), "All matter originates and exists only by virtue of a force. We must assume behind this force the existence of a conscious and intelligent Mind. This Mind is the matrix of all matter". Or simply "God's thoughts," [Albert Einstein](#).

D. Chakalov  
Easter 2013, [17:50:34 EET](#)

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**Outline of RS theory of gravity**

## 1. Introduction: The *total field* of Einstein

[Albert Einstein](#): The [present formulation](#) of General Relativity (GR) is "merely a makeshift in order to give the general principle of relativity a preliminary closed-form expression. For it was essentially no more than a theory of the gravitational field, which was isolated somewhat artificially from a *total field* of as yet unknown structure."

The main unsolved task in Einstein's unfinished GR is the presentation of matter ("timber"):

$$\underbrace{R_{\mu\nu} - \frac{1}{2}g_{\mu\nu}R}_{\text{Marble}} = \underbrace{\kappa T_{\mu\nu}}_{\text{Timber?}}$$

Firstly, the [density of matter](#) in the energy-momentum tensor ([Erik Curiel](#); [Babak and Grishchuk](#)) is presented with some continuous "dough", ignoring its [quantum structure](#), which in turn leads to "the worst theoretical prediction in the history of physics!" ([Wiki](#)). Secondly, in metric theory of gravity there is no *physical* gravitational energy obeying conservation law ([Jose Geraldo Pereira](#)): the **conversion** ([Hans Ohanian](#)) of "marble" into "timber" ([Hermann Bondi](#)) must be presented in such way that only the "timber" can do work, but **not** the "marble" **itself**. The latter must **not** obey [Newton's third law](#), as the inertial mass of an accelerating particle is **not** "a back-reaction to its own gravitational field" (Wolfgang Rindler, [p. 22](#)). And thirdly, the **conversion** between the "marble" and its physicalized "timber" is a bi-directional "talk" (cf. [below](#)), which makes matter ("timber") **self-acting**. Why? Because the other party ("marble") is [hidden by the "speed" of light](#).

$$R_{ij} - \frac{1}{2}g_{ij}R = \frac{8\pi G}{c^4}T_{ij}$$

«Space acts on matter, telling it how to move. In turn, matter reacts back on space, telling it how to curve.»

C.W. Misner, K.S. Thorne, J.A. Wheeler – *Gravitation*. Freeman & Co., 1973 (p.5).

Yes, the [gravitational waves](#) are real, but they do **not** transport [energy or momentum](#). They do **not** obey [Newton's third law](#), cannot perform **work**, and must **not** be localizable (MTW, [p. 467](#)). Just like the [pre-quantum](#) Kochen-Specker "state" (never in plural), the "marble" **itself** must be [wegtransformierbar](#) (cf. [below](#)). It can only cast its "jackets" under "measurements" -- one-at-a-time -- made by asymptotically flat spacetime, in terms of "a parametrization of the gravitational field and *nothing else*" ([Günter Scharf](#)). What we call "marble" actually belongs to a wider form of reality: [potential reality](#),

endowed with "[pure](#)" and *intangible* ([Hermann Bondi](#)) energy of 'the universe as [ONE](#)'.

**NB:** As anticipated by [Albert Einstein](#), the solution to "marble-timber" relations can indeed be derived "from a *total field* of as yet unknown structure": **it** could be a hypothetical General Platonic Idea (GPI) field of the joint phenomenon 'entanglement & flow of time', under the stipulation that 'the universe as [ONE](#)' functions as a [brain as well](#). Physically, we cannot observe the mind **inside** its brain -- just a *self-acting* brain.

In the case of 'the universe as [ONE brain](#)', we replace '*self-acting* brain' with '[sufficient conditions](#) for spacetime', to recover a *holistic* quantum-gravitational phenomenon which determines -- one-at-a-time -- the *quasi-local* mass of *quasi-local* fish, bootstrapped ([Geoffrey Chew](#)) by their [school of fish](#). The end result from 'entanglement & flow of time' is a *wave pattern* of the "timber", like the wave-like *holomovement* of centipede's legs. That's how we see "[waves](#)" without any *physical* source that would otherwise have to jitter or pulsate in space, due to [energy loss](#). (Forget about [dimensionless "strain" h](#).)

Yes, the [gravitational waves](#) and [quantum waves](#) are real, because they belong to [potential reality](#), yet their [physicalized "timber"](#) can only display a [self-acting universe](#).

Which means that there are no "[carriers](#)" of some biological "field", no "physical basis" of [spin](#), no "[particles](#)" for gravity, and of course no "[Higgs boson](#)".

**NB:** This fundamental phenomenon is widely known from [life sciences](#); we simply translate it to the language of theoretical physics with [entanglement](#) & flow of time -- [Arrow of Space](#) from [emergence of spacetime](#) -- and suggest the [Relative Scale \(RS\) gravity](#).

To be specific:

1.1. GR has unlawful *background*: *absolute* size of macroscopic objects viz. *absolute* relations such as 'inside vs. outside' and 'small vs. large volume of space'. An immediate problem comes from *entanglement*: if Archimedean geometry were fundamental phenomenon, an EPR-like correlations of [quantum](#) and [gravitational](#) objects would imply, or even require *Geistfelder* (spooky "fields" devoid of [tangible energy](#)) and various "[ghost fields](#)" introduced from "the infinitesimal gauge transformations of quantized gauge fields" (Günter Scharf, [p. 1](#)).

1.2. Spacetime topology is not fixed in current GR ([Alan Macdonald](#); MTW, [p. 837](#)); the [Einstein-Hilbert action](#) is derived from the "dynamics" of values taken by the 3-metrics on a frozen ([Robert Geroch](#)) "[slice](#)" with *fixed* spatial topology -- no [explicit time variable](#). Solution: [Time](#) requires *dynamics* of spacetime topology in terms of [Arrow of Space](#) -- an infinitesimal 'change **of** space' (not coordinate change *within* space).

1.3. **Ansatz:** Gravity is not quantum phenomenon, for the same reasons why quantum entanglement is not producing "[dark](#)" gravitational effects ([rotation & curvature](#)). Instead, the underlying phenomenon is [entanglement](#) & [flow of time](#) in Relative Scale ([RS](#)) gravity.

## 2. Entanglement & flow of time: Arrow of Space

2.1. The *emergence* of spacetime ([Isham & Butterfield](#)) is made **by** an [Arrow of Space](#) along [null "direction"](#) (**w-axis**) -- one-at-a-time (Phoenix Universe). Namely, a global, [atemporal](#), and *non-Archimedean* realm of the universe (global mode of spacetime) is *complemented* by a [quasi-local](#), physical, and teleological realm of the universe (local mode of spacetime). The global, non-Archimedean mode keeps an [intact potential reality](#) separated from its fleeting "jackets" ([Plato](#)), while the local, Archimedean mode is produced as **re-created** "back bone" of the whole universe *at all length scales*, made by "[measurements](#)" executed by the *self-acting* universe on **itself** -- [one-at-a-time](#).

The instant 'now' separates the two modes of spacetime, which evolve along [null "direction"](#): one-instant-*now*-at-a-time. Hence the topological dimensions of spacetime are being accumulated **during** the [Arrow of Space](#), and because all "dark gaps" of the global mode of spacetime are made **zero** by [the "speed" of light](#), we observe a *perfect* spacetime continuum and try to explain the dynamics of spacetime with 'time read with a clock' due to change of coordinates *within* spacetime. Hence Einstein's [total field](#) and the '[thoughts of the Universe](#)' are completely missing in current GR and QM textbooks.

### 3. [Potential reality](#): Quantum, astrophysical, and [cosmological implications](#)

3.1. Quantum form of entanglement: The [Kochen-Specker Theorem](#) and [Wilson chamber](#).

3.2. Astrophysical form of entanglement: No "dark" basis, just as in the case of '[spin](#)'.

3.3. Quantum cosmology: [Dual age](#) of the universe and [The Gospel](#).

### 4. Discussion of RS gravity and outlook

4.1. The theory is indirectly falsifiable: *every* alternative theory of quantum gravity must necessarily be *wrong*.

4.1.1. Specific errors in alternative theories: [localization](#) and "[boundaries](#)" of spacetime.

4.2. [Outlook](#): Asymptotic "boundaries" of spacetime, creation of mass *one-at-a-time* ([elevator metaphor](#)), and atemporal "[Macavity](#)".

## Frequently Asked Questions (FAQ)

**Q1:** "GR works perfectly well and I can't agree with your ideas."

**A1:** This is a statement, not question. Recall that the current version of GR is based on "miracles": you can't have any geometry at [Planck scale](#). There is nothing resembling law and order in the "[spacetime foam](#)" to [raise](#) a robust [Lorentzian metric](#) within  $10^{-30}$  seconds "after" the "[big bang](#)" and inflation of universe's "size" (with respect to *what?*) by a [factor of  \$10^{78}\$](#) , and keep the Lorentzian metric for at least [13.77](#) billion years rooted on Planck length at which "points" are *fuzzy* and *locality* has lost its meaning [13.77](#) billion years ago.

**Q2:** "What do you intend to achieve?"

**A2:** A model of bootstrapped universe, in which every geometrical "point" is determined by states of mater ("[jackets](#)") that are [pre-correlated](#) with 'the rest of the universe'. Which will be impossible if [Archimedean](#) space were fundamental phenomenon. Hence [RSP](#). Notice that at Planck scale the equation  $\mathbf{SL} = \mathbf{1}$  (Small is denoted with **S**, Large with **L**), which holds for observer **A**, is again valid, but now it describes 'the *non-Archimedean* universe as [ONE](#)' of observer(s) **B**. Then we use this unique ONE entity as [Reichenbach's Third Cause](#) to explain the *relational ontology* produced by [entanglement](#) during the flow of time (cf. Escher's drawing hands [below](#)).

**Q3:** "How do you explain the [mind-body problem](#)?"

**A3:** With 'potential reality' in the [Arrow of Space](#); but please see first [Gottfried Leibniz](#), [Wolfgang Pauli](#), and the [Eskimo metaphor](#). We encounter two *forms* of potential reality: one explicated under macroscopic conditions ([BrainMonad](#)), and the GPI field of quantum-gravitational world ([observer B](#)). The first interacts with the brain and the physical world along the Arrow of Space, and can be metaphorically explained as a 'steering wheel' of 'the car' (brain and 'the rest of the universe'). Namely, the [BrainMonad](#) is neither 'matter' nor 'mind', but a *macroscopic* form of potential reality. One might suggest that it has a dual nature, because it acts like a "filter" *through* which the Psyche can enter spacetime, a bit like images displayed on a TV screen (not located inside TV). So, if the [BrainMonad](#) is a 'steering wheel', the 'driver' is the [human mind](#) endowed with Free Will. We speculate that the GPI field may also act as a "filter" for Universal Mind ([Henry Margenau](#)), but cannot prove such claim. Point is, the 'driver' (human mind) may have access to the joint 'steering wheel' ([BrainMonad](#) & GPI field), and alter the propensities (not "probabilities") for future *potential* events, almost like learning a new [motor skill](#). Math is a [crucial issue](#), too. The first off task here is to explain the **physics** of [binding phenomenon](#) -- how all sensory "data" are combined into a single experience, derived from their joint *amodal* presentation ([BrainMonad](#)). In my opinion, the only way to approach the challenge is to assume that the whole universe as [ONE](#) works as a "[brain](#)". Hence [RS gravity](#).

**Q4:** "What is this all about, Dimi?"

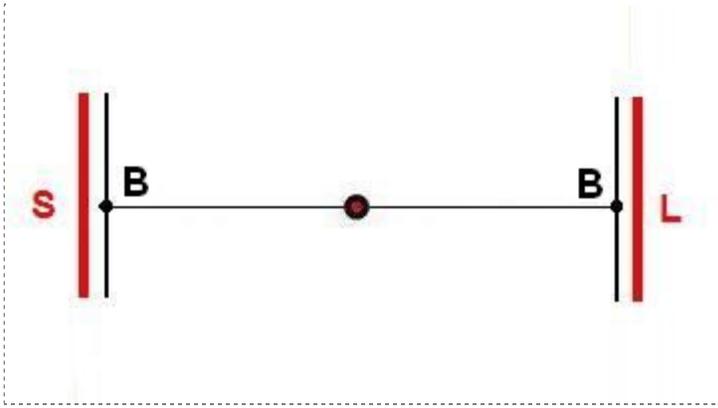
**A4:** Tough question. Actually, it's all about cat astrology. I'm also selling cat food from my website, with special discounts for [theoretical physicists](#) like you. Aren't you interested?

Feel free to submit your questions. Just please don't forget that [RS theory of gravity](#) is an alternative to all multidimensional theories in which gravity would operate in some "extra dimensions" with some hypothetical "[gravitons](#)".

For example, people try to bridge the "desert between the weak and Planck scales" with "extra compact spatial dimensions" leading to "(4 + n) dimensional theory" in which "particles cannot freely propagate in the extra n dimension, but must be [localized](#) to a 4 dimensional submanifold", while "the only fields propagating in the (4 + n) dimensional bulk are the (4 + n) dimensional **graviton**" (N. Arkani-Hamed, S. Dimopoulos, and G. Dvali, [arXiv:hep-ph/9803315v1](#), p. 2). Then comes this (*ibid.*, p. 3):

"As within any extension of the standard model at the weak scale, some mechanism is needed in the theory above  $m_{EW}$  to forbid dangerous higher dimension operators (suppressed only by  $m_{EW}$ ) which lead to proton decay, neutral meson mixing etc. In our case, the theory above  $m_{EW}$  is unknown, being whatever gives a sensible quantum theory of gravity in (4 + n) dimensions! We therefore simply assume that these dangerous operators are not induced."

But every sensible quantum theory of gravity should solve *the* most widely known public secret in theoretical physics -- [localization](#). First things first. Then comes [QM](#) and [GR](#), and the new [Quantum Geometry](#) in which the *geometrical* points possess *quasi-local* structure due to the [global mode of spacetime](#) of 'the universe as [ONE](#)', shown with **red** in the drawing below.



One can introduce "[boundary](#)" on spacetime *only and exclusively only* with [RSP](#). This kind of "boundary" is *the only possible* logical option for [gravity](#). We are macroscopic observers, and in the case of Archimedean geometry the *entanglement of space*  $E_{\text{space}}$ , expressed with "fusion" of Small and Large, is effectively zero, yet it takes values in an open interval

$$E_{\text{space}} \in (0, \infty).$$

Also, Baldy's Law, according to which "some of it plus the rest of it is all of it," is strictly valid only for an inanimate macroscopic world with  $E_{\text{space}}$  effectively zero, but does *not* hold for [Quantum Gravity](#). More in **A2** [above](#).

D. Chakalov

May 7, 2013

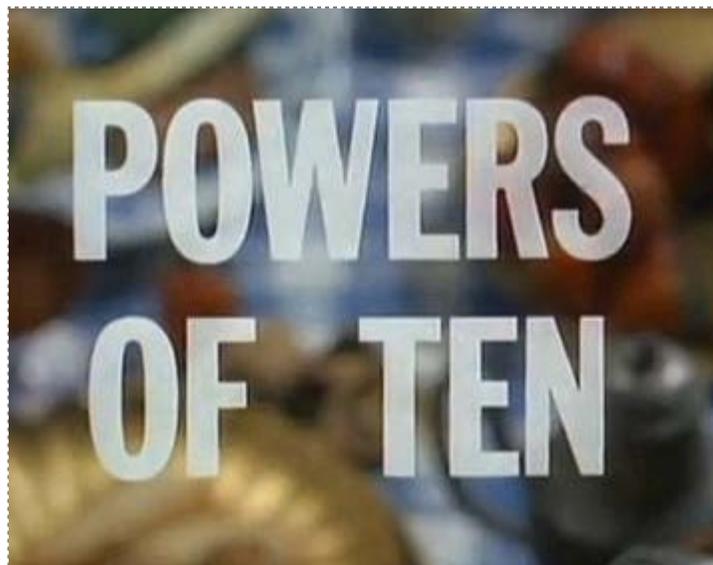
Last updated: June 8, 2013, [13:25:26 GMT](#)

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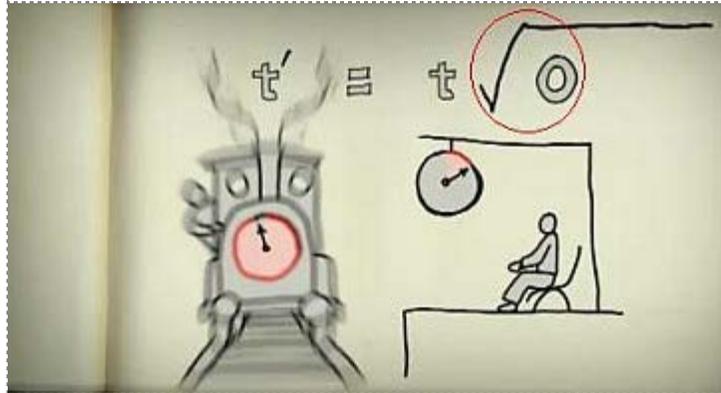
Today, 14 March 2013, Albert Einstein (b. [1879](#)) would be 134 year old. My efforts to unravel his '[total field of as yet unknown structure](#)' and the nature of gravitation and quantum entanglement are posted [here](#).



**Happy Birthday, Albert!**



The so-called 'God's thoughts' refer to a web of [correlations](#) of all physical systems, which occur in a hypothetical 'global mode of spacetime' produced by the [Arrow of Space](#). Relative to a physical (inanimate) clock, the *global mode* of time will inevitably look "[frozen](#)".



0.47-0.52: "Relative to the platform, time on the train [completely stops](#)."

This "frozen" time pertains to 'the whole universe as ONE' and to the so-called [BrainMonad](#). The "speed" of gravity is **dual**: both "instantaneous", in the global mode of spacetime, and *finite*, in the local mode. The end result is a *quasi-local mass* and [quasi-instantaneous](#) correlations, resembling those in a [school of fish](#).

Relative to the local mode of spacetime, the *global mode* is at 'absolute rest', and serves as the [reference fluid](#) of [General Relativity](#). It is located **]**[between](#)**[** any two neighboring "points" from the spacetime manifold, and renders its local mode a *perfect continuum*: due to the so-called [speed of light](#), the "separation" of the spacetime points (local mode of spacetime) is in fact **zero**.

There is **no direct link** between the local and global modes of spacetime, i.e. between 'physical reality' and 'potential reality': the UNdecidable pre-quantum KS state must **not** be included in the set of its [color-able explications](#).

The 3-D projection(s) of the [global mode of spacetime](#) are *both* an infinitesimal "point" *and* 'the infinitely large universe'. It is a **dual** object which [wraps up](#) the local (physical) mode of spacetime, and produces [finite 'templates' for spacetime](#).

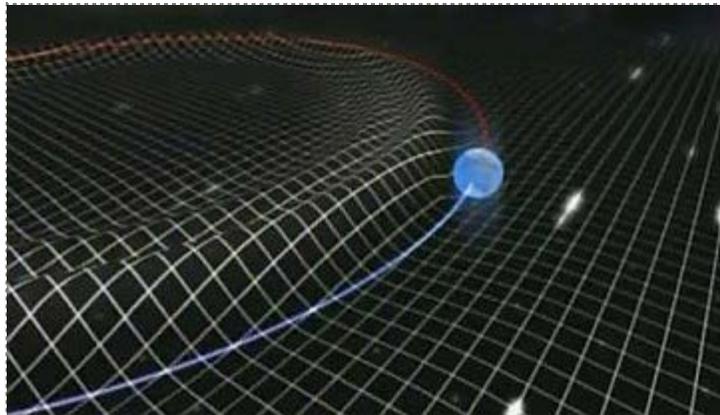
The [cosmic vacuum/quantum aether](#), called here [global mode of spacetime](#), is an absolute reference frame pertaining to the whole universe as ONE: the physical world there is in absolute rest, in the sense that its proper time is **zero**, as "seen" from such luxonic reference frame.

Thanks to the [Arrow of Space](#), 'the universe as ONE' is not "frozen". In the quantum realm, it exists as 'potential reality' or [UNdecidable pre-quantum KS state](#).

As to the current GR, 'the universe as ONE' is the absolute reference frame in which space "**expands**".

It is also the [atemporal medium](#) for [bootstrapping](#) the physical world and generation of [Machian inertia](#).

More on the errors in GR literature [here](#).



The current GW detectors are manifestly [blind and deaf](#) to the ripples of spacetime. Their proper detectors must be endowed with the faculty of 'self-acting', resembling the [human brain](#). Ditto for the so-called "dark energy".

[LIGO tunnels](#) should be converted to [wine cellars](#). Any other ideas?

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Latest entries on GW "astronomy":

<http://www.god-does-not-play-dice.net/#Bondi>

<http://www.god-does-not-play-dice.net/#letter>

"The representation of matter by a [tensor](#) was only a fill-in to make it possible to do something temporarily, a wooden nose in a snowman."

Albert Einstein's Last Lecture, Relativity Seminar, Room 307, Palmer Physical Laboratory, Princeton University, April 14, 1954

"In the first place, we entirely shun the vague word "space," of which, we must honestly acknowledge, we cannot form the slightest conception."

[Albert Einstein](#), *Relativity: The Special and General Theory*, 1920

"According to the general theory of relativity space is endowed with physical qualities; in this sense, therefore, there exists an [ether](#). But this ether may not be thought of as endowed with the quality characteristic of ponderable media, as consisting of parts which may be tracked through time."

A. Einstein, *Äther und Relativitätstheorie*, May 5, 1920

(Lisa M. Drolling *et al.*, *The Tests of Time: Readings in the Development of Physical Theory*, Princeton University Press, Princeton, 2003, [p. 346](#))

*Panta rei conditio sine qua non est*

Sunday, October 20th, 2013  
Your Local Time: 45 minutes past 8 P.M.  
Your Global Time is [ZERO](#)

It is suggested that the spacetime *manifold* is a dynamical entity re-created at every step of a hypothetical [spacetime arrow](#): the latter is due to the "[expansion](#)" of space by the dynamic dark energy (DDE). Two modes of spacetime are postulated in this [Phoenix Universe](#): local mode, in which we have point-like events cast on a [perfect continuum](#), with a "carpe diem" *unit probability* (cf. the measurement problem in QM [here](#)), and a global *atemporal* mode, in which a [Machian-type negotiation](#) of every *next* step is being processed. The effects from the global mode of spacetime, which literally build up '[3-D space](#)', begin from the macro-scale of classical physics in two "directions": quantum effects toward the Small, and dark matter & dark energy effects toward the Large. Briefly, we model the universe as a huge [brain](#) which 'thinks' with its [global-mode state](#) by following the rule 'think globally, act locally'. The implications for quantum gravity are explained by revealing the two modes of spacetime in [Quantum Theory](#) and [General Relativity](#), and by suggesting conceptual solutions to the problems and paradoxes hindering the quantum gravity of **He Who Does Not Play Dice**.

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We haven't the money, so we've got to think!  
[Lord Rutherford](#), 1962 Brunel Lecture, 14 February 1962

Overfunded research is like heroin: It makes one addicted, weakens the mind and furthers prostitution.

[Johann A. Makowsky](#), The Jerusalem Post 19.4.85



## Does a fish need a bicycle?

Latest update: November 26, 2009

Printable copy (current version) from  
[http://www.god-does-not-play-dice.net/front\\_page.pdf](http://www.god-does-not-play-dice.net/front_page.pdf)

Check out 'Quantum Mechanics 101' [here](#), my detailed reproach upon wasting taxpayers' money with LIGO [here](#), and my efforts toward quantum gravity [here](#).

Regarding [Quantum Mechanics](#) (QM), the aim is to avoid the incomprehensible paradoxes and *artifacts* in it (watch the double slit experiment [here](#)), which originate from its textbook interpretation (Niels Borh's belief that quantum world can only be "seen" through classical "glasses"). We can indeed *understand* the quantum world (but not the current QM textbooks; cf. [Richard Feynman](#)), by changing the "glasses" through which we "see" and construe the quantum world: the universe modeled as a [brain](#).

Regarding the artifacts in QM, we may be in a situation similar to an Eskimo trying very hard to comprehend the notion of "[trunk](#)". In our case, we encounter an incomprehensible [wave-particle complementarity](#), which could be just an artifact from our wrong thinking, like the "nose-arm complementarity" in the case of the Eskimo observing [elephant's trunk](#). Surely '*the quantum system*' doesn't live in any [relativistic space](#), so one should expect all sorts of headaches and *artifacts* (e.g., "diese verdammte Quantenspringerei", [Erwin Schrödinger](#)) from imposing wrong "glasses" onto the quantum world 'out there'. (A typical example is Franco Selleri's quest for detecting [de Broglie waves](#).)

The prerequisites for the interpretation of QM suggested [here](#) originate from Schrödinger. Back in 1935, [Erwin Schrödinger](#) stressed the following:

"The rejection of realism has logical consequences. In general, a variable *has* no definite value before I measure it; then measuring it does *not* mean ascertaining the value that it *has*."

And in a letter to Einstein dated 18 November 1950 (quoted after J. Bub, [p. 115](#)), he wrote (emphasis added):

"It seems to me that the concept of probability is terribly mishandled these days. Probability surely has as its substance a statement as to whether something is or is not the case — an uncertain statement, to be sure. But nevertheless it has meaning **only** if one is indeed convinced that the something in question quite definitely **is** or **is not** the case. A probabilistic assertion presupposes the **full reality** of its subject."

We are obviously dealing with a new form of reality: a *probabilistic* assertion, and the Hilbert space itself, **cannot** accommodate the Kochen-Specker case in which "the something in question" is **beyond** an unequivocal "**is** or **is not**" state (cf. "an unequivocal true-false value" in Isham and Butterfield, [p. 3](#); emphasis added):

In quantum theory, on the other hand, the relation between values and results, and in particular assumptions (i) and (ii), are notoriously problematic. The state-space is a Hilbert space  $\mathcal{H}$ ; a quantity  $A$  is represented by a self-adjoint operator  $\hat{A}$  (which, with no significant loss of generality, we can assume throughout to be bounded), and a statement about values " $A \in \Delta$ " corresponds naturally to a linear subspace of  $\mathcal{H}$  (or, equivalently, to a spectral projector,  $\hat{E}[A \in \Delta]$ , of  $\hat{A}$ ).

Assumption (i) above (the existence of possessed values for all quantities) now fails by virtue of the famous Kochen-Specker theorem [4]; which says, roughly speaking, that provided  $\dim(\mathcal{H}) > 2$ , one cannot assign real numbers as values to all quantum-theory operators in such a way that for any operator  $\hat{A}$  and any function of it  $f(\hat{A})$  ( $f$  a function from  $\mathbb{R}$  to  $\mathbb{R}$ ), the value of  $f(\hat{A})$  is the corresponding function of the value of  $\hat{A}$ . (On the other hand, in classical physics, this constraint, called *FUNC*, is trivially satisfied by the valuations  $V^s$ .) In particular, it is no longer possible to assign an unequivocal true-false value to each proposition of the form " $A \in \Delta$ ".

Check out the implications of KS Theorem to the Precise Value Principle (PVP) and the statistical interpretation of QM from R.I.G. Hughes, [p. 164](#).

Going back to Ernst Specker's [tripod](#), if there are states of the tripod in which *one* of its legs has UNdecidable color, then *not* just this particular leg, but **the whole** tripod will be UNdecidable. It's a package.

The phrase "an incomplete Kochen-Specker colouring" (Helena Granström, [p. 2](#)) has no meaning whatsoever; it is the result from imposing wrong "glasses" onto the quantum world. And if you subscribe to the modern quantum mysticism -- "the quantum state is not a physical object, it is a representation of our state of knowledge, or belief" (Itamar Pitowsky, [p. 28](#)) -- your brain will wind up in a schizophrenic state of, say, 68% "knowledge" of the quantum state, and 32% of "[what da heck is that *uncolored* KS sphere?]".

No mental concepts, such as 'knowledge' or 'imagination', are admissible in the ontology of quantum reality. We must never mix apples with oranges (*Res Extensa* and *Res Cogitans*).

[Karl Svozil](#) refers to this UNdecidable faculty of the quantum world as "ambiguity" ([p. 4](#)), and stressed: "This ambiguity gets worse as the number of particles increases." If you think about the quantum world with classical concepts, it will get from bad to worse, until you end up with the ([old](#)) cosmological "constant" problem (more on that from [Alan Guth](#)).

As Erwin Schrödinger might have said in 1935, the same "variable" that *has had* no definite value before you measured it will *continue* to keep its UNdecidable nature [after you "measure" it as well](#). And you can't fit it in *any* Hilbert space, of course (what is the  $\dim(H)$  for 32% "uncolored" and 68% colored KS sphere?).

Let's give it a name: potential reality. In the quantum realm, it (i) offers its context-dependent *explications* (a.k.a. "[observables](#)"), (ii) keeps the sameness ([Genidentität](#), Kurt Lewin) of particles of the same type, which MTW regard as "a central mystery of physics" ([p. 1215](#)), and (iii) facilitates the ultimate quantum phenomenon: [entanglement](#). It may be difficult to grasp, but is much simpler to the juggling with the possible implications from Bell's inequality and their loopholes (e.g., [Ghim and Zhang](#)).

As to quantum gravity (notice the opinion of an expert [here](#)), the 'potential reality' is introduced to revive the *physical objectivity* of spacetime "points", by making the spacetime manifold itself an [emergent phenomenon](#): "The requirement of general covariance takes away from space and time the last remnant of physical objectivity" (A. Einstein, *Grundlage der allgemeinen Relativitätstheorie*, *Annalen der Physik* 49 (1916) 769-822). The current formulation of GR can only determine "the [mutual relations](#) that exist between the gravitational field and the matter fields (i.e. the value the gravitational field takes where the matter field takes such and such value)", but not "the proper time between spacetime points" ([Wiki](#); more from [Butterfield and Isham](#)), and the field equations "cannot even uniquely determine the topology of a manifold" (Alan Macdonald, Einstein's Hole Argument, [p. 4](#)).

How can we fix these problems? By introducing two connections, geometric (local mode) and [torsion](#) (global mode of spacetime). The torsion connection is *completely vanished* ([Hehl and Obukhov](#)) in the local mode, hence its effects are considered "dark" (see [Alex Murphy](#)).

Notice also that a *hierarchy* of 'potential reality' (never in plural), resembling the structure of [cognitive concepts](#), is postulated (application [here](#)). In metaphysical terms, it supports the views of Aristotle and Spinoza: no "parts" of the infinite can exist, as the infinite Substance is *indivisible*. It's not like Russian dolls.

In the case of a human [brain](#) (not [mind or consciousness](#)), the UNSpeakable potential reality can be explicated with, for example, three (and many more) sayings, which produce "measurements" (if you prefer QM jargon) on it:

1. All are not hunters that blow the horn.
2. La robe ne fait pas le médecin.
3. Es ist nicht jeder ein Koch, der ein lang Messer trägt.

None of these "measurements" can "collapse" the potential reality ([Platonic idea](#)) explicated with these sayings. And if our *brain* can work with 'potential reality', so can the universe modeled as a [brain](#).

Regarding the brain above your neck: its 'potential reality' is to its [human self](#) what EM radiation is to your subjective experience of 'color' -- no *direct* action of the human self on its brain is allowed in science. Hence it may be conceivable that the *potential reality* entwined with the human brain could be [bridged](#) to that of the quantum vacuum ([BCCP](#)). All you may need is an [arrow of spacetime](#). (Notice, however, the 'two rules of success' [here](#).)

Notice also that 'potential reality' is an intrinsically [holistic phenomenon](#), so it will be *very* misleading to call it "[dark](#)", just because it is not possible to be traced back from *any* of its physical explications in the r.h.s. of [Einstein field equation](#).

Forget about "[energy conservation in GR](#)". It's an [oxymoron](#) (details from [Denisov and Logunov](#)). What kind of "time" is implied in the **non-linear** dynamical cancellation of the two "fluxes" ([Merced Montesinos](#)), such that the ether would *not* "[come back](#)"? Can your [wristwatch](#) read it?

The sole "explanation" of this [ultimate puzzle of GR](#), offered by Chris Isham, was that, "after all, general relativity does seem to work well as a theory, and yet I can certainly read the time on my wrist watch!" But your wristwatch should **not** be able to read more than *one* instant from this (global) non-linear "time". [Complex problems](#) have simple, [easy-to-understand](#) wrong answers (Murphy's Law No. 15).

We need quantum gravity, to uncover "the proper time [tau] along spacetime trajectories" ([Carlo Rovelli](#); drawings [here](#)) and the genuine 'time variable' associated with the expansion of space due to DDE. Once we achieve this formidable task, we will (hopefully) find out what -- if anything -- *might* remain unchanged/conserved in *this particular* (global mode of) time. In the current 'GR without DDE', the dynamics is "entirely generated by constraints. The dynamical data do not explicitly include a time variable" ([Karel Kuchar](#)), and one can only *hope* that "the energy momentum tensor which is the source of gravity" *might* be conserved "due to the [Bianchi identities](#)" (E. Guendelman, [p. 9](#)). Such hopes are (i) utterly murky even in the textbook GR, because **any** observable of the gravitational field is "*necessarily* quasi-local" ([Laszlo Szabados](#)) and (ii) not applicable to the *new* dynamics of GR due to DDE. For example, [Noether's Theorem](#) holds only for flat spacetime, and the Bianchi identities are applicable only for 'GR without DDE'.

At this point, I got an emotional response from [Eduardo Guendelman](#), saying that the [Bianchi identity](#) is a mathematical theorem, so there is no ambiguity involved here. Well, I'm just a [psychologist](#), so let me quote Matt Visser, [p. 3](#):

"... the Einstein equations of general relativity are local equations, relating *some aspects* (notice the poetry -- D.C.) of the spacetime curvature at a point to the presence of stress-energy at that point. Additionally, one also has local chronology protection, inherited from the fact (Sic! -- D.C.) that the spacetime is locally Minkowski (the Einstein Equivalence Principle), and so "[in the small](#)" (that's the sole application of those 'twice-contracted Bianchi identities', cf. George F R Ellis and Henk van Elst, [Eq. 2](#) -- D.C.) general relativity respects all of the causality constraints of special relativity.

"What general relativity does *not* do is to provide any natural way of imposing *global* constraints on

the spacetime — certainly the Einstein equations provide no such nonlocal constraint."

Which is precisely the missing element needed to address the 'global properties of spacetime' in the presence of DDE. As R. Rakhi and K. Indulekha acknowledged ([p. 5](#)): "Because this energy is a property of space itself, it would not be diluted as space expands. As more space *comes into existence* (the same phrase was used by [Sean Carroll](#) -- D.C.), more of this energy-of-space would appear. (...) So the mystery continues."

And so does the confusion about it -- click [here](#).

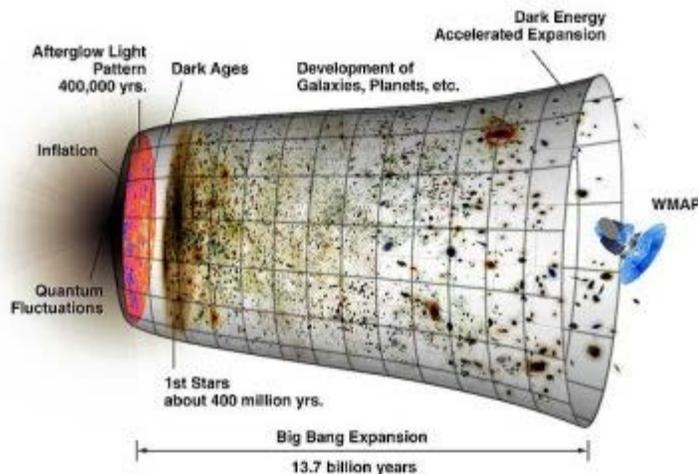
The intrinsic dynamics of the phenomenon of 'more space *comes into existence*' could **only** be detected in a reference frame from which this phenomenon is *excluded*, like '**not** acting there'. But because DDE acts on the whole 3-D space *en bloc*, without any irregularities, there is no place in the universe in which we could install a clock and say -- look, this clock does read the (global mode of) time pertaining to the *omnipresent* phenomenon of 'more space *comes into existence*'. It is the theory of relativity itself, which cannot "detect" it. Which is why some people call it "dark".

Although the mathematical meaning of the phrase "more space *comes into existence*" is not clear, I don't think [Kurt Gödel](#) would have called the ultimate source of spacetime points "dark". Once we move from [physics to geometry](#), it's a whole new world there. Pity [Mike Turner](#) called it "dark"; that's so wrong!

One cannot *insert the "dark" energy of X into its consequence* -- accelerated expansion of space. The source **X** does not belong, and cannot be fitted into *the same* 3-D space (Cauchy hypersurface) which is being **created** by **X**. You can do this only in [GR textbooks](#) that deal with 'GR *without* DDE'. [Capiche?](#)

Notice also that Matt Visser (see above) considers the metaphysical assumption that the spacetime were "locally Minkowski (the Einstein Equivalence Principle)" to represent a *fact*. But we only have a *mathematical* fact that *locally*, "over" a **point**, one can indeed eliminate the gravitational "field" by hand ([Hermann Weyl](#)). But because nobody has so far explained the resulting *quasi-local* nature of the gravitational field's observables (see Laszlo Szabados above), nor the origin and the mechanism of inertial reaction "[forces](#)", I think we should be very cautious and open-minded in interpreting such *mathematical* facts and theorems, like the above-mentioned [Bianchi identity](#).

If you are looking for a genuine quantum-gravitational measuring device, your wristwatch (as well as the one of [Kip Thorne](#)) fits the bill, because it reads an **already**-linearized (see the explanation of '**already**' [below](#)) time variable obtained from the "the proper time [ $\tau$ ] along spacetime trajectories" ([Carlo Rovelli](#)) and the (global mode of) time associated with the [expansion of space](#) due to DDE.



This is to me the ultimate puzzle in present-day GR. The sole "explanation" of [Chris Isham](#) was that, "after all, general relativity does seem to work well as a theory, and yet I can certainly read the time on my wrist watch!"

I will desist to comment on C. Isham's observation, and will instead take the liberty of being (again) deadily boring, by explaining the difference between 'GR without DDE' vs 'GR with DDE'.

First, a simple example from STR, with a trajectory of a Frisbee, on the fixed background of Minkowski spacetime: we can calculate the *instantaneous* state of the Frisbee at each point from the trajectory, and attach to this dimensionless point a well-defined *vector*. My teenage daughter couldn't understand how it is possible to attach a vector to a "point", and I explained the puzzle by saying that the *information* from a *finite* interval from the *history* of this infinitesimal "point" is encapsulated in it -- we instruct this interval to shrink asymptotically toward zero -- so the vector is indeed well-defined. All this is possible under the premise of the fixed "grid" in STR. But once we move to 'GR without DDE', the "grid" is gone ([Emilio Elizalde](#)): at each and every "point" from the trajectory, the non-linear *mutual determination* of matter and space ([John Wheeler](#)) takes place. But in what **time** (see Chris Isham's wrist watch above)? There is no background grid or "ether" w.r.t.w. one can define the dynamics of 'GR without DDE'. Yet people don't ask such questions and prefer to just do calculations with the *linearized approximation* of 'GR without DDE'. As another expert explained to his undergraduates, "one begins by introducing the notion of a tangent vector to describe an infinitesimal displacement *about* a point **p**" (Bob Wald, [p. 4](#)). But again, in order to recover the true dynamics of 'GR without DDE', you need some "ether" or rather 'reference fluid' w.r.t.w. one can describe the fundamental phenomenon of **transience** ([Abner Shimony](#)): see the so-called Aristotelian Connection [here](#).

At this point, the 'GR with DDE' comes to rescue the [Hamiltonian formulation](#) of 'GR without DDE': we have a brand new, *global* degree of freedom of spacetime *en bloc*, hence can recover the **transience** of spacetime, as driven by the *source* of DDE, along the [arrow of spacetime](#) -- see [above](#).

To identify *this same source* in the quantum realm (called 'potential reality'), let's go back to the interpretation of QM [here](#).

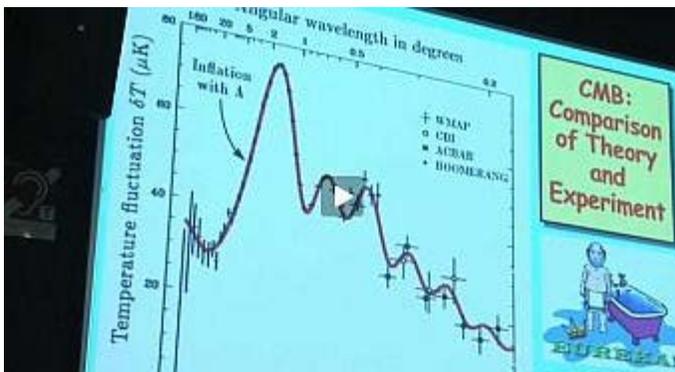
In a nutshell, the so-called [PR<sup>2</sup> interpretation of QM](#) offers a solution to the non-unitary "collapse" by replacing the alleged "U" and "R" processes with a new (at least to people like [Ed Witten](#), [Steven Weinberg](#) and [Gerardus 't Hooft](#)) form of reality, known since Plato, called here 'potential reality'. Its quantum presentation is *ubiquitous* and has [zero entropy](#); hence the familiar notion of time, which pertains to monotonic increase of entropy "in time", is not applicable to 'potential reality'. It may produce "shadows" in terms of 'quantum observables', yet these "shadows" cannot be traced back, to

reveal *any* evidence of such events (or "[quantum information](#)") ever having *emerged* from 'potential reality'. It may *act*, yet not experience any backaction from its "shadows". Hence it is the ultimate "background" for [QM](#) and [GR](#). It *evolves* along the [arrow of spacetime](#) (resembling the "memory" of the universe), by unfolding from 'the ideal monad [without windows](#)'. In the *local* mode of spacetime, every "point" is filled with an *already explicated* value of its 'potential reality', and as the latter evolves and becomes enriched, the "number" of its localized explications increases accordingly: more and more things *come into existence* in the universe. As John Wheeler put it, "Time is Nature's way to keep everything from happening all at once". Only with 'potential reality' there is no need nor place for any 'unitary dynamics' in the *local* mode of spacetime. This is the metaphysics of 'the universe modeled as a brain', viz. the interpretation of '[expansion of space](#)' along the [arrow of spacetime](#).

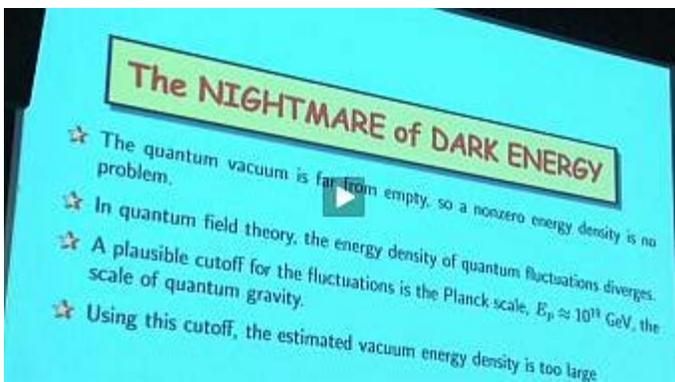
From this perspective, if we follow the deflation time arrow in the *local* mode of spacetime, things will gradually fade away in a strictly non-unitary fashion, but will only approach *asymptotically* The Beginning, because it is *logically* impossible to reach **It** from/within the local mode of spacetime (cf. the paradox [here](#)). The solution is '[dual age cosmology](#)'.

As M. Gell-Mann and J. B. Hartle have noticed, "quantum mechanics is best and most fundamentally understood in the framework of quantum cosmology" (quoted after [Claus Kiefer, p. 1](#)). And *vice versa*.

The current situation with inflationary cosmology was presented by [Alan H. Guth](#), the winner of the 2009 Isaac Newton medal, on 13 October 2009. He speculated that our galaxy could be an amplified "quantum fluctuation" ([Part 2](#), 3:30 - 6:16),



... and then confessed his "Nightmare of Dark Energy" ([Part 2](#), 11:36), on which the "eureka" of inflationary cosmology is grounded.



Perhaps Alan Guth should have entitled his talk 'The Dark Energy Nightmares of Inflationary Cosmology', as encapsulated in the [?] area in [V. Mukhanov's paper](#):

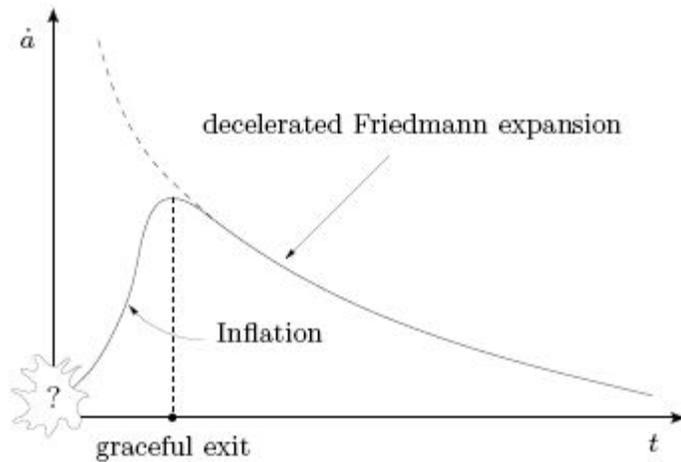


Figure 1:

With the so-called [dual age cosmology](#), the "first" Plankian time "after" The Beginning is stretched toward infinity in the *local* mode of time. This is otherwise being explained as 'the universe started *asymptotically* from time zero'. In this *local* mode of time (read by your wristwatch), the universe is effectively eternal and its age is *indecisive*, while in the *global* mode of time it has a *finite* age. Another nice feature of [dual age cosmology](#) is that The Beginning is an *atemporal* phenomenon, and is always present (global mode of time) in the instant 'now'.

Let's go back to QM. Think of a trajectory of a Frisbee: at each "point" from the trajectory (the latter could be a *perfect continuum* of such "points"), the state of the Frisbee is a perfectly well defined *fact*, with a 'carpe diem' *unit probability*. I use this simple idea to introduce a new kind of *cancellation mechanism*, pertinent to '[potential reality](#)', for removing the non-unitary "R" process (historical account from October 2002 [here](#)); hence the motto of this web site, since July 1997: Dead matter makes quantum jumps; the living-and-quantum matter is smarter.

Notice that not only the "R" process is being removed (as did Hugh Everett III in his [relative state interpretation of QM](#)), but the alleged "U" process and Hilbert space as well.

The established theoretical physics community, particularly Niels Bohr, [ridiculed Everett's interpretation](#) to the extent to which Hugh Everett left physics (and became millionaire).

**NB:** Notice that if the [PR<sup>2</sup> interpretation of QM](#) is correct, then all tentative solutions proposed for the [measurement problem](#) and the [classical limit](#) of QM, based on either probabilistic or "[toposification](#)" ([Chris Isham](#)), 'neo-realist' interpretation of QM ([Cecilia Flori, p. 211](#)), will necessarily be wrong.

The next step is to elaborate on the *continuum* of such explicated quantum states (local mode of spacetime), which emerges from the [back bone](#) of the whole physical world (global mode). Here we enter quantum gravity, particularly the *emergence* of time and space from "something else" ([Isham and Butterfield](#)): check out the arrow of spacetime [here](#), and think of 'the whole universe' as a huge [brain](#) which self-determines its consecutive quantum-gravitational states in line with the Bootstrap Principle of [Geoffrey Chew](#). Also, the alleged quantum "fluctuations" are interpreted as [flexibility](#) of 'the quantum state' to offer *potential* states, one of which to be chosen (one by one) by 'everything else in the universe'. Hence the speculation about some "[spacetime foam](#)" and the insoluble problems from it (how do you tell apart spacelike from timelike at [Planck scale](#)?) are avoided from the outset. Possible practical implications are outlined [here](#).

As in the case of Hugh Everett, many theoretical physicists jumped to play the role of Niels Bohr, chief among them was [Britain's leading expert in quantum gravity](#), who declared seven years ago ([Wed, 23 Oct 2002 19:24:15 +0100](#)):

"You do not know enough theoretical physics to help with any research in that area."

To the best of my knowledge, nobody has so far offered some new *cancellation mechanism* as a joint solution to the [measurement problem of QM](#) and the [cosmological "constant" problems](#). Such

cancellation mechanism is built in the UNdecidable quantum state (quantum presentation of Platonic ideas) from *the outset*: instead of dealing with some  $|\text{alive cat}\rangle$  &  $|\text{dead cat}\rangle$  from the "U" process, we encounter an UNdecidable '*cat per se*', so **if** we happen to observe an 'alive cat' as a *fact*, with unit probability, the 'dead cat' will happily live undisturbed in '*the UNdecidable quantum state*'. No "collapse" nor [dead cat doppelgänger](#) à la Everett are needed.



The animated cat above is very deceptive, because its "evolution" prior to the "collapse" seems fully deterministic. If you think about the quantum "evolution" of such superposed states in terms of 'energy eigenstates', notice the imaginary unit in S. Carroll's essay, [Eq. 4](#): "all of the time evolution is encoded in the phases [XXX]" (*ibid.*, p. 6). But how do you encode 'time evolution' in *complex* phases ([Chen Ning Yang](#))? Recall that, *after* you "collapse" the cat, the alleged "time parameter" in the Schrödinger equation turns into some *non-relativistic* [you-name-it], but the equation itself doesn't say anything whatsoever about the nature of this "time parameter" *prior* to the "collapse", as introduced by hand (along with the [Born rule](#)) in QM textbooks.

To understand the origin of this whole mess, read the second sentence from the excerpt below (R.I.G. Hughes, *The structure and interpretation of quantum mechanics*, [p. 77](#)):

### 2.7 The Evolution of States in Quantum Mechanics

Like classical mechanics, quantum theory tells us how the state of a system evolves with time. The key role in the equation governing this evolution is played by an operator rather than by the Hamiltonian function, in line with the general principle that, in quantum mechanics, operators represent physical quantities. As in the classical case, the quantity in question is the total energy of the system; it is represented in quantum theory by a Hermitian operator  $H$  which we call the *Hamiltonian operator* for the system. The rate of change of the state  $\mathbf{v}$  of a system is given by

$$(2.6) \quad i\hbar \frac{\partial \mathbf{v}}{\partial t} = H\mathbf{v}$$

and this equation is known as *Schrödinger's time-dependent equation*, or sometimes simply as *Schrödinger's equation*.

This "general principle", however, does not cover the case of UNdecidable, hence not-yet-physical, KS quantum state, as explained by R.I.G. Hughes [here](#). One can hardly overestimate the *enormous confusion* from this huge blank spot in current QM textbooks -- just recall the ongoing quest for "[quantum computing](#)" and the alleged "decoherent histories" ([J. Halliwell](#); cf. [Franck Laloë](#), Sec. 6.4 and footnote 47 on p. 81).

All these problems are resolved in the [PR<sup>2</sup> interpretation of QM](#) from the outset. Moreover, the new *cancellation mechanism* is introduced to explain the ongoing, as-we-speak mechanism of 'the flatness problem' ([asymptotically flat spacetime conjecture](#)), producing an extremely precise balance between the two tug-of-war effects, [CDM & DDE](#), of the geometry of spacetime at cosmological scales.

Otherwise we have to inject up to 96% "dark stuff" (with all sorts of "[ghosts](#)") into the current theoretical physics, as calculated under the assumption that 'potential reality' doesn't exist. As Evalyn Gates put it ([p. 196](#)), the detection of DDE was "like finding an [elephant](#) on top of a table impeccably set with the finest china and silver (...). We stare in shock at the uninvited guest and demand to know [where the elephant came from](#) -- and [how it got into \(the\) room](#)."

Regarding the [arrow of spacetime](#): notice that the Frisbee-like sequence of *explicated facts* (local mode of spacetime) is inherently background-free, because the *background* (the reference fluid of GR and the UNdecidable quantum state) is '[not there](#)', being placed [\[between\]](#) the "points" of the *continuum* of the **local** mode of spacetime. In other words, the "dark gaps" of the **global** mode are **not** like the real gaps between the tiles in R. Penrose's bathroom: regardless of how small tiles you choose, if you decrease the size of the tiles in a [Fibonacci sequence](#), you will never ever reach the "gaps" from/within the **local** mode of spacetime (more on Fibonacci [here](#)).

This proposal makes the **local** mode of spacetime a **perfect 3-D continuum** with **dynamical** topology of '[asymptotically flat spacetime](#)'. The "dark" gaps of the postulated global mode of spacetime are *completely sealed off* by the arrow of spacetime -- the *mechanism* by which the "dark" gaps of the *global* mode are made **nonexistent** in the *local* mode is the same that makes the "speed" of light a fundamental constant (and also hides the [mirror tachyonic world](#)). This renders the [Schlaefli conjecture](#) (L. Schlaefli, *Ann. di Mat.* 5 (1873) 170), as well as all "[branes](#)" and other multidimensional superstitions in [GR](#) and string hypotheses ([Lisa Randall](#); see also A. Vilenkin below) redundant, to say the least.

In the context of GR, the *global mode* of spacetime is located "**within**" each and every point from spacelike hypersurfaces, as it "lives" exclusively on [null hypersurfaces](#). (Unlike the geometry of spacelike hypersurfaces, the geometry of null hypersurfaces is *not* metric ([D. C. Robinson](#)), which leaves a challenging opportunity to introduce an *additional*, to the Christoffel connection, [global torsion connection](#).) To be precise, the "duration" of the global mode, recorded with a physical clock (local mode), matches the "duration" of the atemporal "handshaking" transaction in Cramer's interpretation of QM: it has been **already** completed at *each and every instant* we "look" at it (see [below](#)).

Hence in the **local** mode of spacetime, the [dimensionless GW amplitude](#) is [zero, nonexistent, zilch](#). (Another case of reining a dimensionless amplitude, the mythical "quantum computing", is examined [here](#).)

Notice also that the hypothetical **global** mode of spacetime cannot be read by a physical clock (it will "[stand still](#)"). It is introduced to replace the "external time parameter" in H.-D. Zeh ([p. 13](#)) and the "auxiliary internal time" (cf. Macias and Quevedo, [p. 8](#)) by '*the* reference fluid of GR'. The latter can "act" upon matter without being affected in turn by matter. In this unphysical "absolute" reference frame, an electromagnetic radiation field can indeed "stand still" (recall that EM radiation field cannot stand still with respect to *any* physical observer, Bahram Mashhoon, [p. 14](#)).

The next metaphysical idea is [straightforward](#): 'time' does not originate from 'change *in* space' but from 'change *of* space'. Only if you have the latter (global mode), you may introduce the former, as 'time read by a clock' (local mode). Why? Because one cannot insert the "dark" energy of **X** [into its consequence](#): accelerated expansion of space. The dynamics of 'the change *of* space' is defined relative to the "omnipresent ether **X**" (global mode of spacetime). The latter is located "within" each and every point from the *local* mode of spacetime, and is *wrapping* the local mode by two ([in fact, one](#)) 'numerically finite but physically unattainable [Aristotelian boundaries](#)'.

All we can *physically* observe is that the local mode of spacetime is being '[acting upon itself](#)'. Such [self-action](#) will of course look "dark" to all local sub-systems (see [Alex Murphy](#)).

Hence we can bridge QM and GR, and understand the *origin* of [quantum](#) and gravitational "[waves](#)": [EPR-like correlations](#) (global mode) will inevitably induce wave-like [holomovement](#) of physical stuff along the [arrow of spacetime](#). Such wave-generation effects can be found in our brains and in many [living organisms](#). Perhaps it determines the [inertial reaction "forces"](#) as well (don't bother to ask

[Criss Angel](#), he knows [nothing](#) about it).

Recall what William Kingdon Clifford claimed in his paper 'On the Space-Theory of Matter', presented to the Cambridge Philosophical Society on February 21, 1870 (quoted after Domenico Giulini, [p. 2](#)):

I hold in fact:

1. That small portions of space *are* in fact of a nature analogous to little hills on a surface which is on the average flat; namely, that the ordinary laws of geometry are not valid in them.
2. That this property of being curved or distorted is continually being passed from one portion of space to another after the manner of a wave.
3. That this variation of the curvature of space is what really happens in that phenomenon which we call the *motion of matter*, whether ponderable or etherial.
4. That in the physical world nothing else takes place but this variation, subject (possibly) to the law of continuity.

I believe Clifford's idea in (2), about "the manner of a wave", is amended here with the proposed origin of quantum-and-gravitational "waves": the *continuous* passage of "curved or distorted" from one **point** (not "portion", as in (1) above) to the *next one* is what the [arrow of spacetime](#) does on the *perfect continuum* of the [local mode](#) of spacetime (the "dark" gaps of the passage are being completely *sealed off* by the arrow of spacetime).

But why 'arrow of spacetime'? Because our good old 3-D space is not like a huge static warehouse, in which we would notice some redshifted light from moving objects, receding from us in line with the Hubble Law (some [balloon metaphors](#) may be [highly misleading](#)). It is the other way around: distant galaxies are not "speeding up" with respect to us in some *absolute static space*, but the very *metric* of space is "expanding" (I firmly disapprove of this notion of "[expansion](#)", and have suggested the so-called '[relative scale principle](#)').

Hence the space itself is endowed with *dynamics*, but then we need some [ether](#) w.r.t.w. such 'global dynamics of 3-D space' can be formulated. Then **the only** possibility -- trust me, there is no other option -- is to place the *omnipresent ether*, as '[the source](#) of the "dark" energy', in the *global mode* of spacetime. Otherwise you will have to define the *dynamics* of space w.r.t. itself, and will look like [Baron Munchausen](#). That's why we need an arrow of spacetime, in my opinion (but notice the opinion of Chris Isham [above](#)).

**NB:** If this is the case chosen by Nature, then *any* approach to quantum gravity, based on the "splitting" of spacetime ([Brett Bolen](#)), will necessarily be [wrong](#).

The speculations of [Roger Penrose](#) will necessarily be wrong as well: "The fuzzy idea of where and what is infinity was clarified and made more specific by the work of Penrose [[45](#), [46](#)] with the introduction of the conformal compactification (via the [rescaling of the metric](#)) of spacetime, whereby infinity was added as a [boundary](#) and brought into a finite spacetime region." ([Ted Newman et al.](#))

Perhaps we may have to develop new mathematical theory of 'potential reality', such that the "[state space](#)" of [Margenau's Onta](#) (quantum presentation of Platonic ideas) would match the structure of [cognitive concepts](#); notice that in the "cheating on 20 questions" the answer '[cloud](#)' was explicated by a Bayesian [learning rule](#) (not the Born rule). For comparison, the categorification of Feynman diagrams requires "black boxes with many wires going in and many wires going out" (Baez and Lauda, [p. 16](#)), while in our case all wires are "[instantaneously](#)" (global mode of spacetime; see the Escher drawing below) keeping track of all virtual 'black boxes' *as well* ([relational ontology](#)), in order to dynamically adjust to the changing context of the game, until they jointly select the final, explicated 'black box': '[cloud](#)' (see also the four dice [here](#)).

**NB:** In the *local* mode of spacetime, the "duration" of the total negotiation with 'everything else in the universe' ([relational ontology](#)) is **zero**. Hence a *wave pattern* is being created, without any source of these "waves" being present in the local mode, and a new form of retarded causality (*biocausality*; see below) can be postulated -- a revitalization of Leibnitz' *harmonia praestabilita*, Jung's

[Synchronicity](#), and Einstein's [Überkausalität](#).

We definitely need mathematical theory of '[potential reality](#)'. The task is highly non-trivial, but once we unravel the correct mathematical theory, the astonishing effectiveness of mathematics ([Eugene Wigner](#)) may drive us closer to the true quantum gravity of He Who Does Not Play Dice -- the world is not deterministic but [flexible](#), and the 'chooser' of one possibility ([one](#) at a time) amongst infinitely many is 'the whole universe' in its state of [ONE](#).

All I've been getting so far is either [dark silence](#) or insults (some of them [really harsh](#)).

Perhaps the situation will improve in 2010, after the sixth consecutive failure of LIGO Scientific Collaboration (LSC) to detect GWs with the so-called "[enhanced LIGO](#)". GW energy transfer is fundamentally non-linear phenomenon ([Hermann Bondi](#)), but is wiped out with the "linearized approximation" adopted by LSC. Also, GW energy is intrinsically [quasi-local](#), in the sense that GWs do not propagate exclusively "[in one direction only](#)" ("when the waves are all moving in the same direction", cf. [P.A.M. Dirac](#), Ch. 33, [p. 64](#)), as they *also* have a [holistic global component](#) ([atemporal "handshake"](#)), which covers [the whole 3-D space en bloc](#).

LIGO Scientific Collaboration ([LSC](#)) stubbornly refuse to acknowledge that there are no bans whatsoever on the [dipole radiation](#), simply because [conservation](#) of gravitational mass-energy and momentum, in a world dominated by an *evolving* cosmological "constant", is a wishful thinking. They fear to even mention the implications of DDE to their project, and have never tried to address the (old) cosmological "constant" problem, which **inevitably** occurs if you trust the unwarranted assumption that the "dark energy" from the quantum vacuum can *only* spring from Lorentz-invariant stuff with [positive energy density](#).

Is it possible to detect some 'elementary shift' of the expanding metric -- the "intrinsic time interval associated to any timelike displacement", T. Jacobson, pp. [18-19](#) -- due to the omnipresent and perfectly smooth DDE? In what [reference frame](#)? Notice that you're dealing with some "fluid" that "has *zero* inertial mass! It can be accelerated with no cost, no effort" (B. Schutz, [p. 255](#)) and "provides an all-pervading energy density and negative pressure that are the same to all observers, at all places, and at all times in the history of any universe model, even the expanding ones." ([p. 257](#))

Similar rhetoric questions apply to the dynamics of the metric, producing [inflationary gravitational waves](#) on the 3-D "balloon" hypersurface. It's a bundle.



Yet *the same kind* of waves, only much "weaker", are expected to be detected by LIGO (see [below](#)).

Forget it. There is no need for "[precise calibration](#)" of a dead turkey.

The insane efforts of LSC remind me of the old joke about a drunken man, who has lost his key somewhere in the dark, but is searching for it under the street lamp, simply because it is brighter there. Only LSC's "key" costs **billions**. Which is why I accused LSC members of [aggressive professional negligence](#), and offered them to review my [White Paper](#). They responded with dark silence, as usual.

🔍 Check out the communist censorship of Paul Ginsparg's "moderators" [here](#).

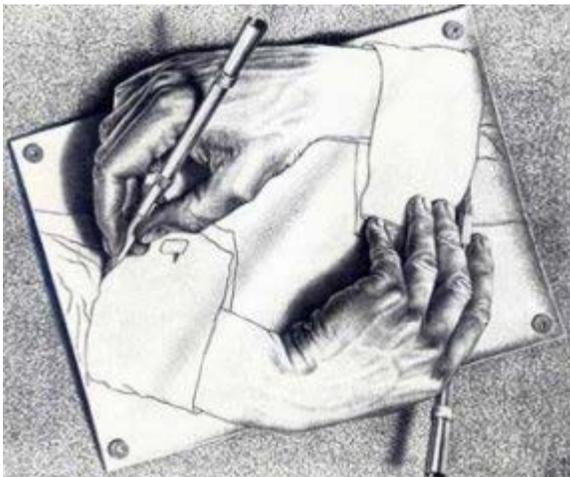
Since all this points to the [unknown dynamics of GR](#), consider this: similar to the case of [particle-wave duality](#), the splitting the spacetime into two "components" is allowed for educational purposes only. In fact, we are dealing with [one object](#), as stressed by [Hermann Minkowski](#) (recall again the [elephant's trunk](#)). Hence if you split the spacetime into two "components", and let one of them ('time read by a clock') to "evolve" *with respect to* the other one (3-D space) -- as [Paul Dirac](#) and [ADM](#) did in the misfortunate [Hamiltonian formulation of GR](#) -- you will end up with a [dead frozen snapshot](#) of the [arrow of spacetime](#), in which all GW effects (the [positivity of mass](#) and its [inertial reaction "force"](#)) have **already** been completed by the "instantaneous" [non-linear Machian-type negotiation](#) (global mode of spacetime; see the Escher drawing below) with 'everything else in the universe' (the so-called [biocausality](#)).



To explain "[already](#)", let me quote from Thomas E. Phipps, *Should Mach's Principle be taken seriously? Speculations in Science and Technology*, 1(5) 499-508 (1978), p. 504:

"Gravity is a different beast from radiation of any kind. Being mediated by virtual particles, which may be considered to be kept permanently virtual by the physical non-existence of [gravity shields or absorbers](#), gravity can act (nonlocally) with infinite speed -- in effect, with precognition. That is exactly what it does, if Mach's principle has any substance. The fixed stars "know" the subway is going to jerk, because they have sent their virtual spies [forward in time](#) to find out about it."

The crux of the idea of [biocausality](#) is well-known. Back in [1953](#), Wolfgang Pauli suggested that the concept of [finality](#) ("the end (*telos*), that for which a thing is done", Aristotle, *Physics* 194b33) should be considered as a *complement* to causality in deterministic and statistical laws. The stipulation here is that Aristotle's *effective cause & final cause* determinate jointly the **next** state of all material constituents of the universe *relationally*, in line with the bootstrap principle 'think globally, act locally' (global mode of spacetime; see the Escher drawing below), but in the *local mode* the resulting *biocausality* is **retarded**, along the [arrow of spacetime](#).



From this perspective, detecting GW effects requires "online" access to the global mode of spacetime, in which the [dynamical determination](#) of spacelike and timelike directions (hence [Lorentzian metric](#)) is being produced -- one-at-a-time, along the [arrow of spacetime](#). In simple words, this means that the [proper GW detectors](#) must be endowed with the self-acting faculty of the [human brain](#), to match the "interaction of spacetime with itself" (C. Kiefer, [p. 2](#); cf. also J. G. Pereira *et al.*, [arXiv:0909.4408v1 \[gr-qc\], p. 10](#), Eq. 7.2).

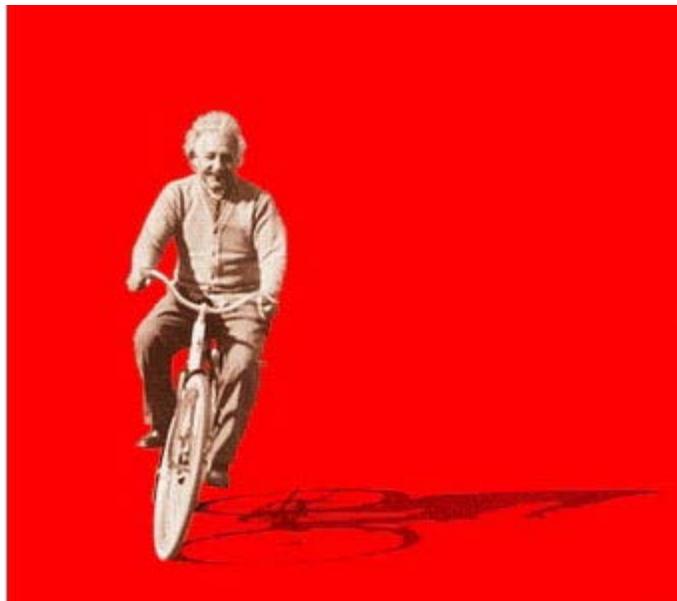
As of today, nobody cares. [Nobody](#).

I can take it. I'm psychologist, and don't need quantum gravity to [practice PHI](#).

Why would a fish need a [bicycle](#)?

[D. Chakalov](#)

Thursday, 26 November 2009



[click the image to enter the web site]

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Some history of the project outlined [above](#). In January 1972, shortly after my demobilization from BG army (age 19, with the lowest possible rank), I decided to study psychology and "sort out" the physics of the human brain, to explain and eventually explore its amazing latent abilities. It took me sixteen years to realize that the task is unfeasible with the established *Weltbild*, and on 22 May 1988, at 23:45 local time, I decided to try the project 'the other way around', namely, to develop a model of the universe as a 'brain', such that there will be a natural explanation of the physics of the (small) brain from the outset. After many trials and errors, the first (relatively) encouraging evidence appeared in [July 1998](#), but the project is still [far from being completed](#). I am trying to find *any* weak points or inconsistencies in it, just as I would do with a brand new parachute, which I would have to put on ultimate test by jumping from a helicopter. I do like the unfolding of the whole project, since it seems to me that all pieces of '[the bridge](#)' snap to their places *effortlessly*. Yet there is no room for contention, and I never go into the mood of '*chi si contenta gode*' (a contented mind is a perpetual feast; he who contents himself, enjoys).

Hopefully, if we join our efforts and knowledge (included at the level of our collective unconsciousness, cf. Jungian [Kollektives Unbewusstes](#)), some day we may succeed.

Meanwhile, please keep in mind the prediction of [Robert Millikan](#), Nobel Prize in Physics (1923): "There is no likelihood man can ever tap the power of the atom."

This web site is my feedback to [all people](#), who are helping me, one way or another, with improving the theory. Feel free to download it (app. 11.8MB) from

[http://www.god-does-not-play-dice.net/PHI\\_info.zip](http://www.god-does-not-play-dice.net/PHI_info.zip)

By unzipping [PHI\\_info.zip](#), a new folder, !Einstein\_PHI, will be created on your hard drive. Find there START.html.lnk and open it (it is linked to this front page (index.html) in the website folder).

If, for some reason, you believe we don't need new approach to quantum gravity, try to understand [Sean Carroll](#)'s speculations (448 pages, [January 2010](#)):

"... wavefunctions appear to collapse in one direction of time but not the other is not an explanation for the arrow of time, but in fact a *consequence* of it. The low-entropy early universe was in something close to a pure state, which enabled countless "branchings" as it evolved into the future." Yet he acknowledged: "we can't, once again, define a conserved total energy in [any reasonable way](#)." Consequently, the main speculation of S. Carroll about some "low-entropy early universe" is just as unclear as is its gravitational energy which would evolve "into the future". (Also, there may be a critical low *geometric* entropy state of the 'extremely early' universe, which may blur the timelike and spacelike directions themselves, and turn them into some primordial quantum dough from which nothing could possibly "[decohere](#)", ever.) As one of his [senior colleagues](#) summarized, "the magnitude of the entropy of the universe as a function of time is a very interesting problem for cosmology, but to suggest that a law of physics **depends** on it is sheer nonsense."

... Alex Vilenkin's [arXiv:0908.0721v1](#) (\$63,000 [FOXi Grant](#)):

The physical properties of all low-energy bubbles do not have to be the same. In fact, string theory, which is at present our best candidate for the fundamental theory, appears to have a multitude of solutions describing vacua with different values of the low-energy constants of nature. These solutions are characterized by different compactifications of extra dimensions, by branes wrapped around extra dimensions in different ways, by different values of the fluxes, etc. The number of possibilities is combinatorial and can be as high as  $10^{1000}$ . Bubbles of all possible vacua will nucleate in the course of eternal inflation. The resulting multiverse, with bubbles within bubbles within bubbles, provides a natural arena for anthropic applications, such as the one I described for the cosmological constant.

... Laura Mersini-Houghton's [arXiv:0909.2330v1 \[gr-qc\]](#) (\$50,000 [FOXi Grant](#)):

"... when treated in a multiverse framework, fundamental time is directionless and consequently physical laws inherit its time-reversal symmetry. Despite that reversal symmetry is broken for the local time by the bubble nucleation, the bubble still inherits laws of physics at birth from the multiverse, without modification. Thus the emergent time's arrow in the bubble does not affect the time-reversal symmetry imprinted onto the physical laws that the bubble inherits from birth in the multiverse. (...) An emerging time in the multiverse does not appear plausible since the emergence adds information on the multiverse that wasn't there prior (... but we face the same kind of emergent *non-unitary* phenomenon with DDE -- an evolving cosmological "constant" that springs from the quantum vacuum - D.C.)."

... and the obstinate belief of [Andrei Linde](#) (\$164,179 [FOXi Grant](#)):

"During the last 25 years a new scientific paradigm gradually emerged. (...) My main goal is to learn how to make *scientific predictions* in this complicated framework."

Sure enough, Andrei Linde tried to answer the first off question of how many universes are in the "multiverse" ([arXiv:0910.1589v2](#)):

slow-roll inflation. This process may create

$$\mathcal{N} \sim e^{e^{180}} \sim 10^{10^{77}} \quad (3)$$

universes with different geometrical properties. This number is incomparably greater than  $10^{500}$ . If the initial size of the universe is greater than  $H_I^{-1}$ , the total number of different universes is even much greater.

Coincidentally or not, his calculation matches the number of angels (mostly blond) that can fit on the head of a pin, as suggested by A. Linde's medieval colleagues.

If these people were here in the 21st century, I suppose they would gladly join LIGO Scientific Collaboration (see [above](#)), and speculate that, shortly after the "big bang", the whole universe was still small enough to fit on the head of a pin, with strong ripples of the spacetime metric (see their picture [above](#)). They would *love* to feel again like an 'absolute observer' with an absolute clock paired with an absolute measuring rod, to tell the dimensions of the universe and its current cosmological age, as read by their [absolute wristwatch](#). But instead of arguing about angels (either blond or not), they would certainly prefer to measure the "ripples of the metric" (albeit [very weak](#)), which again can *only* be seen from the same standpoint of 'absolute observer'. Needless to say, they will easily publish tons of articles on "GW astronomy", and will ignore any [alternative viewpoint](#) on what can be "seen" by such absolute observer: nothing but "[gauge-dependent](#)" stuff.

That's how '[potential reality](#)' is being *camouflaged* in [present-day GR](#), simply because if it were possible to detect the [source of DDE](#) as 'gauge invariant observable', the omnipresent and *perfectly smooth* ether (the [source of DDE](#)) will be exposed to direct physical observations, as 'spacetime acting [upon itself](#)'.

Back in April 1986, Yakov Zel'dovich wrote in a letter the following (private communication): "Long time ago, there was a period of time during which there was still no time at all." Of course he was joking.

Yet the 'global mode of time', pertaining to [potential reality](#), cannot be read by any physical clock, because the poor inanimate clock will read it as '[stand still](#)' or "no time at all", as Yakov Zel'dovich put it. Maybe The Beginning, which lives in "no time at all", is always with us ([dual age cosmology](#)).

Anyway. Perhaps in the next twenty-five years a new paradigm will emerge: the universe modeled as a **brain**. The *driving force* of its [arrow of spacetime](#) cannot spring entirely and exclusively from the "brain" itself, which brings us to Virgil's statement: *Mens agitat molem* (*The Aeneid*, [Ch. 6, 727](#)).

In German, it reads: *Der Geist bewegt die Materie*. Physically, *Der Geist* may look like 'the ideal monad [without windows](#)'. However, no *scientific predictions* can be made about **it**, or else we will conflate religion with science. Thank God, this is impossible.

D. Chakalov  
October 31, 2009

---

Subject: "best of all possible worlds."  
Date: Fri, 8 Oct 2010 21:09:20 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Robin G Jordan <jordanrg@fau.edu>

Dear Professor Jordan,

It was a great pleasure to read your essay on [Newton](#) vs. Leibniz,

<http://courses.science.fau.edu/~rjordan/phy1931/NEWTON/newton.htm>

"Leibniz thought the idea of God as an astronomical maintenance man as absurd. He believed that God had carefully chosen among an infinity of possible worlds, the one He felt the most suitable. So that although we may not have a perfect world, it was the

"best of all possible worlds."

I intend, Deo volente, to talk on a similar subject on 25 November 2015,

<http://www.god-does-not-play-dice.net/#VGP>

My web site isn't encrypted (like Newton's 6accdae13eff7i3l9n4o4qrr4s8t12ux), and if you have some spare time, I will highly appreciate your comments on my efforts.

Kindest regards,

Dimi Chakalov

=====

Subject: New limit on [the mass](#) of Father Christmas' beard (a.k.a. [WIMPs](#))

Date: Fri, 8 Oct 2010 21:55:02 +0300

From: Dimi Chakalov <dchakalov@gmail.com>

To: Joe Silk <j.silk1@physics.ox.ac.uk>, silk@astro.ox.ac.uk

Cc: M Angeles Perez-Garcia <mperezga@usal.es> ,

Jirina R Stone <j.stone1@physics.ox.ac.uk> ,  
rminchin@naic.edu,

Jonathan.Davies@astro.cf.ac.uk,

Mike.Disney@astro.cf.ac.uk,

Sarah.Roberts@astro.cf.ac.uk,

caj@jb.man.ac.uk,

Wim.vanDriel@obspm.fr,

benjamin.allanach@googlemail.com,

s.sarkar@physics.ox.ac.uk,

matthew.chalmers@iop.org,

Plus@maths.cam.ac.uk,

J.D.Barrow@damtp.cam.ac.uk,

uzan@iap.fr,

blanchet@iap.fr,

alain.blanchard@ast.obs-mip.fr,

edwin.cartlidge@yahoo.com

Dear Joe,

I am really surprised that you took part in the calculations of a new limit of WIMPs (arXiv:1007.1421v2; Phys. Rev. Lett. 105 (2010) 141101).

May I use this opportunity to invite you and your colleagues to my talk on quantum gravity,

<http://www.god-does-not-play-dice.net/#VGP>

All the best,

Dimi

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How do we know that Father Christmas has a beard?  
We know it, because snow falls when he shakes his beard.

Old Tanzanian saying

=====

Subject: Spherical cows  
Date: Wed, 12 May 2010 14:42:46 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Richard Gray <richard.gray@telegraph.co.uk>  
Cc: Jim Hough <J.Hough@physics.gla.ac.uk>,  
Sheila Rowan <S.Rowan@physics.gla.ac.uk>,  
Ralph Cordey <Ralph.Cordey@astrium.eads.net>,  
Keith Mason <keith.mason@stfc.ac.uk>,  
council@stfc.ac.uk  
Bcc: [snip]

RE: Largest scientific instrument ever built to prove Einstein's theory of general relativity, by Richard Gray. The Daily Telegraph, 8:30 AM BST, 09 May 2010,  
<http://www.telegraph.co.uk/science/space/7695994/Largest-scientific-instrument-ever-built-to-prove-Einsteins-theory-of-general-relativity.html>

Dear Mr. Gray,

I trust you are familiar with the anecdotal story about a 'spherical cow',

[http://en.wikipedia.org/wiki/Spherical\\_cow](http://en.wikipedia.org/wiki/Spherical_cow)

Suppose someone claims that \*the real cows are indeed round\*, because cows might be approximated as spherical objects, and then ask your government to allocate a significant portion from your taxes for detecting the unique pattern of 'real spherical cows'.

Likewise, you were told by a number of people that, after applying their spherical-cow approximation to Einstein's theory of general relativity, they might eventually detect gravitational waves (GWs): "we haven't been able to detect them yet because they are very weak" (Jim Hough).

However, their persistent optimism is rooted on artifacts due to their spherical-cow (=linearized) approximation of GR,

<http://www.god-does-not-play-dice.net/Szabados.html#SBG>

In fact, they ignore [all problems](#) due to their approximation. For example, Hermann Weyl proved in 1944 that such spherical-cow approximation implies the existence of a tensor that, except for the trivial case of being precisely zero, does not otherwise exist,

<http://www.sjcrothers.plasmareources.com/weyl-1.pdf>

Regarding Ralph Cordey at Astrium UK and the so-called LISA Pathfinder: How much this spherical cow will cost to UK taxpayers, I wonder.

Yours sincerely,

Dimi Chakalov  
35 Sutherland St  
SW1V 4JU

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**Note:** The failures to detect GWs were "explained" by Jim Hough with a *very* misleading statement: "we haven't been able to detect them yet because they are very weak". In fact, GWs are immensely powerful phenomena, but nobody -- Jim Hough and Sheila Rowan included -- can offer a non-linear theory of GWs. All they can do is to imagine that, by the time GWs reach LIGO or LISA, they will be "very weak", such that their spherical-cow approximation to Einstein's GR would be correct. But again, they don't have any non-linear theory of strong GWs, from which some "weak limit" can be derived.

All they do is asking for more taxpayers' money for detecting spherical cows, instead of doing their homework first on paper, to demonstrate such "weak limit" to initially strong GWs. Pity nobody cares.

D.C.  
May 12, 2010

=====

Subject: [arXiv:1005.1614v1 \[gr-qc\]](#)  
Date: Tue, 11 May 2010 05:14:25 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Robert Geroch <geroch@uchicago.edu>  
Cc: Alexander Vlasov <Alexander.Vlasov@pobox.spbu.ru>, qubeat@mail.ru

Robert Geroch, Faster Than Light? arXiv:1005.1614v1 [gr-qc]  
<http://arxiv.org/abs/1005.1614>

R. Geroch: "I am not sure that this is the right perspective — or even whether "right" makes much sense in this context."

Bob, I think you can have your cake and eat it -- the key word is 'quasi-local',

<http://www.god-does-not-play-dice.net/#topology>

You and your Russian colleague are so good in math ...

D.  
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**Note:** To explain *quasi-local*, and 'what is going on' in QM, check out Feynman [[Ref. 1](#), 12-1]:

"The first question we have to answer is: What are the *base states* for the system? Now the question has been put incorrectly. There is no such thing as "*the*" base states, because, of course, the set of base states you may choose is not unique. New sets can always be made out of linear combinations of the old. There are always many choices for the base states, and among them, any choice is equally legitimate. So the question is not what is *the* base set, but what *could* a base set be? We can choose any one we wish for our own convenience. It is usually best to start with a base set which is physically the clearest. It may not be the solution to any problem, or may not have any direct importance, but it will generally make it easier to understand what is going on."

There *is* such thing as "*the*" base state (never in plural) -- the UNdecidable KS state, as explained [below](#).

For example, in the case of [two spin-half particles](#), everything you insert in brackets

$|1\rangle = |++\rangle$ ,  $|2\rangle = |+-\rangle$ ,  $|3\rangle = |-+\rangle$ ,  $|4\rangle = |--\rangle$

... are just possible *physical* manifestations of "*the*" base state, much like the three sayings [above](#), emanating from their UNSpeakable *potential-reality* state of your **brain**.

Thus, the system {"*the*" base state & |whatever>} evolves along the arrow of spacetime in a strictly

*quasi-local* fashion: see Fig. 1 and Fig. 2 [below](#).

Feynman also stressed [[Ref. 1](#), 12-2]: "That's the question: How do the amplitudes change with time in a particular (fixed) base?"

The amplitudes change along the *global* mode of time: see again Fig. 2 [below](#). Don't be befuddled by the *anti*-relativistic "time parameter" in the Schrödinger equation, because you need "*the*" base state to eliminate the measurement "problem" in QM and reconcile QM with STR, as well as solve the puzzle of quantum vacuum and gravitation: "*the*" base state [does not gravitate](#).

It would be nice if Robert Geroch writes up a sequel to his 30-year old book [General Relativity from A to B](#), entitled "General Relativity from A to A+ds", to elucidate the concept of 'interval' in GR -- professionally. But he wouldn't. Trying to discover [new math](#) is a tough challenge.

The last time I heard from Robert Geroch was eight years ago, only to require his email to be removed from my web site. I will gladly do that, if only he writes a serious paper on GR, or at least reply professionally. Here are two questions:

Do you believe that the "points" from the underlying manifold can be **connected only and exclusively only** by their *physical* content that is invariant under "[active](#)" [diffeomorphisms](#)? If your answer is 'no', what could be "*the*" base state in GR (a.k.a. *the reference fluid* of GR), which [binds](#) the "points" by one single unique bare [UNdecidable](#) matrix?

If your answer to the first question is 'yes', you are ready to [teach GR](#) and enjoy its [generic pathologies](#) [[Refs 2](#) and [3](#)].

It is [generally believed](#) that (i) one can picture the spacetime in GR as a manifold that can be "locally modeled" on some fictitious flat Minkowski space, but (ii) this picture should break down at short distances of the order of the Planck length. Neither of these ideas are needed, however. There is no need for any limitation in the possible accuracy of localization of spacetime events either. Why is that? Because the so-called Planck length may possess an [inner geometrical structure](#).

Ignore it at your peril.

D.C.

May 12, 2010

Last update: May 14, 2010

[[Ref. 1](#)] *Feynman Lectures on Physics*. Volume III : Quantum Mechanics, Addison-Wesley, Reading, MA, 1965; [ISBN: 9780201020144](#)

[[Ref. 2](#)] José M.M. Senovilla, Singularity Theorems in General Relativity: Achievements and Open Questions, [arXiv:physics/0605007v1](#)

"The problem of the definition of the concept of singularity in General Relativity is very difficult indeed, as can be appreciated by reading on its historical development (Hawking and Ellis, 1973; Tipler, Clarke and Ellis, 1980). The intuitive ideas are clear: if any physical or geometrical quantity blows up, this signals a singularity. However, there are problems of two kinds:

- the singular points, by definition, do not belong to the space-time which is only constituted by regular points. Therefore, one cannot say, in principle, "when" or "where" is the singularity.
- characterizing the singularities is also difficult, because the divergences (say) of the curvature tensor can depend on a bad choice of basis, and even if one uses only curvature invariants, independent of the bases, it can happen that all of them vanish and still there are singularities.

"The second point is a *genuine property* of Lorentzian geometry, that is, of the existence of one axis of time of a [different nature](#) to the space axes.

...

"All in all, it seems reasonable to diagnose the existence of singularities whenever there are particles (be them real or hypothetical) which go to, or respectively come from, them and disappear unexpectedly or, respectively, subito come to existence.

"And this is the basic definition of singularity (Geroch, 1968; Hawking and Ellis, 1973), the existence of incomplete and inextendible curves. That is to say, curves which cannot be extended in a regular manner within the space-time and do not take all possible values of their canonical parameter.

...

"Singularities in the above sense clearly reach, or come from, the *edge* of space-time. This is some kind of boundary, or margin, which is not part of the space-time but that, **somehow**, it is accessible from within it."

[Ref. 3] Lars Andersson, The global existence problem in general relativity, [arXiv:gr-qc/9911032v4](http://arxiv.org/abs/gr-qc/9911032v4)

Footnote 1: "All manifolds are assumed to be Hausdorff, second countable and  $C^\infty$  (maximal differentiable atlas, cf. Michael Spivak, Vol. 1, [Ch. 2](#) - D.C.), and all fields are assumed to be  $C^\infty$  unless otherwise stated."

*Id.*, Notes on Differential Geometry, 1, [p. 8](#):

"A differentiable manifold is a topological manifold  $M$  together with a differentiable structure, i.e. a way of defining differentiable functions on  $M$ . The natural way of doing this (forget about this "natural way" - D.C.) is to use the charts  $[X]$  to transfer the definition of differentiable functions from  $\mathbb{R}^n$  to  $M$ ."

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Subject: The global existence problem in general relativity,  
[arXiv:gr-qc/9911032v4](http://arxiv.org/abs/gr-qc/9911032v4)

Date: Wed, 6 Apr 2011 03:54:55 +0300

From: Dimi Chakalov <dchakalov@gmail.com>

To: Lars Andersson <laan@aei.mpg.de>

Cc: ehrlich@ufl.edu, chris.tsokos@gmail.com, keti@mat.unb.br,  
hbrandt@arl.army.mil, ljalias@um.es, andrzej@math.ohio-state.edu,  
fabrice.debbasch@gmail.com, sanchezm@ugr.es

Dear Dr. Andersson,

I suppose if you (i) do not assume upfront some space-like Killing fields, (ii) don't confine your analysis to some hypothetical vacuum spacetimes, and (iii) wish to avoid poetry [Ref. 1], you may have to start from scratch,

<http://www.god-does-not-play-dice.net/about.html#GR>

<http://www.god-does-not-play-dice.net/#Ruben>

<http://www.god-does-not-play-dice.net/#LIGO>

Perhaps the tasks are [strictly mathematical](#).

Yours sincerely,

Dimi Chakalov

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[Ref. 1] José M.M. Senovilla, Singularity Theorems in General Relativity: Achievements and Open Questions, [arXiv:physics/0605007v1](http://arxiv.org/abs/physics/0605007v1)

p. 6: "This is some kind of boundary, or margin, which is not part of the space-time but that,

**somehow** (Sic! - D.C.), it is accessible from within it."

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Subject: Positive-mass conjecture in the case of "[more and more space appears](#)" ?  
Date: Wed, 2 Jun 2010 05:28:23 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Shing-Tung Yau <yau@math.harvard.edu>,  
Richard M Schoen <schoen@math.stanford.edu>,  
Niall Ó Murchadha <niall@ucc.ie>,  
Claus Gerhardt <gerhardt@math.uni-heidelberg.de>,  
Adam Helfer <adam@math.missouri.edu>

Dear colleagues,

As of April 2010, "over 2250 papers with the words '[dark energy](#)' in the title have appeared on the archives since 1998, and nearly 1750 with the words 'cosmological constant' have appeared" (Shinji Tsujikawa, arXiv:1004.1493v1, p. 39).

I believe Michal Chodorowski explained, in arXiv:astro-ph/0610590v3, the meaning of "more and more space appears",

<http://www.god-does-not-play-dice.net/#Blanchard4>

It is totally unclear to me how one could define an isolated system in GR, in which "more and more space appears", to start thinking about some new positive-mass conjecture and the total energy in such "isolated system". Perhaps if one can demonstrate that **\_no\_** asymptotically flat spacetime can be stable under the conditions of such (accelerated or not) "flux" of "more space", we will face a paradoxical situation similar to the ultraviolet catastrophe of late 19th century, after which some bright mathematician will sort out [this whole mess](#).

Please advise.

With kindest regards and admiration,

Dimi Chakalov

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Re: Positive-mass conjecture in the case of "more and more space appears" ?  
Date: Mon, 25 Oct 2010 15:11:29 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Shing-Tung Yau <yau@math.harvard.edu>,  
Shing-Tung Yau <yau@ims.cuhk.edu.hk>  
Cc: Chiu-Chu Melissa Liu <ccliu@math.columbia.edu>,  
Mu-Tao Wang <mtwang@math.columbia.edu>,  
Xiao Zhang <xzhang@amss.ac.cn>,  
Lau Loi So <s0242010@gmail.com>,  
Hsin Chen <hchen@ntnu.edu.tw>,  
Fei-Hung Hoa <93242010@cc.ncu.edu.tw>,  
Chih-Hung Wang <chwang@phy.ncu.edu.tw>,  
Hwei-Jang Yo <hjyo@phys.ncku.edu.tw>

Dear Professor Yau,

I hope my email from Wed, 2 Jun 2010 05:28:23 +0300 has been safely received.

I believe some young and hungry grad student might crack the puzzle of quasi-local mass,

[http://www.god-does-not-play-dice.net/#Hehl\\_final](http://www.god-does-not-play-dice.net/#Hehl_final)

If you and/or some of your colleagues know such person, please pass her/him the link above. The task is highly non-trivial and strictly mathematical, and also requires guidance from Shao Yong.

I also believe the future of new energy sources belongs to your country, but if you wish to extract energy from 3-D space, you should always follow the advice of Shao Yong. Since I haven't heard from you so far, it seems the latter turned out to be too difficult for you.

Yours sincerely,

Dimi Chakalov

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Examine the objects as they are and you will see their true nature; look at them from your own ego and you will see only your feelings; because nature is neutral, while your feelings are only prejudice and obscurity.

Shao Yong, 1011-1077

Fooling around with alternative current is juts a waste of time.  
Nobody will use it, ever.

[Thomas Alva Edison](#), 1889

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Subject: [arXiv:1107.1374v3 \[math-ph\]](#) and [arXiv:0912.2886v4 \[math-ph\]](#)

Date: Fri, 29 Jul 2011 17:37:03 +0300

Message-ID:

<CAM7EkxkNe2NriAaNhSd60JnDeggcuqrUUQUmhqXnABtSZqANbQ@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Bert Schroer <schroer@cbpf.br>, bert.schroer@physik.fu-berlin.de

Cc: Carlos Perelman <perelmanc@hotmail.com> ,

Robert M Wald <rmwa@midway.uchicago.edu> ,

Stefan Hollands <HollandsS@cardiff.ac.uk>

Dear Bert,

You consider Haag's 1957 idea "of interpreting the spatial extend of a measuring device and the duration of its activation as an observable localized in the corresponding spacetime region fulfilling Einstein causality and an appropriately formulated causal propagation was (and still is) metaphoric if not to say naive" (arXiv:1107.1374v3 [math-ph], p. 8). His latest views are summarizer in [\[Ref. 1\]](#).

There is no such thing as "local covariance principle" (arXiv:0912.2886v4 [math-ph], Sec. 6 and p. 32).

Regarding the nonobservance of the holistic aspects of QFT (arXiv:1107.1374v3 [math-ph]), see a quasi-local approach to GR & QM at

<http://www.god-does-not-play-dice.net/about.html#GR>

<http://www.god-does-not-play-dice.net/#shoal>

I think the opposition to such proposals is not related to our current Zeitgeist. People just don't care. They live in total socialism and love to play with their hobbies.

Names? They're all at my web site.

All the best,

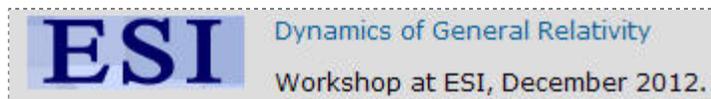
Dimi

[Ref. 1] Rudolf Haag, Questions in quantum physics: a personal view,  
arXiv:hep-th/0001006v1

<http://arxiv.org/abs/hep-th/0001006>

"In simple cases the event may be regarded as the interaction process between a particle and a detector. But the notion of 'particle' does not correspond to that of an object existing in any ontological sense. It relates to the simplest type of global state and describes possibilities, not facts. The notion of 'partial state' demands in addition that we ignore all possible events outside some chosen region and thus ignore possible correlations with outside events."

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Subject: 260037 PR Spezialisierungsmodul Mathematische Physik und Gravitationsphysik

Date: Sun, 26 Aug 2012 17:45:27 +0300

From: Dimi Chakalov <dchakalov@gmail.com>

To: Theor-Physik@univie.ac.at,  
joachim.schwermer@univie.ac.at,  
jakob.yngvason@univie.ac.at,  
bernhard.baumgartner@univie.ac.at,  
helmut.rumpf@univie.ac.at,  
mark.heinzle@univie.ac.at,  
robert.beig@univie.ac.at,  
piotr.chrusciel@univie.ac.at,

Dear colleagues,

I learned that the Spezialisierungsmodul offers "guidance to scientific research on open problems in mathematical physics and general relativity", which I hope to discuss with you during the ESI Workshop in December this year.

Meanwhile, please check out the Ansatz for 'necessary and sufficient conditions for spacetime', which can (hopefully) eliminate 'dieser verdammten Quantenspringerei',

<http://www.god-does-not-play-dice.net/#Erlangen>

As I mentioned in my email to Dr. Robert Beig ([Sun, 8 Apr 2012 20:04:57 +0300](mailto:robert.beig@univie.ac.at)), the task is strictly mathematical. I will be happy to explain it under the roof of Erwin Schrödinger Institute.

Kind regards,

Dimi Chakalov

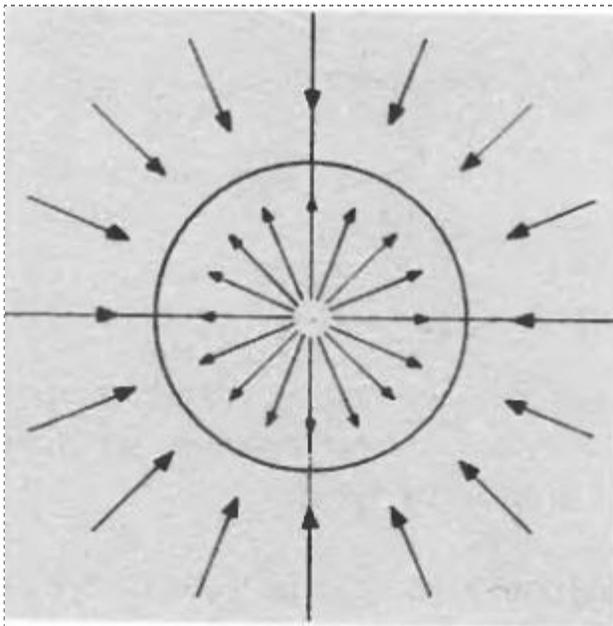
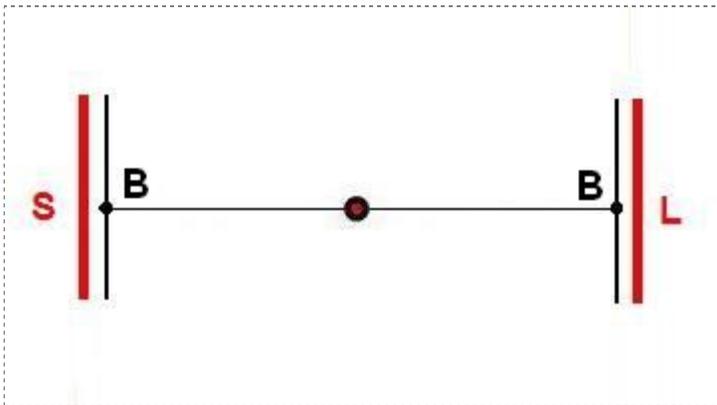
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Wenn es doch bei dieser verdammten Quantenspringerei bleiben soll, dann bedauere ich, mich mit der Quantentheorie überhaupt beschäftigt zu haben.  
Erwin Schrödinger

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Printable version is available from [here](#); mathematical details [here](#).

### FINITE INFINITY



Space inversion

Finite 3-D space (depicted with [circle](#)) obtained by **snapping** the inversion of points along the  $w$  axis (sphere-torus transitions, [Fig. 5](#)). Space becomes *both* "infinite" (local mode of spacetime) *and* bounded from **S** and **L** (global mode of spacetime).

## Abstract

To introduce "boundaries" on the physical spacetime at all (timelike, spacelike, and null) directions, I will consider an ideal dimensionless point of 'pure geometry', and will postulate a *structure* of such point: a *dual* presentation of 'the universe as ONE', interpreted along an axis ( $\mathbf{w}$ ) as *both* 'an infinitesimal' ( $\mathbf{S}$ ) *and* 'arbitrarily large volume of 3-D space' ( $\mathbf{L}$ ). Then I will suggest topological transformations of points (called 'space inversion') in an infinite-dimensional Euclidean space to obtain a 'collapse over infinity' - reduction of this unphysical Euclidean space to 'asymptotically flat 4-D spacetime' endowed with "boundaries" placed at the *dual* object, 'the universe as ONE'. The spacetime of 'the universe as ONE' is called 'global mode of spacetime', with equation  $\mathbf{L} = \mathbf{S} = \mathbf{1}$  (Eq. 2), while the equation of the [Arrow of Space](#), generating *perpetual emergence* and *re-creation* of an asymptotically flat spacetime ('collapse over infinity'), is postulated as  $\mathbf{LS} = \mathbf{1}$  (Eq. 1), in line with Virgil's dictum *Mens agitat molem* or [Der Geist bewegt die Materie](#).

I will also outline the so-called 'relative scale principle' ([RSP](#)) aimed at removing an absolute structure of space known as 'size of objects': nobody has 'the right meter'. Relative to an observer placed at the macroscopic length scale (the "middle" of  $\mathbf{w}$ ), objects in 3-D space would look like "large" in the direction toward  $\mathbf{L}$  and "small" in the opposite direction toward  $\mathbf{S}$ , while a co-moving observer will not notice any change in her 'one meter and one second', and will always experience the same "speed of light". Since 'space' is interpreted as an [emergent phenomenon](#) along the Arrow of Space, I will introduce [finite templates](#) for 'size of objects', and will argue that their *scale-dependent* alteration resolves the paradox of the (accelerated) "expansion" of space toward  $\mathbf{L}$  and the (non-accelerated) "shrinking" of space toward  $\mathbf{S}$ , as seen by an observer placed at the macroscopic length scale (the "middle" of  $\mathbf{w}$ ), while their *local* alteration recovers the correct geometrical manifestation of gravity (not "curvature"). Hence one can eliminate all "dark" effects of gravity such as "black holes", "cold dark matter", and "dynamical dark energy", and amend Einstein's General Relativity with the "total field of as yet unknown structure" from the [Arrow of Space](#).

The quest for Finite Infinity has a long history, starting from [Gunnar Nordström](#) (Über die Möglichkeit, das elektromagnetische Feld und das Gravitationsfeld zu vereinen, *Phys. Z.* **15** (1914) 504-506). It is [an age-old problem](#) of [General Relativity](#). Nothing could be more important than understanding the *topological manifold* of the Universe, and its [dynamics](#).

Traditionally, experts in GR start with what I hope to **derive** at the end of this project: asymptotically flat spacetime with [quasi-local](#) positive mass. For example, Rick Schoen would presuppose a "smooth manifold", which has already been equipped with a "Lorentz signature metric", "asymptotic flatness", and "appropriate falloff" conditions, and then ask question like: 'why do we see [positive mass](#) only'? A short answer: because we have an [Arrow of Space](#). The detailed answer requires careful analysis of all initial presumptions in Rick Schoen's talk and in present-day GR textbooks.

Part 1: Introduction to the Problem

We first recall the basic set up in General Relativity.

Mathematical Model:  $S^4$  is a smooth manifold with a Lorentz signature metric  $g$ . This means that for any point  $p \in M$  we can find a Lorentz basis  $e_0, e_1, e_2, e_3$  for the tangent space so that  $g_{ab} = \epsilon_a \delta_{ab}$  where  $\epsilon_0 = -1$  and  $\epsilon_i = 1$  for  $i = 1, 2, 3$ .

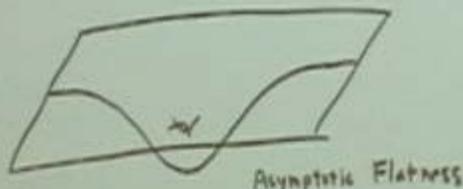


Lightcone Structure  
 $v \in T_p \mathcal{M}$   
 $\langle v, v \rangle > 0$  Spacelike  
 $\langle v, v \rangle < 0$  timelike  
 $\langle v, v \rangle = 0$  Null



Asymptotic Flatness

The most natural boundary condition for the Einstein equations is the condition of asymptotic flatness. This boundary condition describes isolated systems which are the analogues of finite mass distributions in Newtonian gravity. The requirement is that the initial manifold  $M$  outside a compact set be diffeomorphic to the exterior of a ball in  $R^3$  and that there be coordinates  $x$  in which  $g$  and  $p$  have appropriate falloff

$$g_{ij} = \delta_{ij} + O_2(|x|^{-1}), \quad p_{ij} = O_1(|x|^{-2}).$$


Asymptotic Flatness

08:43 57:30 HD O

A New Mean Curvature Proof of the Spacetime Positive Mass Theorem  
 By [Richard Schoen](#), November 13, 2011, at  
*Celebrating Jim Isenberg's 60th birthday*  
 Pacific Northwest Geometry Seminar, Corvallis, OR, [November 12-13, 2011](#)

A rigorous definition of 'isolated gravitating system', which would ensure an "asymptotic regime such that **all** gravitational effects are localized inside of it" ([Adam Helfer](#)) and proper boundary conditions, is still an unresolved task: there are no *physically* motivated boundary conditions in the case of the Einstein equations; for example, "we do not know how to build a mirror for gravitational waves" ([A. Rendall](#)), nor can we resolve the paradox of [geodesic incompleteness](#) and "black holes". Moreover, how can we define an 'isolated gravitating system' and its (obviously) [positive mass](#) if the *space itself* is endowed with a new, [dynamical "dark" energy](#)? The calculating machinery of ADM, suggested [half a century ago](#), doesn't work anymore. Enter the Finite Infinity (FI).

In a nutshell, the idea of FI is to suggest a mechanism for obtaining a **finite** volume of [Archimedean 3-D space](#). The very notion of 'finite 3-D space' implies the existence of two distinguishable volumes of 3-D space, separated by a "trapped" surface (cf. lion's cage [below](#)), such that we can *always* define the notions of 'inside vs outside' (hence "large" vs "small") and 'left vs right'. (In order to eliminate the [absolute](#) structure of 'size', we will introduce later the so-called Relative Scale Principle, [RSP](#).) Now, how can we introduce some process and mechanism by which 'finite space' can be fixed at **all** length scales, in such way that 'physical space' will never *actually* reach zero nor infinity but

will *always* remain 'finite' ? We will use an infinite-dimensional Euclidean space and will introduce **smooth** sphere-torus conversions in it, along a new axis  $w$ , such that these sphere-torus conversions **snap and fix** all Archimedean volumes of 3-D space from both "below" and "above" (cf. Fig. 5). Hence space becomes *both* "infinite" (local mode of spacetime) *and* bounded from **S** and **L** (global mode of spacetime). The latter is physically unobservable, because we're stuck in the Archimedean 3-D space and don't have access to 'actual infinity'. Only Chuck Norris has been there (twice).

As in a good crime novel, all will become crystal clear at the end. Well, eventually.

Some history. The notion of 'finite infinity' (FI) was suggested by George F R Ellis in 1984; please see:

George F R Ellis, gr-qc/0102017v1, Sec. 5, "Finite Infinity and Local Physics",  
<http://arxiv.org/abs/gr-qc/0102017>

"This led me some years ago to ask the question: 'How far away is an effective 'infinity' to use in discussing boundary conditions for local physical systems of this kind?' (...) Then incoming and outgoing radiation conditions can be imposed on that surface  $F$ , rather than at infinity or conformal infinity  $I$  as is usual [57]. (...) Furthermore the famous positive mass theorems [64] should also be generalized to this case.

...

"This may also be the best setting for numerical calculations for 'isolated systems', which often talk about 'integrating to infinity', but in most cases do nothing of the sort. As in the rest of theoretical physics, it would be advantageous to have a theoretical framework that corresponds more closely to actual calculations - namely an integration to a surface at a finite distance from the centre of coordinates. It is usual to make that surface a null surface; the suggestion here is that it would be better to make it timelike, corresponding to the region in the real universe where the exterior is physically separated from the local system.

"So the obvious proposal [54] is that we should put boundary conditions on all fields at **that distance**, rather than at infinity itself, leading to the concept of a 'finite infinity' FI ... "

--

[54] Ellis G F R, Relativistic Cosmology: Its Nature, Aims and Problems, in: *General Relativity and Gravitation*, Ed. B. Bertotti *et al.*, Reidel, Dordrecht, 1984, pp. 215-288; cf. Sec. 5.2 and Fig. 11(c).

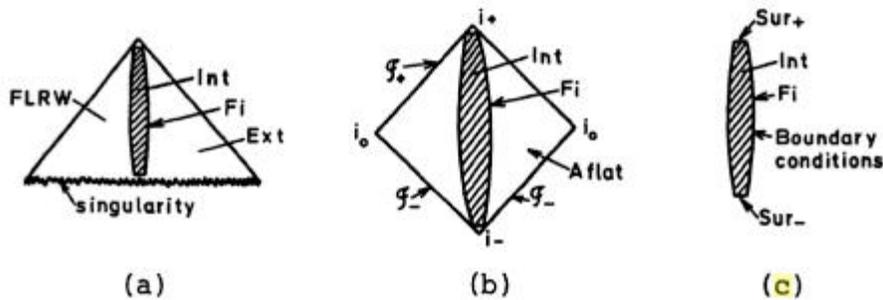


Fig. 11. (a) In a FLRW universe,  $F_i$  is surrounded by a region  $Ext$  which is matter-filled and is not asymptotically flat. Note that we cannot take the limit as  $Sur_- \rightarrow -\infty$ , because the universe started a finite time ago. (b) In the asymptotically flat representation, we surround  $F_i$  by an exterior empty space-time region  $Aflat$ , with properties at infinity similar to those of the Schwarzschild solution. (c) In the finite boundary representation, we simply consider the region  $Int$  bounded by  $F_i$ . Boundary conditions are stated as conditions on  $Sur_-$  and on  $F_i$ .

See also: Ehlers J (Ed) (1979). *Isolated Gravitating Systems in General Relativity*. Proc Int School Enrico Fermi Course LVII (Academic Press, New York).  
<http://www.directtextbook.com/prices/0444853294>

By using exclusively the notion of 'potential infinity', [Stephen Leacock](#) posed the dilemma of 'infinite space' in the following fashion:

"We cannot imagine that the stars go on forever. It's unthinkable. But we equally cannot imagine that they come to a stop and that beyond them is nothing, and then *more* nothing. Unending nothing is as incomprehensible as unending something."

In order to resolve the conundrum of 'ending something', notice that the nature of the *local Archimedean* mode of spacetime (cf. [below](#)) is determined by 'potential infinity': every step toward the Finite Infinity provides the necessary and sufficient condition for the *next* step, just as in the [Thompson's lamp paradox](#). If we go in the "direction" toward 'the infinitesimal' ( $S$ ), one can (with some luck) work out a cutoff and end-point, but it will belong, again and always, to the *local ("colored")* mode of spacetime (see the story about 'John's jackets' [below](#)).

If we wish to work out a proper Finite Infinity, the obvious choice is to introduce a new 'cutoff and end-point' conjugated with the infinitesimal,  $S$ , and to employ the two forms of 'infinity': potential and **actual**. The latter is 'already completed', in the sense that (i) it does not entail any "dynamics" that can be recorded with a physical clock, and (ii) applies only to the *global non-Archimedean* mode of spacetime.

We begin with postulating an uncountably infinite "number" of points packed in any **finite** -- arbitrarily "large" or arbitrarily "small" -- line segment, plane, or volume of space in the *local* (physical) mode of spacetime, in such way that 'there is **nothing** between these points'. Then we will "insert" the *global mode* of spacetime between the points from the local mode, and will make

sure that the *global mode* is **non-existent** in the local mode, with the *sole exception* of the instant 'now' from the Arrow of Space, in which the two modes of spacetime coincide (cf. Fig. 1 below).

Notice the crucial difference between the two *modes* of spacetime: in the local mode, a test particle equipped with a clock reading its proper time will need a finite Archimedean time interval to pass through a finite Archimedean volume of space, even if the test particle travels with the speed of light. It cannot pass through a *finite* volume of space for 'zero time', even if the volume of space is 'tending *asymptotically* toward zero', as in the case of the empty set (R). Thus, it will always need 'more Archimedean time' to pass through **all** uncountably infinite points from the *perfectly smooth* continuum of the local (physical) mode of spacetime. This is the essence of 'potential infinity', and it is valid only for the local mode of spacetime.

Hence the interpretation of 'the infinitesimal' as the empty set (R): in the local mode of spacetime, it *is* and will always remain a **finite** entity, tending *asymptotically* toward zero, being comprised from uncountably infinite points. In the global mode, however, it is a purely geometrical, dimensionless point -- just **one single** geometrical point (Fig. 1).

**NB:** This **one single** geometrical point cannot be reach from/within the local (physical) mode of spacetime, for any **finite** duration of time, as read with a physical clock. Why? Because its physical content (jacket) is **UNdecidable**, after the Thompson Lamp paradox.

Thus, the empty set (R) is endowed with a *structure*, as hinted in Fig. 1 below, and with 'space inversion' (Fig. 1.1). It is the flashmob for the two modes of spacetime, at which they "coincide". It is also the instant 'now' (now-at-a-distance) from the Arrow of Space. And thanks to the so-called "speed of light", it has **zero** duration and zero spatial extension.

Compared to the local mode, the global mode of spacetime is *ontologically* different: it is a non-Archimedean realm of 'potential reality' (GPIs), which can traverse any finite -- arbitrarily "large" or arbitrarily "small" -- line segment, plane, or volume of space from the *local* (physical) mode of spacetime for **zero time**, as it *would have been* read by the clock attached to a test particle from the local mode. Namely, the global mode is equipped with 'actual/completed infinity': it can traverse the uncountably infinite points of any **finite** object for **zero time** (as it *would have been* read by the clock attached to the test particle from the local mode), and endows the *local mode* with a web of "instantaneous" correlations (as they *would have been* read by an inanimate clock from the local mode). With the Arrow of Space, such kinematics gives rise to a new dynamics resembling a living organism: a 'school of fish'-type bootstrapping of physical systems in their quantum and gravitational regimes, and *quasi-local* geodesics, in line with the rule 'think globally act locally' (hence one can introduce a background-free, *relational* reality and Machian quantum gravity).

The question of what kind of 'global time' runs in the global mode of spacetime, equipped with "instantaneous" *actual* infinity, can be answered by explaining its corresponding 'global space' and the non-Archimedean structure of the *purely geometrical GPIs* in it.

In general, the quest for amending Finite Infinity with an Arrow of Space is highly non-trivial, because we should also consider the following tasks:

1. The two *modes* of spacetime are separated by the fleeting instant 'now' from the Arrow of Space, namely, the *global* mode is placed in the realm of 'potential reality' (GPIs residing in the *potential future* in the Arrow of Space), while the *local* mode refers to the irreversible world of explicated GPIs in terms of **facts**, placed in the steadily increasing 'irreversible past' from the Arrow of Space. Such 'ever-increasing past' is what makes an 'arrow', due to irreversible 'information gain': every instant 'now' pertains to an explicated *physical* universe, which contains *more* information than its immediate predecessor in the 'ever increasing past', and at the same instant 'now' the physical universe is offered an *enriched* spectrum of potential states to choose from for its *next* instant 'now', just as in the cognitive cycle of Ulric Neisser (Fig. 2 and Ch. 2 and 4).

Metaphorically speaking, the Arrow of Space is depicted with the Dragon devouring its tail (Ouroboros), from the Chrysopoeia ('Gold Making') of Cleopatra during the Alexandrian Period in Egypt. The enclosed words mean 'The All is One.'



The ultimate source for such information gain is 'the true monad without windows' which remains at **absolute rest** [within](#) the instant 'now' (see [below](#)), depicted with Fig. 1 below.

1.1. The only "meeting point" of the two modes of spacetime is the instant 'now', in which they **coincide** (Fig. 1). The result is [an already completed](#) and already [negotiated](#) physical universe, spanned across the **absolute** instant 'now' from the [Arrow of Space](#), with 3-D space and **zero** "[thickness](#)" along  $w$  (cf. below), in which "there's energy in the gravitational field, but it's negative, so it **exactly** cancels the energy you think is being gained in the matter fields" ([Sean Carroll](#)); check out the Photoshop layers metaphor [below](#) and the resulting non-linear dynamics [here](#).

2. The unique "boundaries" on 3-D space in all (timelike, null, and spacelike) directions, introduced with [Finite Infinity](#), should make the universe an 'isolated system', which (i) contains 'absolutely everything', included its Aristotelian First Cause, (ii) is self-enclosed ([Albert Einstein](#)), and (iii) is "bounded" by some ambient *unphysical* spacetime (called here 'global mode of spacetime') which is part and parcel from *the same* 'isolated system'.

2.1. To describe such 'universe as ONE' -- self-wrapped (cf. (iii) above) and endowed with the faculty of '[self-acting](#)' due to its "gravitational field" -- one needs to place its **source** "inside" the instant 'now' from the Arrow of Space (Fig. 1), and make sure that the so-called "dark" energy of 'the universe as ONE' is unobservable [in principle](#).

3. Last but not least, the ultimate source of 'the universe as ONE' should be interpreted as '[zero nothing](#)', that is, a special kind of "zero" *opposite* to the mundane case of '[zero something](#)'. Perhaps the only way we could grasp the notion of '[zero nothing](#)' or 'the true monad without windows' is by recalling the relation between the content and volume of concepts: the larger the volume, the smaller the content; hence the source of 'absolutely everything, the *unknown* unknown included' should possess **zero** intrinsic content (cf. the [undefinable matrix](#)).

I haven't been able to find suitable mathematical formalism to describe these widely known ideas. All I can offer is a simple (but [incomplete](#)) geometrical explanation of Finite Infinity.

Firstly, there should exist a *maximal volume of 3-D space* ( $L$ ), at which we place the Finite Infinity (**FI**), such that any *finite* volume of space, no matter how large, is identified as an [Archimedean](#) sub-volume **smaller** than the 'maximal space volume',  $L$ . Likewise, there should exist a *minimal volume of 3-D space* ( $S$ ), at which we place *the same* Finite Infinity (**FI**), such that any *finite* volume of space, no matter how small, is identified as an [Archimedean](#) volume **larger** than 'the minimal space volume',  $S$ .

Secondly, the two physical, finite, [Archimedean](#) volumes of space tend *asymptotically* toward  $L$  and  $S$  in the local (physical) mode of spacetime, but **cannot** reach them for any **finite** [Archimedean](#) duration of **time** due to the "structure" of [the empty set \(R\)](#) at which the *global mode* and the *local mode* coincide (Fig. 1).

The 'no-go' axiom about [the empty set \(R\)](#) ("cannot reach them for any [Archimedean](#) duration of **time**") stems from our belief (not 'fact') that there exist, in the [local mode](#) of spacetime, an

'[uncountably infinite](#)' "number" of points between any finite [Archimedean](#) volumes of space and their "two" cutoffs, **L** and **S** : [the empty set \(R\)](#) cannot be bridged by any finite [Archimedean](#) system for any **finite** duration of time, even if it jumps over the points with the "[speed of light](#)". That is, in the [local mode](#) of spacetime [the empty set \(R\)](#) is '**finite**' entity, and will always occupy a **finite**, albeit "very small", volume of space packed with '[uncountably infinite](#)' points arranged by '**potential infinity**'. On the other hand, the same [empty set \(R\)](#) is consumed/traversed *instantaneously* in the [global mode](#) of spacetime, which has [non-Archimedean](#) nature and is endowed with 'actual/completed' infinity.

Thus, we shall place the "two" cutoffs, **L** and **S** , *within* the **red** point in Fig. 1 below, stressing again its **UNdecidable** nature ([Thompson Lamp paradox](#)) of 'potential reality': [pre-quantum non-colorizable](#) General Platonic Ideas ([GPIs](#)).

**FI Postulate:** Due to the [Thompson Lamp paradox](#), any finite, arbitrarily "large" or "small", [Archimedean](#) volume cannot **physically** reach **L** and **S** residing in the *global mode* of spacetime, equipped with *actual* infinity.

A precise explanation of '*physically reach*': in the local (physical) mode of spacetime, we *always* reach/nullify [the empty set \(R\)](#) at the point of '2 min', which is why the state of Thompson's lamp is *always* defined by the rules of '[bartenders](#)', but it is just a fleeting "**jacket**" cast by **John** from the *global* mode of spacetime. The latter is endowed with *actual* infinity. In other words, in the *global* mode of spacetime the interval [0, 2] is closed, while in the local mode the same interval is **open** -- (0, 2).

Thanks to the [Arrow of Space](#), the 'large finite volume' will chase **L** in the local mode **indefinitely**; in the *local mode* of spacetime [the empty set \(R\)](#) can only tend *asymptotically* toward **zero**. The same holds for the *opposite* case of the **separation** of any arbitrarily small [Archimedean](#) volume of space from **S** by the same [empty set \(R\)](#): in the local mode, it would require an infinite -- **actual infinity** -- amount of **time** for the *elimination* of [the empty set \(R\)](#) and reducing it to **zero**, at which point the [Arrow of Space](#) would **stop**, and the universe would cease to exist.

Notice that the FI Postulate introduces [new structure of spacetime](#) at the level of '[differentiable manifold](#)' **prior** to any matter; example [here](#).

The very notion of 'space' requires that all physical objects acquire *finite* [Archimedean](#) size; a table with length '[one meter](#)' fills in a [template](#) for 'one meter'. In the case of an one-meter *template*, we observe a **finite** table with length one meter, which is again a '**sub-volume** of finite space'. The purpose of Finite Infinity (FI) is to define the [largest template](#) and the [smallest template](#) for all finite **volumes** of 3-D space.

The *maximal volume of 3-D space*, **L** , and *minimal volume of 3-D space*, **S** , belong to the global mode of spacetime for which the *actual* infinity holds ('[already completed](#)'), and are related by

$$LS = 1 \quad (\text{Eq. 1}).$$

Thanks to [the empty set \(R\)](#), no physical, Archimedean stuff can '*physically reach*' **L** and hence go "beyond" **L** , and also no physical stuff can '*physically reach*' **S** and hence go "below" **S** (compared it to the [conformal recipe](#)): **L** & **S** is ONE object which belongs to the [non-Archimedean global mode](#) of spacetime.

In a nutshell, the modified Finite Infinity satisfied two conditions: in the local mode of spacetime the universe approaches *asymptotically* its causal boundary (cf. Eq. 1 above) within an **open interval**, while *at the same time* the universe is being (present continuous) permanently wrapped *by itself* in the global mode of spacetime. Hence 3-D space can be literally [wrapped by itself](#), exactly as [Albert Einstein](#) required.

Again, there is no path whatsoever to the *global mode* of spacetime **from** the *local mode* of spacetime; hence the FI Postulate above. The difference between **S** and **L** is that in the case of the former we can find some 'numerically finite but physically unattainable boundary/cut off' (the Planck length), but for **L** we have only an [eternally expanding](#) '**sub-volume** of finite space', which can only chase **L** but can never *physically reach* it: **L** and **S** belong to the [non-Archimedean global mode](#) of spacetime.

It is the Arrow of Space which creates such *asymmetry* in the treatment of **L** and **S** . We have a

numerically finite but physically unattainable "bottom", while space "expands" in the local mode toward **L** indefinitely: at each and every instant 'now' from the Arrow of Space, the universe occupies a finite **sub-volume**, being literally **wrapped** from both "below" and "above" with Eq. 1 above. Depending on the direction we look at the edge of the universe in the local mode of spacetime, either toward **L** or toward **S**, we see "two" edges, while in the *global mode* they are ONE -- the universe as ONE, as stressed by [Lucretius](#) some 2060 years ago. We don't have such structure of spacetime in [differential geometry textbooks](#).

Notice that we face here a kind of '[logical infinity](#)': no physical, [Archimedean](#) volume of space can reach **L**, because **L** & **S** belong to the 'the universe as ONE' (Eq. 1 above). In other words, one could *logically* reach something *only* if this "something" is 'not yet reached', while in our case it is *logically impossible* to "reach" something (**L**) which is being eternally residing "inside" us (**S**) from the outset. Thus, the notion of '[logical infinity](#)' refers to the statement that if the [Arrow of Space](#) is terminated, the universe will cease to exist and will return to its initial state of pure light and cognition, known as [John 1:1].

Without the global mode of spacetime, the universe would be governed exclusively by [Archimedean geometry](#), [conformal recipes](#) would have worked, tessellation of space with 3-D "tiles" would have been possible, and we would calculate the *exact finite* number of "atoms" filling a finite volume of space without *any* gaps from [the empty set \(R\)](#): we would hit an "end-point" beyond which "is nothing, and then *more* nothing" (S. Leacock). Thank God, this is impossible. Again, we cannot *physically* "see" **L** & **S**, because we don't have access to 'actual infinity'. Only Chuck Norris has been there ([twice](#)).

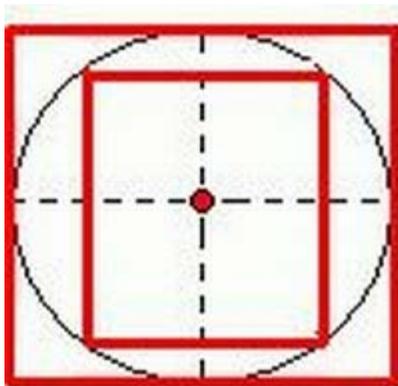
Now, let me try to explain geometrically [the empty set \(R\)](#), which would "point" to the "dimension" of space, denoted with **w** (from *wunderbar*, after [Theodor Kaluza](#)), of the postulated global mode of spacetime (pictured with **red**; local mode with **black**).

The size of physical bodies along **w** are **zero**, because **w** lives *only* at the fleeting instant '[now](#)' - a purely geometrical "point" at which the two modes of spacetime, global and local, **coincide**. Attached to the same instant '[now](#)' is a 'pocket of propensity states' in the global mode of spacetime, called General Platonic Ideas ([GPIs](#)); check out GPIs in the human **brain** (not "mind") [here](#).

First, the dimensionless instant 'now', at which the two *modes* of spacetime coincide:



Fig. 1



**Fig. 1.1**  
[Space inversion](#) with respect to the instant 'now' (Fig. 1).

The so-called 'space symmetry' in the global mode of spacetime (pictured with **red**) is defined as two interchangeable and

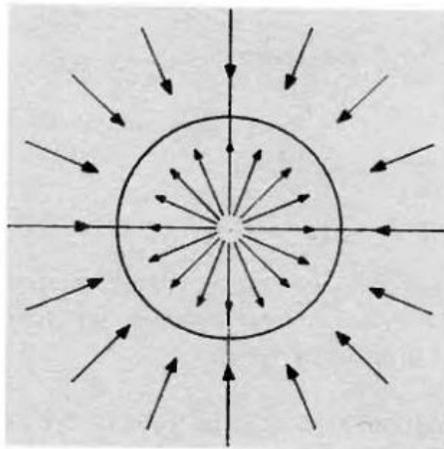
simultaneous presentations of any **finite** volume of space from the local mode (pictured with **black** circle), such that a **global** observer can monitor *any finite* volume of space in the two directions of **w** *simultaneously*, as explained in [Wiki](#): (i) from the center of the circle (Fig. 1) "outside" in all radial directions, and (ii) from "outside" the **black** circle (2-D trapped surface of [lion's cage](#)) toward the center of the circle along the same **T**-inverted radial directions (not shown). In 2-D space, the "trapped surface" is a circle; in 3-D space it is a sphere with radius **r** (Fig. 4.2). In order to derive the circumference of the **black** circle, consider the two red rectangles (sides **n** = 4), and start doubling their parameter **n**, after [Archimedes](#). At the instant 'now' from the Arrow of Space (Fig. 1), **n** reaches **actual/completed** infinity and the inscribed and the circumscribed polygons shift to 'pure geometry' of 'the grin of the cat without the cat', as observed by Alice (in the LHS of [Einstein field equation](#)).



The sides of the polygons are converted into [uncountably infinite](#) "geometrical points", each of which can take a *fleeting* physical ([colored](#)) "jacket" in the [local mode](#) of spacetime (cf. the parable of John's jackets [below](#)).

If we apply space inversion along the two "directions" in the drawing from Mark Armstrong below, we can grasp the notion of Finite Infinity: every volume of 3-D space is being snapped like [the circumference of a circle](#), along the two "directions" of **w** (see Fig. 5 below), thanks to which it becomes a **finite** entity. [Voila!](#)

1. Homeomorphic spaces have the same homotopy type.
2. Any convex subset of a euclidean space is homotopy equivalent to a point.
3.  $\mathbb{E}^n - \{0\}$  has the homotopy type of  $S^{n-1}$ . Define  $g: \mathbb{E}^n - \{0\} \rightarrow S^{n-1}$  by  $g(\mathbf{x}) = \mathbf{x}/\|\mathbf{x}\|$ , and let  $f: S^{n-1} \rightarrow \mathbb{E}^n - \{0\}$  be inclusion. Then  $g \circ f = 1_{S^{n-1}}$ , and  $1_{\mathbb{E}^n - \{0\}} \simeq f \circ g$  via  $G(\mathbf{x}, t) = (1-t)\mathbf{x} + t(\mathbf{x}/\|\mathbf{x}\|)$ . The case  $n = 2$  is illustrated by Fig. 5.7; the arrows indicate how points move during the homotopy  $G$ .



**Figure 5.7**

In the local mode of spacetime (pictured with **black**), we multiply the dimensionless point in Fig. 1 along one dimension in two **opposite** directions, to obtain 2-D spacetime. For the purpose of this presentation, the time direction will not be shown. Notice that 1-D **space** is endowed with T-invariance: we can flip all the points to the right with those to the left (Fig. 2.1), and *vice versa*, with respect to the initial point in the middle (Fig. 2.2).



Fig. 2.1



Fig. 2.2

The next step is constructing 2-D space from Fig. 2.2, by introducing a second spatial dimension, again with two *directional* degrees of freedom, and move **all points** from 1-D space, *en bloc*, in two **opposite** directions (Fig. 3.1).

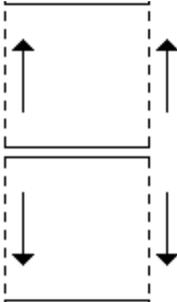


Fig. 3.1

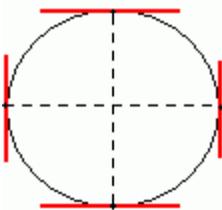


Fig. 3.2

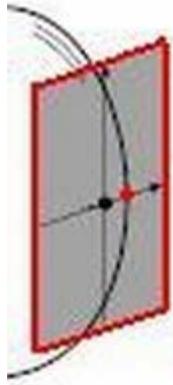


Fig. 3.3

Notice that Fig. 3.2 is a Flatland universe (time dimension not shown) in which Flatlanders enjoy PT-invariance: swapping the points along the horizontal line (Fig. 3.2), with respect to the vertical line, will bring T-symmetry, while the vertical flip, with respect to the horizontal line, will produce a mirror image with 'right' and 'left' interchanged. If we try to apply Finite Infinity to such Flatland universe, the two spatial dimensions will be "bounded" by the non-physical (to Flatlanders) **third** spatial dimension in which their space would look *extrinsically* "curved", with "tangential surfaces" attached to one "point" but spanned in the **third** spatial dimension.

In the current GR textbooks and [tutorials](#), the **black** and **red** points in Fig. 3.3 are fused with the rules of [diff calculus](#), after [Leibniz](#); then people claim that in "[sufficiently small](#)" (notice the poetry) neighborhood around such fused **black/red** point "*it is possible to choose a "locally inertial coordinate system" such that, within a [sufficiently small](#) region of the point in question, the laws of nature take the same form as in unaccelerated Cartesian coordinate systems in the absence of gravitation*" (cf. [below](#)). What a mess.

Going back to the Flatland: we, as "global" observers, can "see" all points from Fig. 3.2 *en bloc*, while the Flatlanders will encounter obstructions from a **line**: it will be like an *infinite* 1-D wall which prevents them from seeing "behind" the wall. We can "see" all the points from Fig. 3.2 simultaneously, *en bloc*, which would translate to Flatlanders as 'keeping simultaneously two *inverted* images from their Flatland', one with T-symmetry and a second one with P-symmetry. Regarding their 'time', the Flatlanders will be totally puzzled by our ability to oversee *en bloc* their two paths from **A** to **B** in their (**t+**)-direction, and from **B** to **A** in their (**t-**)-direction. They don't have such clock, and will claim that *our* "time" is dead frozen (much like [3-D people](#) do in [canonical quantum gravity](#)).

It requires far more efforts to elaborate on the example from [Wiki](#) about an infinite 2-D plane in our 3-D space, which poses no restrictions to "observers" in the *global* mode along **w**, equipped with *actual* infinity and capable to "see" simultaneously all points from our 3-D space both *en bloc* and **inverted** with 'space inversion' (cf. Fig. 5). Notice that we have **three** such restrictive planes in 3-D space (**xy**, **xz**, and **yz**, cf. Fig. 4.2), and enjoy CTP-invariance upon "swapping" the points *via* the global mode of spacetime, as we did in Figs 2.1 and 3.1 above.

The new symmetry, called '[space inversion](#)', should eliminate all **fixed** relations in the Archimedean 3-D space, such as 'large vs small' or 'inside vs outside'. Otherwise our 3-D space will not be dynamical, but will impose a [fixed background](#) for the length scale in terms of **absolute size** of objects in 3-D space. Once we eliminate the absolute Newtonian time, we should eliminate **all** absolute structures from 3-D space as well.

To elaborate on the example from [Wiki](#), I suppose one could "see", from the global mode of spacetime, two superposed P-invariant images of "[the lion](#)", obtained after the inverted (w.r.t. the cage surface) 3-D space. Such symmetry is literally about **inverting** all the "points" trapped **inside** a *finite* volume of space approaching asymptotically **S** with all the "points" from the *finite* volume of

space approaching asymptotically, in "opposite direction",  $L$ , which remain **outside** that "shrinking" finite volume of space (**Fig. 1.1**). The "number" of points in any *finite* volume of space is 'uncountably infinite', so there should be no obstacles to perform such 'space inversion'.

Let's start with endowing the Flatland with a spatial dimension, by moving all the points from Fig. 3.2 *en bloc* along two opposite "directions", up (toward  $L$ ) and down (toward  $S$ ):

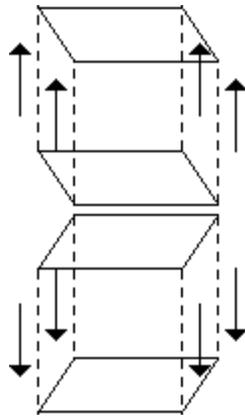


Fig 4.1

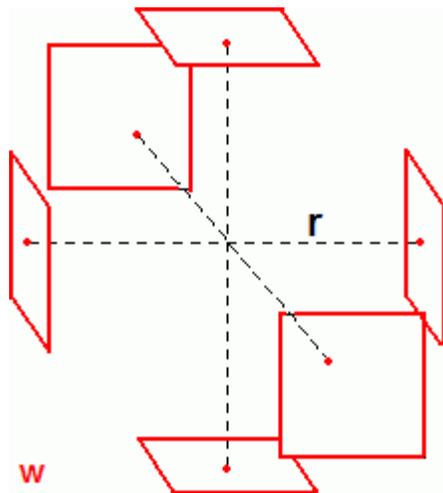
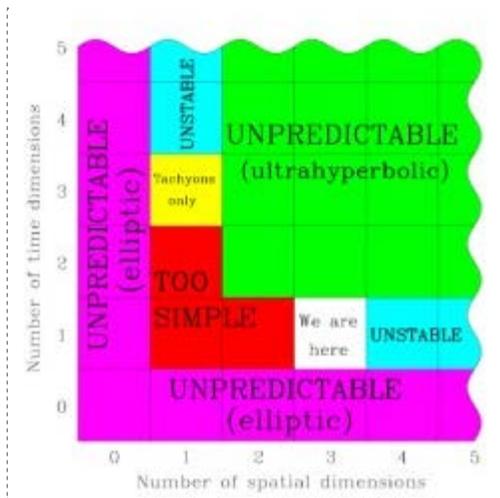


Fig. 4.2

The "expansion" of 3-D space ( $S < r < L$ )

The two opposite "directions" along  $w$ , *inferred* from Fig. 4.1, are absent in Fig. 4.2. One is toward the Small ( $S$ ); the other runs in the opposite direction along  $w$ , toward the Large ( $L$ ). In the instant 'now' (Fig. 1), these additional geometrical degrees of freedom are set to **zero**, as explained in the beginning of this exercise -- they are hidden *within the empty set (R)*. The meaning of 'set to **zero**' corresponds to 'spontaneous broken symmetry' (cf. below): we end up with only one "charge" of mass, and the *wunderbar* (after Theodor Kaluza) dimension  $w$  is being literally *eliminated*, thanks to which we obtain the good old 3-D space of classical physics. It doesn't contain any trace from the "negative mass", but two worlds with inverted spacetime basis, material and tachyonic, separated by a luxonic "surface":



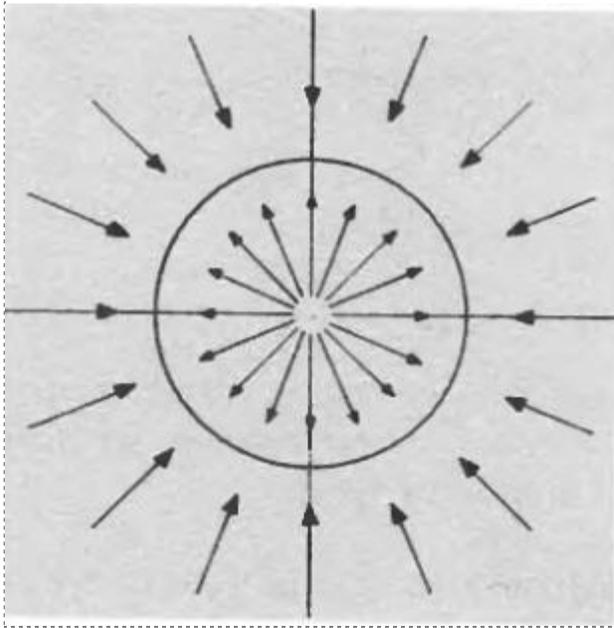
Max Tegmark, [arXiv:gr-qc/9702052v2](https://arxiv.org/abs/gr-qc/9702052v2), Footnote 4: "The only remaining possibility is the rather contrived case where data is specified on a null hypersurface. To measure such data, an observer would need to "live on the light cone", *i.e.*, travel with the speed of light, which means that it would subjectively not perceive any time at all (its proper time would stand still)."

Due to the 'spontaneous broken symmetry' (cf. [below](#)), we have **two** kinds of mass in the picture above, real and imaginary (tachyonic), safely separated by a timeless luxonic world of **zero**, or rather *indifferent* mass, which keeps the dimension **w** **totally hidden**.

Notice that, in addition to the three **planes** in 3-D space (**xy**, **xz**, and **yz**) and their corresponding transformations or "swapping the points" (CPT-invariance), we have a new 'space inversion' symmetry, as mentioned in the discussion of Fig. 1.1 above.

**NB:** This exercise will be really tough. Try to imagine the "trapped circle" from Fig. 1.1 as "trapped 3-D space", that is, a 3-D "rubber glove" hypersurface which can be seen along the **two** directions of **w** as two simultaneous "gloves", right and left, corresponding to the **unbroken** symmetry of the GPI field (see [below](#)) inhabited by the unphysical, [GPI states](#) of negative & positive mass.

You will have the unique freedom to "look" at the 3-D hypersurface *simultaneously* along the two directions of **w** : from 'inside-out' and from 'outside-inside' (cf. the drawing from Mark Armstrong below), corresponding to 'sphere' and 'torus' (cf. Fig. 5).

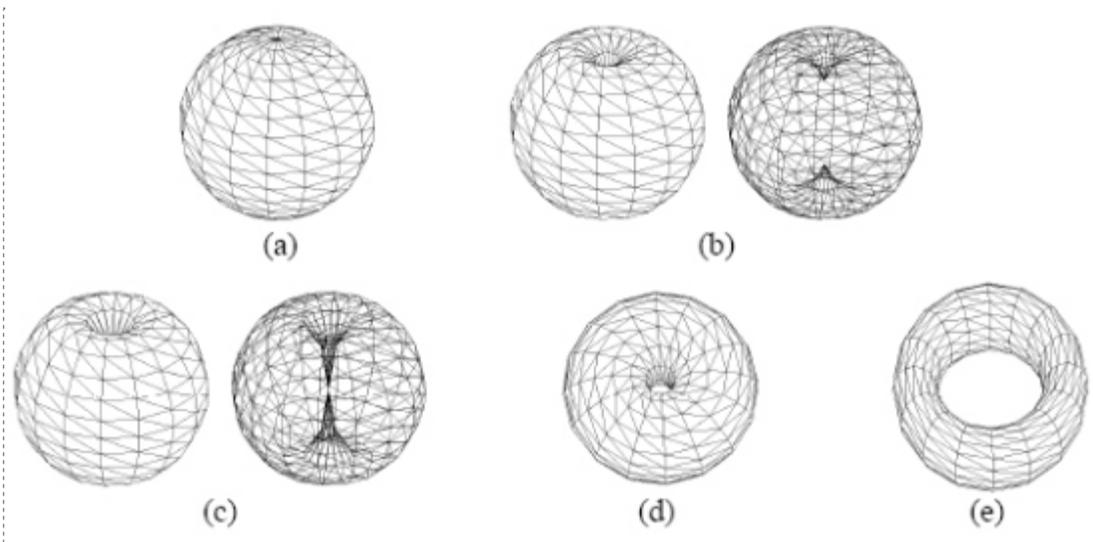


M.A. Armstrong, *Basic Topology*, Springer, 1997, [p. 104](#)

Such simultaneous viewpoint is impossible to imagine, as hinted in [Wiki](#), but if we **lower** the dimensions of the physical space to 2-D spherical surface trapped by the six **red** planes in Fig. 4.2, the 'inside-out' view will display **all** points from the 2-D spherical surface, as seen from the center of Fig. 4.2 along **all** radial directions 'inside-out', and by executing 'space inversion' with respect to the 2-D spherical surface ("[lion's cage](#)") we will see again **all** points from the **finite** 2-D surface from 'outside-inside', along the *inverted* radial directions, keeping the two presentations of the 2-D "rubber glove" (left and right) simultaneously available to our **w** - inspection. However, we *cannot* "move" the unique object at the center of Fig. 4.2, shown with the **red point** in Fig. 1 above: it is in 'absolute rest' and is residing *both* inside every point from the physical 3-D space *and* outside the physical 3-D space, as **The Beginning** (see [below](#)) of the two viewpoints at the 3-D "rubber glove" hypersurface along **w**, from 'inside-out' and from 'outside-inside'.

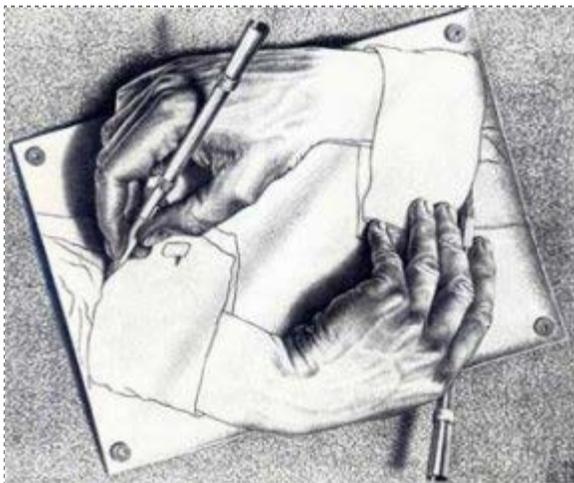
Last but not least, the aim of the putative space inversion is to recover 'asymptotically flat spacetime' with the two 'viewpoints' along **w**. Look at Fig. 3.2 above, and picture it as a clock, such that Fig. 1 is placed at the center, and four red segments tangential to 12, 3, 6, and 9. Imagine one radius "connecting" (*not quite*: see Fig. 4.3) the center to **9**, and blow up the circle by instructing the radius to **reach** infinity and pass "over" it. The conventional wisdom tells us that the circle will "degenerate", or rather "collapse", to 1-D Euclidean space presented with the vertical red line at **9** (Fig. 3.2) at the very instant at which its radius is *exactly* infinite, but at *that same* instant the two points in the orthogonal direction, **12** and **6**, will ultimately **break up**. Once it passes "over" infinity, the object will regain its 2-D status, but will be converted into two finite cross-sections of a torus. Notice that at the instant of 'collapse over infinity' **all** points from the circle in Fig. 3.2 will be arranged in 1-D space, like those in Fig. 2.2 above.

Now, if we keep the radius constant, such non-smooth topological transition will match a well-known screensaver in Windows 97, half of which is depicted with the drawing from D. DeCarlo and D. Metaxas ([1996](#)) below.



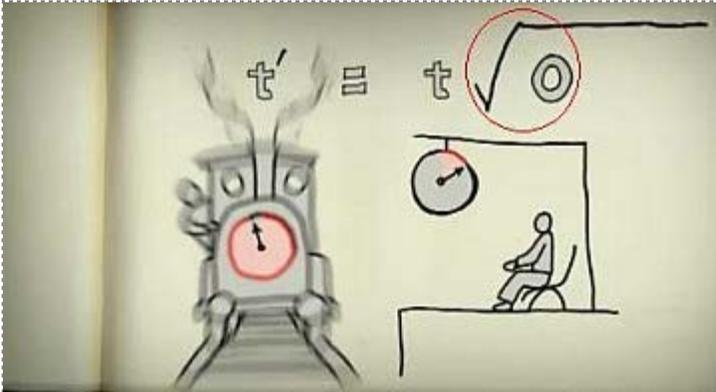
But our case is different, since we wish to recover the asymptotically flat spacetime "around" the critical 'collapse over infinity' instant, with positive and negative space curvature inherited from the circle and the torus. Namely, *after* passing through this critical instant, not just one but **all** "inflating" radial directions -- except for the center, see Fig. 1 -- will be **inverted**, as explained in the exercise [above](#). If we wish to start by inflating the torus from 'case (e)' above, along the opposite direction in  $\mathbf{w}$ , we will again pass through the same 'collapse over infinity' instant, "around" which we imagine some 'asymptotically flat spacetime', after which we will wind up in the "clock" case from Fig. 3.2, only this time its radius will be shrinking toward the center of the clock. Please keep these two invertible **T**-invariant images passing through 'asymptotically flat spacetime' in your mind. All we need now is to replace the circle/torus with the 3-D "rubber glove" hypersurface from the exercise [above](#).

Again, the two opposite directions along  $\mathbf{w}$  are totally hidden *inside* the luxonic world (cf. Max Tegmark above) with *indifferent* (zero) mass. Physically, the two directions of the circle/torus conversion in the global mode of spacetime, along  $\mathbf{w}$ , are totally hidden, their duration is **zero**, and we can only imagine two [atemporal waves](#), depicted with the Escher hands, by which all [non-linear](#) negotiations in '[the school of fish](#)' are completed for **zero** time, as read with your wristwatch: we can *never* see [Macavity](#).



Notice that I haven't tried so far to introduce any '[distance function](#)'. I have only an uncountably-infinite 'points' ordered with the [relation of intermediacy](#), [A (**zero**) B], which is interpreted as "**zero** is [between](#) A and B". The unique object with **zero** physical presence in the local (physical) mode of

spacetime is The Aristotelian Connection of 'the universe as ONE' (cf. the **red** dot in Fig. 1). It is manifested by [purely affine connection](#) facilitating parallel transport of vectors in the local (physical) mode of spacetime, from *one* spacetime point to *the nearest* point, and is [independent from the metric](#). It also captures the essence of the "speed" of light. Let me try to explain.



0.47-0.52: "Relative to the platform, time on the train completely stops."  
 The ill-defined expression " $\sqrt{0}$ " [must be amended](#) by a new *mathematical* object relevant exclusively to the [non-Archimedean](#) global mode of spacetime.

Relative to the passengers in the [train](#) (see the picture above), the **local mode** of their 'time on the train' does indeed "stop": you move into the luxonic world (cf. Max Tegmark [above](#)), and can "see" all the *intermediate* topological transformations of the Universe, not just its 'collapse over infinity'-state depicted in [Fig. 5](#).

Consider again a **finite** chunk of space, say, [one meter](#): it is comprised from uncountably-infinite 'points' *ordered* with the [relation of intermediacy](#), [A (**zero**) B]. The Aristotelian Connection of 'the universe as ONE', [A (**zero**) B], *passes* the physical state at point **A** to its "neighboring" point **B** with particular "speed" which **acquires** an [upper limit](#) for any **finite** volume of space. The numerical value of the "speed of light" isn't interesting; just like the Planck length, it is a 'numerically finite but physically unattainable **boundary** of the local mode of spacetime'. We cannot define, even as a Gedankenexperiment, 'one second' as the product of [[Planck time](#)]  $\times 10^{43}$ . The universe as ONE (global mode) is a totally different world which shows up only with its Aristotelian Connection.

What matters here is that The Aristotelian Connection operates in the global mode of spacetime: it "reads" **all** of the uncountably-infinite 'points' from any **finite** chunk of space **en bloc**. By an analogy with a movie reel, one could speculate that The Aristotelian Connection is "projecting" 3-D space as 'uncountably-infinite infinitesimal "frames" per second', meaning that every "frame" is *the* 'collapse over infinity'-state (cf. [Fig. 5](#)). Unless we encounter relativistic effects (watch the movie from NOVA below), this **en bloc** "reading" does **not** slow down (for comparison, watch a water drop [here](#)).



The unique "speed" of light, due to The Aristotelian Connection, is preventing us from taking even a glimpse at the global mode of spacetime: we can see only an [already-completed](#) physical world, in line with the idea about relativistic causality ("causal processes or signals can propagate only within the light-cone," [Jeremy Butterfield](#)).

Notice the precise meaning in GR of '[already-completed](#)': all **non-linear** negotiations between the two sides of the Einstein field equations are being *post factum* completed for **zero time**, as read with your wristwatch. "All agree that in general relativity, the metric tensor  $g_{ij}$  is (or better: represents a field that is) dynamical: it **acts** and is (at the same *instant* - D.C.) **acted on**. They also agree that it is a special field since it couples to every other one, and also cannot vanish anywhere in spacetime. Many authors go on to say that the metric tensor represents geometry, or spacetime structure, so that geometry or spacetime structure **acts** and is (at the same *instant* - D.C.) **acted on**" ([Jeremy Butterfield](#)). More succinctly: "the metric is treated as a field which not only affects, but also is (**at the same instant** - D.C.) affected by, the other fields" ([John Baez](#)). This non-linear paradox is depicted with the Escher hands above, and can be resolved only with the two modes of spacetime, as argued [previously](#). Michael Redhead argued in [1995](#) that the notion of 'localizable particle' makes sense only for a free particle, while I suggest a '[quasi-local](#)' alternative in terms of [Machian relational ontology](#) with the rule 'with respect to *everything else* in the universe'. In short, the issue of relativistic causality is [anything but trivial](#) in GR. As stressed by [Margaret Hawton](#), in quantum field theory probability density is defined at a fixed *instant*  $t$ , and it is by no means obvious how to "insert" in such fixed *instant*  $t$  the [already-completed](#) non-linear '**acting** and *at the same instant* being **acted upon**' in GR.

Thanks to The Aristotelian Connection [A (**zero**) B], there exists a **bond** between spacetime points, and the "speed" of light is its manifestation. If the "speed" were infinite or unlimited, there would be no difference between 'small' and 'large', and '3-D space' as the **medium** for 'finite things' would have not existed; if the "speed" of light were a **finite** entity, it would be surpassable, and then there would be no separation between the two worlds with inverted spacetime basis, material and tachyonic (cf. Max Tegmark [above](#)).

Notice that 'space as the **medium** for finite things' is a very old idea, debated by [Ernst Mach](#). The difference between 'small' and 'large' is **not** fixed in the [local, Archimedean](#) mode of spacetime, but in the global, non-Archimedean mode by 'finite invariant templates' (cf. below).

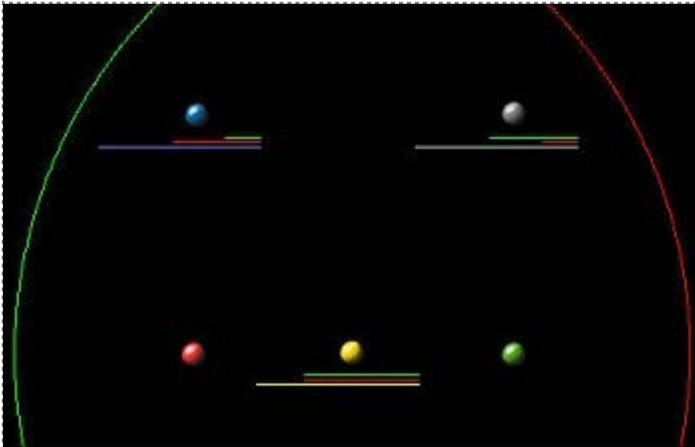
**NB:** The *alteration* of these templates is [the essence of gravity](#). We have 'finite invariant templates' for 'finite space', fixed by The Aristotelian Connection: it is the **bond** between spacetime points that determines 'the time it would take a photon to traverse a distance equal to a [**finite** volume of space]'. (As Erik Curiel explained, [arXiv:0908.3322v3 \[gr-qc\]](#), "in general relativity all the fundamental units one uses to define stress-energy, namely time, length and mass, can themselves be defined using only the unit of time; these are so-called geometrized units. (...) A [unit of length](#) is then defined as that in which light travels *in vacuo* in [one time-unit](#)."") Then a minuscule *alteration* of the **bond** between spacetime points can produce **enormous** change of 'the time it would take a photon', and subsequently of the 'finite invariant templates' (resembling "curvature", cf. [Bill Unruh](#)), leaving the deceitful impression of some "[cold dark matter](#)" or "[supermassive black hole](#)".



The effect is **purely geometrical**, according to the so-called relative scale principle ([RSP](#)).

Namely, an observer placed inside such **altered** (by '[the time it would take a photon](#)') spacetime template will **not** notice any change of her ambient spacetime **assembled** by The Aristotelian Connection, in terms of her 'one meter and one second': she will **always** experience the same "speed of light", regardless of the extent to which *her* template has been altered with respect to an unaltered template of an observer placed at the length scale of tables and chairs. This is because the "number" of spacetime points in any **finite** volume of 3-D space, approaching asymptotically **S** and **L**, remains unchanged ([Kurt Gödel](#)), being a [non-Archimedean](#) phenomenon, and also because The Aristotelian Connection is endowed with 'actual infinity' and "reads" **all** uncountably-infinite 'points' from any **finite** chunk of space **en bloc**.

Notice that '[the time it would take a photon](#)', which defines each and every '**finite** volume of space' (see above), is the **global (en bloc)** mode of time. It is the *background time* code of the animation from [John Walker](#) below, and it must be [totally hidden](#).



Again, the crux of the matter is the initial puzzle of '[one meter](#)' and its treatment with the two manifestations of infinity. Namely, with the *potential* infinity operating in the local (physical) mode of spacetime, '[one meter](#)' will be presented with "open sets" ([James Dungundji](#)), which do **not** include the crucial '[end points](#)', ( 1m ), despite the fact that any such *interval* can be defined only with respect to a [fixed point in The Beginning](#); with the actual/completed infinity operating in the [global non-Archimedean mode](#) of spacetime, the same '[one meter](#)' will be presented as 'completed' **en bloc** interval [ 1m ]. The puzzle of '*the infinitesimal*' was identified by [Titus Lucretius Carus](#) some 2070 years ago, yet people still seek '[the smoothest manifold](#)' like [bartenders](#), and of course cannot find 'the unmoved mover' in GR ([Karel Kuchar](#)).

There is [a lot more to be said](#) about the "speed" of light, as The Aristotelian Connection "happens" only *post-factum*, at [null-surface](#). We cannot witness the *alteration* of these templates online, as it "happens", and we will *always* observe an **already**-assembled, by The Aristotelian Connection, spacetime in which we cannot reach the [luxonic world](#).

By going into the center of Milky Way, all we can *post-factum* observe is a **finite** volume of space in which our 'one meter and one second' has **not** been altered, hence we would claim that these 'spacetime templates' are "invariant to us", while a distant observer will see us "shrinking". Ditto to [the "expansion" of space](#). There is no need to invoke any anomalous "dark" stuff with "positive energy density and negative pressure", as you may have heard from [Ned Wright](#), say.

More on SPR [later](#); for now it suffices to say that the "speed" of light **must** be 'numerically finite but physically unattainable boundary' in order to provide for **finite** volumes of space and time intervals of the local mode of spacetime.

First and foremost, I need to eliminate all absolute structures in 3-D space, such as '[absolute size](#)', by allowing the '[templates for finite space](#)' to shrink toward **S** and expand toward **L**, as viewed by an observer at the length scale of tables and chairs, and also providing *invariant* size of **all** object toward **S** and toward **L**, as seen by a [co-moving observer](#). In other words, we need a *dual*, scale-dependent metric to define 'distances in 3-D space'. Then the "[expansion of space](#)" can be explained

as an illusion observed only from the length scale of tables and chairs. Ditto to the "non-accelerated" shrinking of the "size" of objects toward **S**, in line with the so-called 'relative scale principle' ([RSP](#)). The latter is an elaboration on the old idea about 'the mutual penetration of the Large and the Small'. Who has "the right meter"? Nobody. This is the essence of RSP. [Simple, no?](#)

**NB:** To explain the 'templates for finite space' and their "[dark](#)" influence on matter and fields, recall the operational definition of 'second': the total duration of 9,192,631,770 transitions between the two hyperfine levels of the ground state of the cesium 133 atom, provided the cesium atom is "at rest at a temperature of OK, such that the ground state is defined at zero magnetic field" (reference [here](#)). In the local, [Archimedean](#) mode of spacetime, we imagine that the **distance** between every **two** neighboring dots from the drawing below refers to **one** transition between the two levels of the ground state of the cesium-133 atom, and that the total of such physical, [Archimedean](#) distances, comprising 'one second', is **exactly** 9,192,631,700:

{.....}

This is clearly an unfeasible Gedankenexperiment, which cannot be reproduced. Most importantly, the "*intrinsic* time interval associated to any timelike displacement" (Ted Jacobson, pp. [18-19](#)), defined here as '*the elementary tick of time* [between](#) two purely geometrical points ordered with the [relation of intermediacy](#) [A (**zero**) B]', can be defined only in the global, [non-Archimedean](#) mode of spacetime. These are 'invariant templates' for **finite** durations of time and **finite** volumes of space, which approach *asymptotically* **L** and **S**.

**NB:** An objection to such 'finite templates' would be that they are merely mental, or epistemological constructs representing our "knowledge", hence we cannot grant them an ontological status of '**ideal** geometrical reality'. Well, with [Finite Infinity](#) we can indeed suggest such 'finite templates' fixed **by** the topological transitions in the global mode of spacetime (cf. [Fig. 5](#)), hence resolve the underlying puzzle of '[extendable volumes of space](#)', which allow us to "look around, and see as far as we can" ([L. Smolin](#)). This simple fact can be explained iff the spacetime "points" are **perfect** geometrical points **ordered** by The Aristotelian Connection as a [perfect continuum](#) (the current theory *requires* that "points become *fuzzy* and *locality looses any precise meaning*," cf. [Sergio Doplicher](#)).

The [alteration](#) of these templates, relative to an observer at macroscopic length scale, produces *purely geometrical* effects (interpreted as "[black holes](#)" and "[expanding space](#)"), yet a [co-moving observer](#) will **not** notice any alteration of her intrinsic '[distance function](#)'. Again, this is the well-known idea about 'the mutual penetration of the Large and the Small', which can start only from the macroscopic length scale in the two "directions" along **w**, toward **L** and toward **S**.

With RSP and its [dual spacetime metric](#), one could alter the "distances" in 3-D space in such a way that a "[reactionless](#)" alien visiting craft (AVC) will travel with speed "one meter per second" (relative to the people in the AVC) to cover the size of a galaxy (relative to observers outside the AVC). You won't notice your "speeding", but you will notice that the space in front of you is running towards you, just like with the [Alcubierre](#) warp drive. In [RSP](#), the question of 'who has the right meter and the right second' is meaningless. In present-day GR, the question of 'who has the right meter' is answered with **absolute** size of objects in 3-D space, toward **L** and toward **S**, which is nothing but 'looking for a right answer to a wrong question'.

Fig. 4.3 below shows the main idea of Finite Infinity.

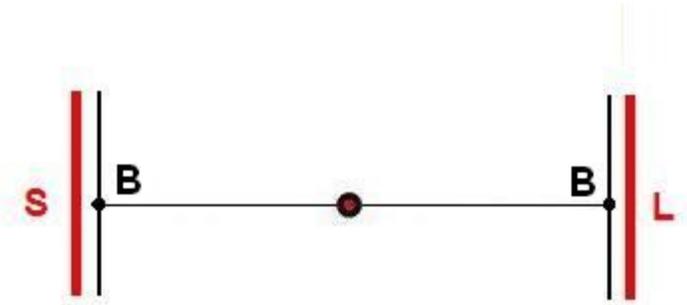


Fig. 4.3

The horizontal line shows the axis  $w$  in terms of two directions in 3-D space, toward  $S$  and  $L$ . The points denoted with  $B$  (from 'bartenders') are the fleeting explications of GPIs in the local (physical) mode of spacetime: John's jackets.

The black horizontal line (asymptotically flat 4-D spacetime, see Fig. 5 below) cannot reach the realm of  $S$  &  $L$  (Thompson Lamp paradox).

And finally, let's see how the  $w$  axis will look in the global mode of spacetime (Fig. 5), by combining Fig. 1 with the blow up of Fig. 3.2 at the point "9 o'clock" (not shown).

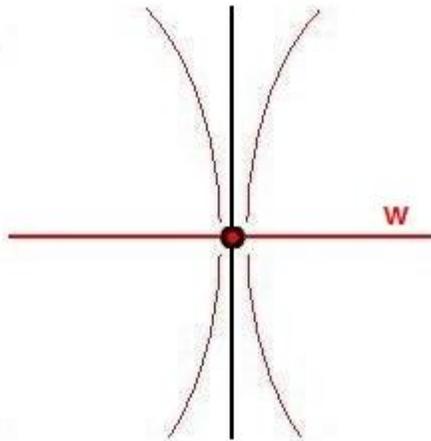


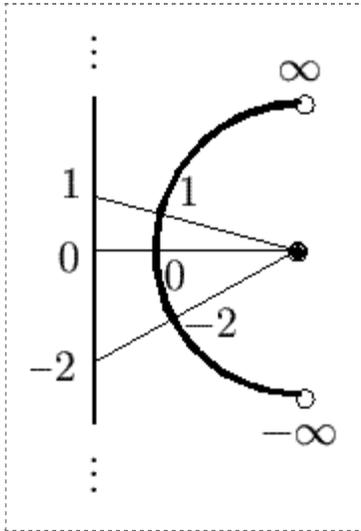
Fig. 5

The **red/black** point in Fig. 5 belongs to an asymptotically flat, physical, 4-D spacetime; the vertical black line is taken from Fig. 2.2. above. The *right* part from Fig. 5 shows the  $T$ -invariant (cf. the drawing from Mark Armstrong above) "blow up" of the circle from Fig. 3.2, by watching the point at "9 o'clock" (see above): at the critical 'collapse over *actual* infinity' instant, at which the radius of the circle in Fig. 3.2 is *exactly* infinite, we would have obtained an absolutely flat 4-D spacetime, which is why I talked, for the lack of better wording, about "*around* the critical 'collapse over infinity' instant". The *left* part from Fig. 5 shows a segment from a torus -- see the drawing from DeCarlo and Metaxas above, 'case (e)', and the explanation of 'space inversion', about the two simultaneous viewpoints at the 3-D "rubber glove" Cauchy hypersurface, from 'inside-out' (right part from Fig. 5) and from 'outside-inside' (left part from Fig. 5). The horizontal  $w$  axis is the one along which 'the mutual penetration of the Small and the Large' begins from the *macroscopic* length scale, as discussed above. Hence the only remnant from  $w$  in our *asymptotically* flat spacetime (called 'local mode of spacetime') is depicted with the two red lines in Fig. 4.3 above, placed at  $S$  and at  $L$ .

Notice that the horizontal  $w$  axis is **not** a 4th spatial dimension, because the new degrees of freedom to "look at" the 3-D "rubber glove" Cauchy hypersurface entail moving *simultaneously* along

**all** directions in the local mode of spacetime, from any point in 3-D space, from both 'inside-out' toward **L** and its time-reverted direction toward **S**. This is impossible in 3-D space, as explained in Wiki [below](#), but recall that these are the "directions" of the Arrow of Space: the elementary 'change of space' is nothing but *the* elementary increment of our physical **time**, as read with our clocks -- it isn't a "vector". Thus, the global mode of spacetime and the axis **w** of the Arrow of Space could only be perceived by us as "occurring" in some infinite-dimensional Euclidean space, much like a Flatlander (cf. Fig. 3.2) would be totally puzzled by our 3-D viewpoint, and would also have to imagine some higher-dimensional space to accommodate **our** 3-D viewpoints **inside** his Flatland.

To visualize these **smooth** torus-sphere transitions over the 'collapse over infinity' instant 'now' (Fig. 1), hence the **re-created** 'asymptotically flat 3-D space', look carefully at the drawing below, from Eric Schechter ([5 December 2009](#), emphasis added): "There are no points for plus or minus infinity on the line, but it is natural to attach those "numbers" to the **endpoints** of the semicircle."



The point denoted with 'zero' from the vertical line corresponds to the point at "9 o'clock" in Fig. 3.2 above (not shown). Notice that **every** point from the **circle** in Fig. 3.2 above will pass over the 'collapse over infinity'-instant, and at this instant its **two** conjugated **endpoints**, from the direction orthogonal to the horizontal line segment pictured here, will "break up" the circle and will convert it into a (hyper?) torus. The 3-D space at the **exact** 'collapse over infinity' instant would be **absolutely** flat, and would contain just a **bare red** point from Fig. 1 above, known as [John 1:1]. Which is why I talked, for the lack of better wording, about "around the critical 'collapse over infinity' instant", to describe the asymptotically flat 3-D space, hence 4-D spacetime, of present-day GR.

But look at Eq. 1 [above](#): in the *global* mode of spacetime, we can set **L** and **S** to take values of some dimensionless variable "measured" along **w**; all we need is to ensure that **L** and **S** take reciprocal values, until they **snap** to

$$\mathbf{L} = \mathbf{S} = \mathbf{1} \quad (\text{Eq. 2}).$$

Eq. 2 describes 'the whole universe as ONE' in its global mode of spacetime, inhabited *only* by [GPIs](#). The Arrow of Space runs simultaneously along the two "opposite directions" from **w**, and at each and every instant '**now**' (see Fig. 1) a newly-born physical universe is being [re-created](#) in the local mode of spacetime.

Namely, Eq. 2 reduces to Eq. 1 [above](#), and the finite, **Archimedean**, 3-D space is born anew by [the "spontaneous" broken symmetry](#), stacked along **w** like [Photoshop layers](#).

We cannot look at the "**gaps**" of **re-creation**: the local (physical) mode of spacetime is being re-created as [a perfect continuum](#), thanks to the "[speed of light](#)".



Perhaps the global mode of spacetime can be presented with *four* segments (notice the favicon of my web site) in which two [atemporal](#) quantum-gravitational waves run against each other, **re-**creating asymptotically flat spacetime at the 'collapse over infinity' instant. Also, the fundamental phenomenon called "spin" should be explained as topological property of 3-D space. As Peter Rowlands suggested (arXiv:0912.3433v1, Sec. 3, [p. 5](#)), "Space and time are simply quaternions multiplied by *i*, and spin is simply a topological property of space (as Dirac knew), and not quantum or relativistic in origin."

In the quantum-and-gravitational realm of the local (physical) mode of spacetime, physical objects [gradually](#) acquire increasing access to 'the whole universe as ONE'. They become [bootstrapped](#) by their "gravitational field", due to opening a "**red** window" to their GPIs residing in the global mode of spacetime. Which is why a quantum particle can be in a superposition of its GPI states (say, a superposition of  $|\text{cat}\rangle$  and  $|\text{dog}\rangle$ , [Erich Joos](#)), and all (not just "small") bodies follow *quasi-local geodesics*: at each point from such *quasi-local* geodesics we can install a local Lorentzian frame, by going into "[freefall](#)" at such *quasi-local* point, and imagine that [the effects of gravity](#) have **re-**disappeared.

All this is a very brief and [incomplete](#) effort to amend the Finite Infinity, introduced by [George F R Ellis](#). Needless to say, I will be happy to [elaborate](#). Details [here](#).

D. Chakalov

October 28, 2010

Last updated: Saturday, 25 February 2012, [12:53:14 GMT](#)

Created:	Saturday, February 25, 2012, 12:53:14
Modified:	Saturday, February 25, 2012, 12:53:14
Application:	Microsoft Office

=====  
Subject: The Cauchy problem in General Relativity, Proceedings of ICM, Vol. III, 421-442, 2006

Date: Tue, 3 Jan 2012 03:54:22 +0200

From: Dimi Chakalov <dchakalov@gmail.com>

To: Igor Rodnianski <irod@math.princeton.edu>, irod@math.mit.edu

Cc: Henk van Elst <hvanelst@karlshochschule.de> ,

Hans Ohanian <hohanian@uvm.edu> ,

Mark Burgin <mburgin@math.ucla.edu> ,

Piotr T Chrusciel <piotr.chrusciel@univie.ac.at> ,

Paul Tod <tod@maths.ox.ac.uk>

Dear Dr. Rodnianski,

May I ask you and your colleagues for [clarification](#) of the meaning of "implies" (cf. attached) used on p. 422 (emphasis mine).

For comparison, please see an excerpt from Hans Ohanian's [arXiv:1010.5557v1 \[gr-qc\]](#) (cf. [attached](#)).

Kind regards,

Dimi Chakalov  
<http://tinyurl.com/Einstein-Prague>

422

Igor Rodnianski

The contracted Bianchi identity  $D^\alpha R_{\alpha\beta} = 2\partial_\beta R$  implies that the gravitational tensor  $G_{\alpha\beta} = R_{\alpha\beta} - \frac{1}{2}g_{\alpha\beta}R$  is always divergence free,  $D^\alpha G_{\alpha\beta} = 0$ . As a consequence, evolution equations for the external fields in the models described above follow from the requirement that  $D^\alpha T_{\alpha\beta} = 0$ .

=====  
Subject: [GR19 - 2010](#)

Date: Thu, 3 Jun 2010 02:39:23 +0300

From: Dimi Chakalov <dchakalov@gmail.com>

To: Kei-Chi Maeda <maeda@waseda.jp> ,

Don Marolf <marolf@physics.ucsb.edu> ,

Malcolm MacCallum <m.a.h.maccallum@qmul.ac.uk> ,

Alan Rendall <rendall@aei.mpg.de> ,

Jose M M Senovilla <josemm.senovilla@ehu.es> ,

[Miguel Alcubierre](#) <malcubi@nuclecu.unam.mx> ,

Bernard Schutz <bernard.schutz@aei.mpg.de>

Gentlemen:

I mentioned your [gathering](#) at

<http://www.god-does-not-play-dice.net/#Blanchard>

Four years ago, I proposed to convert LIGO tunnels to wine cellars. If you have a better idea, please do write me back.

Sincerely,

Dimi Chakalov

=====  
Subject: GR19 - 2010

Date: Fri, 4 Jun 2010 01:49:18 +0300

From: Dimi Chakalov <dchakalov@gmail.com>

To: Gabriela González <gonzalez@lsu.edu>

Cc: Jorge Pullin <pullin@lsu.edu> ,

rgambini@fisica.edu.uy,

rgambini@relativity.phys.lsu.edu

Dear Professor González,

Regarding my email from June 8, 2005: I noticed your name at

<http://www.gr19.com/scicom.php>

Perhaps it will be a good idea if you blow the whistle at GR19 and expose the insurmountable problems of "GW astronomy",

<http://www.god-does-not-play-dice.net/#Blanchard>

The sooner, the better.

Should you have professional questions, please don't hesitate to write me back.

Yours sincerely,

Dimi Chakalov

-----  
Subject: Re: LSC March 2005 and June 2005 Meetings  
Date: Wed, 08 Jun 2005 20:08:12 +0300  
From: Dimi Chakalov <dimi@chakalov.net>  
To: Gabriela González <gonzalez@lsu.edu>  
CC: Jorge Pullin <pullin@lsu.edu>, rgambini@fisica.edu.uy, rgambini@relativity.phys.lsu.edu

Dear Professor González,

I watched your movie "Gravity: Making Waves", with Ray Weiss and Mike Zucker, and would like to share my concerns regarding the "direction" of detecting gravitational waves  
[snip]

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**Note:** Look at the "direction" of GW scattering in the animation [below](#): you might be able to "see" these GWs iff you're a meta-observer capable of monitoring the whole spacetime *en bloc*.

However, this same "direction" is assumed to exist inside the same 3-D space **as well**: check out the [Mock LISA Data Challenge Taskforce](#) and LIGO-Virgo Mock Data (custom made) Working Group, as explained eloquently in their [arXiv:gr-qc/0701026v1](#):

"The burst "repeater" source was placed at the center of the Galaxy and the performance modulation due to Earth's rotation has been studied with 24 hours of simulated data."

So, the direction of GW scattering 'from the center of the Galaxy toward Earth' matches the direction of the same GW scattering seen by the meta-observer.

Do you smell a rat? If not, join LIGO Scientific Collaboration.

D.C.

June 4, 2010

=====

Subject: 8th International LISA Symposium, Stanford University, June 28, 2010 - July 02, 2010  
Date: Mon, 7 Jun 2010 06:13:31 +0300  
Message-ID: <AANLkTikjRKN3\_IeSejei8qsM8MgY8tOAv0\_Mv6ziQe\_M@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Vivian Drew <vdrew@stanford.edu>  
Cc: Joan M Centrella <Joan.Centrella@nasa.gov>, Warren Johnson <johnson@ligo.phys.lsu.edu>, Stephen Merkowitz <stephen.m.merkowitz@nasa.gov>, Meredith Gibb <meredith.gibb@nasa.gov>, Karen Smale <karen.m.smale@nasa.gov>, iris.t.purcarey@nasa.gov, Catherine.m.Corlan@nasa.gov, Shau-Yun.Tsai-1@nasa.gov, andre Luiz.s.luz@nasa.gov, notoya.r.russell@nasa.gov, mor.vimmer@nasa.gov, simon.barke@aei.mpg.de, johanna.bogenstahl@aei.mpg.de,

marina.dehne@aei.mpg.de, Roland.Fleddermann@aei.mpg.de,  
antonio.garcia@aei.mpg.de, joachim.kullmann@aei.mpg.de,  
benjamin.sheard@aei.mpg.de, gudrun.wanner@aei.mpg.de,  
frank.steier@aei.mpg.de, [Cliff](mailto:Cliff) <cmw@wuphys.wustl.edu>

Dear Dr. Drew,

The reason why LIGO, LISA, etc. will fail miserably is explained at

<http://www.god-does-not-play-dice.net/#mantra>

Hundreds of millions U.S. Dollars and Euro -- taxpayers' money -- have been wasted so far by LIGO Scientific Collaboration, and even more are scheduled to be wasted with the "enhanced" and "advanced" LIGO and LISA.

I seriously urge you and your colleagues to examine your problems professionally. Please feel free to pass this email to all participants of your 8th International LISA Symposium.

**NB:** Should you or any of your colleagues have \*professional\* questions, please do write me back. Notice I will not reply to insults nor to emotional statements.

Yours sincerely,

Dimi Chakalov

=====

Subject: The Averaging Problem in GR  
Date: Tue, 23 Mar 2010 13:48:51 +0200  
Message-ID:  
<bed37361003230448y8c3d28fr19844c193638a2ab@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Robert van den Hoogen <rvandenh@stfx.ca>  
Cc: Juliane Behrend <jbehrend@stfx.ca>,  
Masumi Kasai <kasai@phys.hirosaki-u.ac.jp>,  
Naoshi Sugiyama <naoshi@a.phys.nagoya-u.ac.jp>,  
Frank Steiner <frank.steiner@uni-ulm.de>,  
Claus Gerhardt <gerhardt@math.uni-heidelberg.de>,  
Eduardo Guendelman <guendel@bgu.ac.il>,  
Thomas Buchert <buchert@obs.univ-lyon1.fr>,  
Yi Zhang <zhangyia@cqupt.edu.cn>,  
Lau Loi So <s0242010@gmail.com>,  
Xiao Zhang <xzhang@amss.ac.cn>,  
Marco Spaans <spaans@astro.rug.nl>,  
Sergio Doplicher <dopliche@mat.uniroma1.it>,  
Volker Runde <vrunde@ualberta.ca>,  
Robert M Wald <rmwa@midway.uchicago.edu>,  
Robert Geroch <geroch@midway.uchicago.edu>,  
Chris Isham <c.isham@imperial.ac.uk>

Dear Professor van den Hoogen,

Your recent paper [[Ref. 1](#)] is a joy to read, and also a tough challenge to study. I haven't yet completed the second part, but since you acknowledged that Problem C (determining the

gravitational correlation) is unresolved, may I offer some thoughts on the subject matter.

It seems to me that many physicists are unaware of the fundamental puzzle in differential calculus, as shown with the [Thompson Lamp paradox](#),

[http://en.wikipedia.org/wiki/Thomson's\\_lamp](http://en.wikipedia.org/wiki/Thomson's_lamp)

They [write textbooks and teach GR](#) like a bartender [Ref. 2]. Other "bartenders" suggest various ad hoc solutions to the "dark" constituents of the universe in the following fashion:

Q: What is green, lives underground, has one eye, and eats stones?

A: The One-Eyed Green Underground Stone Eating Monster!

I believe both dark matter and dark energy are artefacts of our essentially incomplete presentation of 'the infinitesimal', which may in turn be resolved with some [pre-geometric plenum](#) "connecting"  $x$  and  $x$  [Ref. 1] dynamically, along an 'arrow of spacetime',

<http://www.god-does-not-play-dice.net/#quiz>

<http://www.god-does-not-play-dice.net/#Bahn>

I also believe the Thompson Lamp paradox has a quantum version: the UNdecidable KS state,

<http://www.god-does-not-play-dice.net/#KS>

The latter may act as the '[pre-geometric plenum](#)' mentioned above.

Your critical comments and suggestions, as well as the feedback from your colleagues, will be greatly appreciated.

May The Force be with the inhomogeneous cosmologists [Ref. 3].

With all good wishes,

Dimi Chakalov

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[Ref. 1] R. J. van den Hoogen, Averaging Spacetime: Where do we go from here? arXiv:1003.4020v1 [gr-qc], <http://arxiv.org/abs/1003.4020>

p. 1: "Can there be an alternative description for these observational effects that does not assume the existence of these mysterious dark quantities?"

"One possibility is that both dark matter and dark energy are artefacts of some effective averaged theory of gravitation.

....

Problem A (How does one Average tensor fields on a manifold?)

Problem C (What is the nature of the gravitational Correlation ,  $C_{ab}$ ?)

....

p. 7: "3.2. Choice 1: Parallel Transport along Geodesic

"To begin, we must first select a unique curve that connects the points  $x$  and  $x'$  and a connection: for our purposes, we choose the geodesic and the Levi-Cevita connection. The geodesic is a "natural" choice as there are no other "natural" curves that connect  $x'$  and  $x$ . In Riemannian space, the geodesic is the shortest and straightest path connecting points  $x'$  and  $x$ . A weakness in this approach is the assumption that a unique geodesic exists connecting  $x'$  and  $x$ .

....

p. 8: "We have illustrated a covariant averaging procedure for tensor fields addressing problem A. We have not averaged the Einstein Field Equation's of General Relativity, and therefore have not

addressed problem C of determining the gravitational correlation, so much more work to do."

[Ref. 2]

<http://www.math.ualberta.ca/~runde/jokes.html>

An **infinite** crowd of mathematicians enters a bar. The first one orders a pint, the second one a half pint, the third one a quarter pint... "I understand", says the bartender - and pours two pints.

[Ref. 3] Masumi Kasai (23 June 2009): "May the Force be with the inhomogeneous cosmologists. May the Force be with us."

IPMU International Conference dark energy: lighting up the darkness!

June 22-26, 2009, <http://web.ipmu.jp/seminar/darkenergy09/MKasai.pdf>

=====

Subject: Request for opinion

Date: Wed, 31 Mar 2010 20:47:14 +0300

Message-ID:

<w2jbed37361003311047sdef905d3w938a76121dcd3c8@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Helena Granström <granstrom.h@gmail.com>

Dear Dr. Granström,

I am respectfully requesting your professional opinion on the interpretation of KS Theorem at

<http://www.god-does-not-play-dice.net/#KS>

[http://www.god-does-not-play-dice.net/#KS\\_details](http://www.god-does-not-play-dice.net/#KS_details)

Kindest regards,

Dimi Chakalov

=====

Subject: [arXiv:1005.3767v1 \[quant-ph\]](http://arxiv.org/abs/1005.3767v1), Sec. 4

Date: Fri, 21 May 2010 05:06:16 +0300

Message-ID:

<AANLkTinsis\_3Uw6FOYjPNVRHwucvJyalu9j3O\_6\_3GJf@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Diederik Aerts <diraerts@vub.ac.be>

Dear Diederik,

I wonder if your work overlaps with mine:

<http://www.god-does-not-play-dice.net/#KS>

Best regards,

Dimi

=====

Subject: [arXiv:1006.1552v1 \[gr-qc\]](http://arxiv.org/abs/1006.1552v1), dated: June 9, 2010

Date: Wed, 9 Jun 2010 04:06:55 +0300

From: Dimi Chakalov <dchakalov@gmail.com>

To: [Naresh Dadhich](mailto:nkd@iucaa.ernet.in) <nkd@iucaa.ernet.in>

Hi Naresh,

Regarding your idea that  $[\lambda]$  "characterizes the matter free state": the "matter free state" has been discussed at

<http://www.god-does-not-play-dice.net/#KS>

[http://www.god-does-not-play-dice.net/#Geroch\\_note](http://www.god-does-not-play-dice.net/#Geroch_note)

<http://www.god-does-not-play-dice.net/#Blanchard>

I very much look forward to reading your arXiv:1006.1552 v2 [gr-qc].

Regards,

Dimi

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**Note:** Check out N. Dadhich's [arXiv:gr-qc/0405115v1](http://arxiv.org/abs/gr-qc/0405115v1), particularly the discussion of Eq. 4. He also posed the following question ([arXiv:0802.3034v5](http://arxiv.org/abs/0802.3034v5) [gr-qc]):

"It is remarkable that even classical dynamics of gravity asks for dimension  $> 4$ . As two and three dimensions were not big enough for free propagation of gravity, similarly four dimension is not big enough to fully accommodate self interaction dynamics of gravity. Then the most pertinent question is where does this chain end?"

It ends at *infinitely-dimensional* spacetime -- see Fig. 2 [below](#). Every infinitesimal "point" from the *local* mode is endowed with infinitely-many **connections** (global mode of spacetime) with 'the rest of points' in the local mode. And since the global mode is hidden by the so-called '[speed of light](#)', the [bootstrapped](#) local mode is "self-acting" upon itself along the *arrow of spacetime*. Not surprisingly, the origin of this "[self-force](#)" is not traceable, and some people consider it "[dark](#)". This offers a new interpretation of the old idea of "breathing" (inhaling/exhaling) universe (common knowledge in India), only the duration of the "breathing" cycle is [exactly zero](#) in the local mode of spacetime, rendering the latter a *perfect* continuum. That's the proposal for 'quantum principle for spacetime dynamics', after [Schrödinger and KS Theorem](#).

Perhaps [Naresh Dadhich](#) would some day accidentally discover it. All he has to do is to forget about "branes" and other multidimensional superstitious. 😊

D.C.

June 12, 2010

=====

—*mathematics for compositional situations*—

1. Let  $A$  be a raw potato.

$A$  admits many *states* e.g. **dirty**, **clean**, **skinned**, ...

Subject: The raw potato, <http://pirsa.org/09080013>

Date: Thu, 27 May 2010 15:57:16 +0300

From: Dimi Chakalov <dchakalov@gmail.com>

To: Bob Coecke <coecke@comlab.ox.ac.uk>

Cc: John Baez <baez@math.ucr.edu>

Hi Bob,

I trust all my email messages sent in the past three years have been received.

You declared your intentions to make "new models and axiom systems for quantum reasoning", and expressed hopes for "important steps towards quantum gravity",

<http://www.comlab.ox.ac.uk/projects/NewQuantumFormalism/index.html>

If this just a hobby? For if you were collecting stamps, while I was suggesting to switch to collecting paper napkins, I could understand your attitude of neglecting the underlying "raw potato" -- the UNdecidable KS state,

<http://www.god-does-not-play-dice.net/#KS>

Try it with your brain at

<http://www.god-does-not-play-dice.net/#context>

NB: Category theory cannot -- not even in principle -- model the "raw potato". You and John are wasting your time and FOXI donations: [\\$89,981](#) for your efforts, and [\\$131,865](#) for John's "Categorifying Fundamental Physics".

Now, if you ([John](#) won't respond) are [serious about your business](#), please reply professionally, and I will elaborate.

If you're doing it as a hobby -- don't bother. Have a beer instead.

Take care,

Dimi

=====

Subject: Louis Crane, [The category of spacetime regions](#)  
Date: Thu, 27 May 2010 17:03:45 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Louis Crane <crane@math.ksu.edu>  
Cc: Kavita Rajanna <mail@fqxi.org>,  
Bob Coecke <coecke@comlab.ox.ac.uk>,  
Prakash Panangaden <prakash@cs.mcgill.ca>,  
Peter Selinger <selinger@mathstat.dal.ca>,  
ross.duncan@comlab.ox.ac.uk, andreas.doering@comlab.ox.ac.uk,  
schumacherb@kenyon.edu, J.Barrett@bristol.ac.uk

Dear Dr. Crane,

Regarding your talk at the 7th QPL workshop "[Quantum Physics and Logic](#)" and [arXiv:gr-qc/0602120v2](#), and the \$135,247 FOXI award, perhaps you may wish to see my recent email to Bob Coecke,

<http://www.god-does-not-play-dice.net/#Coecke>

I think [\\$135,247](#) is a lot of money to be spend for a hobby. What do you think?

Sincerely,

Dimi Chakalov

=====

Subject: [arXiv:0705.2908v2](#)  
Date: Sat, 22 May 2010 05:43:08 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Yi-Fang Chang <yifangchang1030@hotmail.com>, Yi-Fang Chang <yifangch@sina.com>

Dear Dr. Chang,

I read with great interest your [arXiv:0705.2908v2](#), but couldn't understand the following:

"When the positive and negative matters with the same mass meet, they will become a real vacuum." And also: "The positive and negative matters under some exceeding conditions may be created from nothing at the same time. They will also be main tests of the existence of negative matter."

What could be the [ultimate source](#) of positive and negative matters (called "nothing"), such that it can "meet" them as "a real vacuum"?

Kindest regards,

Dimi Chakalov

=====

Subject: Re: [The shape of space](#)  
Date: Tue, 23 Mar 2010 15:05:42 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Graham Nerlich <Graham.Nerlich@adelaide.edu.au>

Dear Graham,

You said (Thu, 23 Dec 2004) that [the affine structure](#) "is a further primitive (not definable from mere differential structure) structure which you can postulate using some representation or other of it" -- please see

<http://www.god-does-not-play-dice.net/#Force>

I will appreciate your critical comments.

All the best,

Dimi

-----

Subject: Re: The shape of space  
Date: Thu, 23 Dec 2004 12:38:15 +1030  
From: Graham Nerlich <graham.nerlich@adelaide.edu.au>  
To: Dimi Chakalov <dimi@chakalov.net>

I meant something pretty simple by what I wrote in Shape of Space. Consider a space which has the structure only of a [differential manifold](#). Then, so far, no affine structure, no geodesics, no curvature, no Christoffel tensor. The transition from this to affine structure is not given by or extruded from Christoffel symbols or the 3-tensors which they represent. The [affine structure](#) is a further primitive (not definable from mere differential structure) structure which you can postulate using some representation or other of it. You can postulate it as a covariant derivative, a connection, or a tensor

which can be represented in coordinates by a Christoffel symbol. But that representation makes sense only if the affine structure is already there, so to speak. True, in GR, the fundamental equation tells us (among other things) that the curvature and the "matter distribution" are co-determinate. That doesn't mean that the curvature is caused by the matter tensor. A simple analogy shows the catch in that way of thinking. The distance relations between London, New York and Sydney entail that the cities aren't on a flat surface. But the distances don't cause the shape of the surface. These places couldn't have those distances if the surface wasn't curved in the first place. The basic equation of GR places a mutual constraint on the tensors on each side of it.

I guess you know that the tensor as represented by a [Christoffel symbol](#) isn't straightforwardly like other tensors. If you don't, [B. Schutz A First Course in General Relativity](#) sec. 5.5 gives a clear account of it.

Best wishes

Graham Nerlich

=====

Subject: Dreaming about LISA, [arXiv:1011.2062v1 \[gr-qc\]](#)  
Date: Wed, 10 Nov 2010 04:07:11 +0200  
Message-ID:  
<AANLkTinqa4NF+vAwZm1m\_Mb8vYRiGhKcDyW40Y7V+eGU@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Stanislav Babak <stba@aei.mpg.de>,  
jgair@ast.cam.ac.uk,  
antoine.petiteau@apc.univ-paris7.fr,  
alberto.sesana@aei.mpg.de  
Cc: Leonid.Grishchuk@astro.cf.ac.uk,  
Beverly Berger <bberger@nsf.gov>,  
Tom Carruthers <tcarruth@nsf.gov>,  
Denise S Henry <dshenry@nsf.gov>,  
Ramona Winkelbauer <rwinkelb@nsf.gov>,  
LSC Spokesperson <reitze@phys.ufl.edu>

Dear Mr. Babak,

You wrote (p. 2): "we will use the fact that LISA will observe about 30 events per year..."

But it isn't a \*fact\*. The fact of the matter is that people are not stupid, and are fully aware of the errors in your hypotheses:

<http://www.god-does-not-play-dice.net/ExplanatoryNote.pdf>

It is manifestly pointless to dream about LISA, because you won't get it.

Sincerely,

D. Chakalov

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Overfunded research is like heroin: It makes one addicted, weakens the mind and furthers prostitution.

[Johann A. Makowsky](#), The Jerusalem Post, 19.4.1985

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Subject: Pornography at the NSF and [GW parapsychology](#)

Date: Thu, 1 Oct 2009 14:34:37 +0300

From: Dimi Chakalov <dchakalov@gmail.com>

To: Carlos <carlos@hotmail.com>

Cc: Beverly Berger <bberger@nsf.gov> ,

Tom Carruthers <tcarruth@nsf.gov> ,

Denise S Henry <dshenry@nsf.gov> ,

Ramona Winkelbauer <rwinkelb@nsf.gov> ,

Peggy Fischer <pfischer@nsf.gov> ,

OIG <oig@nsf.gov> ,

LSC Spokesperson <reitze@phys.ufl.edu> ,

contact.lrr@livingreviews.org

[snip]

Dear Carlos,

> I forgot about these funny news : 75% of the people who work at the National  
> Science Foundation (NSF) have been found to be surfing at Porno in the web

Here's the link:

<http://washingtontimes.com/news/2009/sep/29/workers-porn-surfing-rampant-at-federal-agency/>

I've been trying to contact NSF since [July last year](#), but the only response I got so far was from Mr Berger (email printed below).

The forthcoming scandal about LIGO will be enormous:

<http://www.god-does-not-play-dice.net/Szabados.html#SBG>

Nobody cares. NOBODY.

All the best,

Dimi

<http://www.god-does-not-play-dice.net/#NB>

=====

Re: LSC: Aggressive professional negligence

Date: Fri, 5 Sep 2008 12:51:16 -0400

Message-ID:

<A74B5B2C42009044AD35C5490049DAE7011BA3A6@NSF-BE-01.ad.nsf.gov>

From: Berger, Beverly K. <bberger@nsf.gov>

To: Dimi Chakalov <dchakalov@gmail.com>

I will be on vacation until Sept. 8 and will have no email contact for most of that time. If you cannot wait until I return, please contact Denise Henry ([dshenry@nsf.gov](mailto:dshenry@nsf.gov)) .

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" . . . and we can save 700 lire by not taking soil tests."

Note: At the age of 57, my hair is getting [lily-white](#), and I may claim that it is *sufficiently white* to enjoy surfing at porno in the web, yet still *sufficiently black* to attract real blond girls. Likewise, LSC members deeply believe that GW strain, which might hit LIGO some day, would be *sufficiently weak* to be modeled with the [linearized approximation of GR](#), yet *sufficiently strong* to be detected with the so-called [Advanced LIGO](#) (cf. J. G. Pereira *et al.*, [arXiv:0909.4408v1](#)).

But LSC can't have their cake and eat it. As [Hermann Weyl](#) demonstrated in 1944 (Hermann Weyl, How Far Can One Get With a Linear Field Theory of Gravitation in Flat Space-Time? *American Journal of Mathematics*, Vol. 66, No. 4 (Oct., 1944), pp. 591-604), the linearized approximation of GR is "**a shadow without power**".

Notice that LSC cannot describe *smooth bi-directional transitions* from strong GWs to very weak GWs, as they approach *asymptotically* their sudden death at the stage of "**a shadow without power**". [Joshua Goldberg](#) is manifestly silent on this crucial problem, and Kip Thorne didn't even mention [Hermann Weyl](#)'s article in his lecture "[Gravitational waves in flat spacetime](#)". Instead, he tried to defend the so-called "invariance angle" of LIGO's arms with an article by Eugene Winger, which he has read as a student "[around 1960](#)". Just look at the **L-shaped** tunnels of LIGO: isn't this '[graviton parapsychology](#)'?

The persistent "evolution" of the beliefs of LSC members is really amazing. Back in 1981 (cf. Daniel Kennefick, [p. 1](#)), Kip Thorne had no difficulty in "finding a taker for a wager that gravitational waves would be detected by the end of the last century. The wager was made with the astronomer Jeremiah Ostriker, one of the better-known critics of the large detectors then being proposed. Thorne was one of the chief movers behind the largest of the new detector projects, the half-billion-dollar Laser Interferometer Gravitational Wave Observatory, or LIGO. He lost the bet, of course."

Now LSC members are effectively saying 'just gives us a couple of billion dollars more, and we gonna make it'. Exactly how much more? The Advanced LIGO Cost Estimating Plan (M990310-05.pdf, updated [05.27.2003](#)) is [here](#), but is hidden to '[mass society](#)' [taxpayers](#).

Notice that LSC have already prepared 'Plan B', in case they fail miserably again. In their latest "science white paper", submitted to the [Astro2010 Decadal Survey](#) (Bernard F. Schutz *et al.*, [arXiv:0903.0100v1 \[gr-qc\]](#), p. 3), they wrote:

"It is worth reminding ourselves why and where GR might fail." (...) "*Any such failure of GR should point the way to new physics.*"

Once the "Advanced LIGO" fails in 2015, they will celebrate the 100th anniversary of Einstein's GR with their "way to new physics", claiming that their total failure is actually of fundamental importance, like the negative result for the ether drift in the experiment of Michelson and Morley ... but with just a few billion dollars more for LISA and [Einstein Telescope](#), everything will be just right.

 Are NSF officials going to risk a devastating embarrassment from their blind support of [GW parapsychology](#)?

D. Chakalov  
October 2, 2009  
Last update: October 26, 2009

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Subject: Re: The schizophrenic behavior of gravity ([SBG](#))  
Date: Sat, 13 Mar 2010 15:45:13 +0200  
Message-ID:  
<bed37361003130545u33d426e5x13c85680c8df766c@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Nikolai Mitskievich <nmitskie@gmail.com>  
Cc: Ludvig Faddeev <faddeev@pdmi.ras.ru>, Viktor Denisov <denisov@srd.sinp.msu.ru>, kip@tapir.caltech.edu, weinberg@physics.utexas.edu, LSC Spokesperson <reitze@phys.ufl.edu>, Beverly Berger <bberger@nsf.gov>, Tom Carruthers <tcarruth@nsf.gov>, Denise S Henry <dshenry@nsf.gov>, Ramona Winkelbauer <rwinkelb@nsf.gov>, GW\_comp@olegacy.gsfc.nasa.gov, Laszlo Szabados <lbszab@rmki.kfki.hu>, Adam Helfer <adam@math.missouri.edu>, Bernard.Schutz@aei.mpg.de, danielk@uark.edu, c.isham@imperial.ac.uk, luca@phy.olemiss.edu, Roger Blandford <rdb3@stanford.edu>, Lynne Hillenbrand <lah@astro.caltech.edu>, Donald C Shapero <dshapero@nas.edu>, Adam Riess <ariess@pha.jhu.edu>

Dear Dr. Mitskievich,

You wrote ([arXiv:1002.1421v1](#)): "I am regretful not to tell these considerations to Kip S. Thorne more than two decades ago, simply because of a kind of awkward modesty."

I think Kip Thorne should have been aware since mid-1980s that the whole idea of some "dimensionless GW amplitude" acting on physical objects is wishful thinking,

<http://www.god-does-not-play-dice.net/#Jones>

The rigorous proof was delivered by Denisov and Logunov in 1982; English translation in 1984,

<http://www.springerlink.com/content/tr05r2853123/?p=2f6d7ad5e83047baab73de519b1007f4&pi=0>

Sec. 6, pp. 1728-1734,  
<http://www.springerlink.com/content/r4227857n075h92h/?p=6191681b74ad428f9ebf0f883311fbcf&pi=6>

Please notice that the crucial \*asymptotic\* expression  $r \rightarrow [\text{infinity}]$  at the link above is

mathematically unclear, that is, pure poetry.

Physically, it is also totally unclear due to the so-called "dark" energy from empty space,

<http://www.god-does-not-play-dice.net/#quiz>

So, even if we assume that Kip Thorne has somehow missed the monograph by V. Denisov and A. Logunov, he is most certainly aware that the whole "GW astronomy" is in murky waters since the discovery of "dark" energy in 1997 by Adam Riess,

<http://www.god-does-not-play-dice.net/#facts>

How did he manage to drag so many people into this nonsense, I wonder.

Notice that LIGO Scientific Collaboration might have prepared 'Plan B', in case they fail miserably again. In their "science white paper", submitted to the [Astro2010 Decadal Survey](#) (Bernard F. Schutz et al., arXiv:0903.0100v1 [gr-qc], p. 3), they wrote:

"It is worth reminding ourselves why and where GR might fail." (...) "Any such failure of GR should point the way to new physics."

Once the "Advanced LIGO" fails in 2015, they will celebrate the 100th anniversary of Einstein's GR with their "way to new physics", claiming that their total failure is actually of fundamental importance, like the negative result for the ether drift in the experiment of Michelson and Morley ... but with just a few billion dollars more for LISA and Einstein Telescope, everything will be just right.

I am afraid NSF officials are indeed taking the risk of devastating embarrassment after their blind support of [GW parapsychology](#). And they will get it:

<http://www.god-does-not-play-dice.net/Szabados.html#SBG>

Perhaps you can help your US colleagues. You know the work by Viktor Denisov, Anatol Logunov, and Ludvig Faddeev. I hope you have some spare time to write up a brief paper and post it on arxiv.org server, to prevent the **abuse** of Einstein's GR with the 'Plan B' above.

Nobody should blame GR for the forthcoming failures to detect GWs with some "enhanced" or "advanced" LIGO. Einstein's errors regarding energy transport by GWs were identified even before Kip Thorne was born. I will be happy to provide you the references.

Looking forward to hearing from you,

Yours sincerely,

Dimi Chakalov

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**Note:** The staggering problem of "GW astronomy", encoded in the *asymptotic* expression  $r \rightarrow$  [infinity], can perhaps be explained by an [ancient Greek](#) in the following fashion. Suppose Achilles is [throwing](#) his famous spear in one direction along the radius of the universe,  $r$ , starting from its center at Athens. He isn't familiar with the wisdom of [present-day cosmology](#), but is a staunch relativist and knows that the universe is like an *unbroken ring with no circumference*, for the circumference is nowhere, and the "center" is *everywhere*.

How can Achilles prove the '*no circumference*' conjecture? Suppose that, at some advanced stage from his exercise, he finds out that *cannot* throw his spear anymore, because he has reached some (asymptotic) limit of being 'too far away from Athens'. Namely, the *increasing* distance ( $r$ ) between Achilles and Athens somehow blocks his spear at  $r \rightarrow$  [infinity], placing the *circumference* of the universe at some "effective infinity" from all "centers", Athens included. But because Achilles is smart relativist, he will be immediately puzzled by the privileged (if not absolute) location of Athens in the universe and its influence on his spear, such that he cannot replace Athens with some closer point

from his path (say, just one point *behind* the last location of his spear) and throw his spear further, *ad infinitum*.

This is *very* unclear, isn't it? As Adam Helfer put it ([arXiv:0903.3016v1 \[gr-qc\]](https://arxiv.org/abs/0903.3016v1)), the *asymptotic spacelike* regime is "less well understood mathematically at present". English translation: it's *pure poetry*, as stated above.

The situation with the alleged null infinity isn't better either: "From a physical point of view, null infinity is *very* far away." ([Bernard F. Schutz](#), Mathematical and Physical Perspectives on Gravitational Radiation, August 2, 2002)

To paraphrase Woody Allen, infinity is *very* long, especially towards the end. People tend to indulge themselves with some "rescaling metric" recipe ([Ted Newman](#)), but it is totally unclear how to "rescale" the metric during its accelerated expansion, as driven by the "dark" energy from [empty space](#).

In this gloomy situation, may I offer some optimistic speculations. [John Stachel](#) mentioned a seminal paper by Niels Bohr and Leon Rosenfeld, *Zur Frage der Messbarkeit der elektromagnetischen Feldgrößen*, published in 1933: Because EM charges "occur with two signs that can neutralize each other, a charge-current distribution acting as a source of an electromagnetic field can be manipulated by matter that is electrically **neutral** and so **not** acting as a source of a further electromagnetic field; and one can **shield** against the effects of a charge-current distribution." Then he added: "A glance at Bohr and Rosenfeld 1933 shows how important the possibility of neutralizing the charges on test bodies is for measurement of the (averaged) components of the electric field with **arbitrary accuracy**, for example. This difference may well have important implications for the measurement of gravitational field quantities."

So, we need some entity that is charge-neutral to the [two signs of mass: potential reality](#). Also, because GWs are sheer coordinate effects, they might "propagate" with *any* velocity desired by the human imagination, included 'the speed of thought' (Arthur Eddington, *The Propagation of Gravitational Waves*, 1922). We have to stick to the full non-linear GR, because its linearized approximation is "**a shadow without power**" (Hermann Weyl; see [above](#)).

Yes, [GWs exist](#), and can be detected. All we may need is a "device" that can also detect [quantum waves](#) without any "collapse" whatsoever: a [human brain](#).

All this has been said many times at this web site; sorry for repeating it here. The only **correction** I need to make concerns my statement above: "Einstein's errors regarding energy transport by GWs were identified even before Kip Thorne was born." But I was wrong. [Hermann Weyl's article](#) was published in 1944, at the time when Kip Stephen Thorne was 4 year old. Sorry, I was wrong. *Mea culpa*.

D. Chakalov  
March 14, 2010

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Subject: STRANGE MISCONCEPTIONS OF GENERAL RELATIVITY, by G. 't Hooft

Date: Tue, 16 Mar 2010 15:50:10 +0200

Message-ID:

<bed37361003160650s3e298c86r5b67c848fa6db72c@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: [CEOFOFOP](#) <G.tHooft@uu.nl> ,

"Szabados,L." <lbszab@rmki.kfki.hu> ,

"Dupre, Maurice J" <mdupre@tulane.edu> ,

Norbert Straumann <norbert.straumann@gmail.com> ,

Domenico Giulini <domenico.giulini@itp.uni-hannover.de> ,

Luca Bombelli <luca@phy.olemiss.edu> ,

Adam Helfer <adam@math.missouri.edu>

Cc: Stephen Crothers <thenarmis@gmail.com> ,

"C. Y. Lo" <c\_y\_lo@yahoo.com>,  
Merced Montesinos Velásquez <merced@fis.cinvestav.mx>,  
Angelo Loinger <angelo.loinger@mi.infn.it>

On Tue, 2 Mar 2010 19:22:24 +0200, Dimi Chakalov <dchakalov@gmail.com> wrote:

>  
> CEOFOP: All you need to prove me wrong is at  
>  
> <http://www.god-does-not-play-dice.net/#Jones>  
>  
> Go ahead Gerardus. Don't be shy. Make your best shot.  
>  
> D.

Dear Laszlo, Maurice, Norbert, Domenico, Luca, and Adam,

May I ask you to share your opinion on the following issues concerning GR.

Dr. G. 't Hooft, the Chief Editor of Foundations of Physics (CEOFOP), has posted a silver-tongued essay on what he calls "gravitating misconceptions":

<http://www.phys.uu.nl/~thooft/>

"[Gravitating misconceptions](#): response on claims by a group of self proclaimed scientists concerning the validity of the theory of General Relativity."

These "gravitating misconceptions" are explained at

STRANGE MISCONCEPTIONS OF GENERAL RELATIVITY,  
[http://www.phys.uu.nl/~thooft/gravitating\\_misconceptions.html](http://www.phys.uu.nl/~thooft/gravitating_misconceptions.html)

Please note CEOFOP's claim that "a true, real stress-energy-momentum tensor for gravity does also exist!", provided "all of the metric is handled as "dynamical" " [\[Ref. 1\]](#). The result is that "the energy in gravity and that in matter always balances out to zero" ([ibid](#)).

This reminds me of Merced Montesinos' paper [\[Ref. 2\]](#) on 'the right answer to the wrong question' ([MTW](#) p. 467).

NB: I wonder how you would comment on CEOFOP's "[true, real stress-energy-momentum tensor for gravity](#)", given his statement that "Einstein's equations are non-linear, and this is why gravitational fields can be the source of additional amount of gravity, so that a gravitational field can support itself." [\[Ref. 1\]](#)

Surely we don't see "the ether" coming back to GR textbooks [\[Ref. 2\]](#), but would you please explain your viewpoint on the above-mentioned "true, real stress-energy-momentum tensor for gravity" ?

Please also check out CEOFOP's interpretation of the "radial coordinate  $r$ " used in the Schwarzschild (actually, it is Hilbert-Droste-Weyl) solution [\[Ref. 1\]](#), and compare it with the interpretation offered by Angelo Loinger [\[Ref. 3\]](#).

A penny for your thoughts!

All the best,

Dimi

## References

[Ref. 1] Excerpts from "STRANGE MISCONCEPTIONS OF GENERAL RELATIVITY",  
by G. 't Hooft  
[http://www.phys.uu.nl/~thooft/gravitating\\_misconceptions.html](http://www.phys.uu.nl/~thooft/gravitating_misconceptions.html)

"What does L say about this? "I have proven that dynamical solutions do not exist, so your solution is wrong". What is wrong about it? First, he ignores the wave packets and focuses on the plane wave solutions. These have infinite extension in space and time and represent infinite energy. That, indeed, is problematic in gravity. If the energy in a given region with linear dimensions  $R$  exceeds  $R$  in natural units, a black hole is formed so that space-time undergoes a **subtle** change in topology. This might arguably be called unacceptable. The problem is manifest in our explicit solutions, and this is why it is important to use wave packets instead. The wave packages are **identical** to the ones in Maxwell theory, and since they represent only finite amounts of energy (per unit of length in the **z direction**), these solutions are indeed legitimate. I showed L how to construct explicit, analytical examples of such wave packets."

.....

**"Actually, a true, real stress-energy-momentum tensor for gravity does also exist!** If all of the metric is handled as "dynamical" one finds that the Einstein tensor  $G_{\mu\nu}$  itself acts as the gravitational part of the energy-momentum. Adding this to the energy and momentum of matter one finds a quantity that is **trivially** conserved: the addition gives zero, according to Einstein's equations. Thus, the energy in gravity and that in matter **always** balances out to zero. In practice, this is not a very useful definition; it would imply that gravity carries a **gigantic amount of energy**, most of which is **invisible**, and no further physical information is obtained, but it is the matter of **principle** (Sic! - D.C.) that counts here. In practice, we may wish to ignore the large contribution from the background, and this is why a "pseudotensor" emerges. One can add to this that, by construction, the pseudotensor should only depend on first derivatives, whereas the "true tensor"  $G_{\mu\nu}$  contains second derivatives, which makes it physically counter intuitive."

.....

" "Black holes do not exist; they are solutions of the equation for the Ricci tensor  $R_{\mu\nu} = 0$ , so they cannot carry any mass. And what is usually called a "horizon" is actually a physical singularity."

"Mr. C. adds more claims to this: In our modern notation, a radial coordinate  $r$  is used to describe the Schwarzschild solution, the prototype of a black hole. "That's not a radial distance!", he shouts. "To get the radial distance you have to integrate the square root of the radial component  $g_{rr}$  of the metric!!" Now that happens to be right, but a **non-issue**; in practice we use  $r$  just because it is a more convenient coordinate, and **every** astrophysicist knows that an accurate calculation of the radial distance, if needed, would be obtained by doing exactly that integral. " $r$  is defined by the inverse of the Gaussian curvature", C continues, but this happens to be true **only** for the spherically symmetric case. For the Kerr and Kerr-Newman metric, this is no longer true. Moreover, the Gaussian curvature is not locally measurable so a bad definition indeed for a radial coordinate. And **why** should one need such a definition? We have invariance under coordinate transformations. If so desired, we can use **any** coordinate we like. The Kruskal-Szekeres coordinates are an example. The Finkelstein coordinates another. Look at the many different ways one can map the surface of the Earth on a flat surface. Is one mapping more fundamental than another?"

"The horizon is a real singularity because at that spot the metric signature switches from  $(+, -, -, -)$  to  $(-, +, -, -)$ ", C continues. This is wrong. The switch takes place when the usual Schwarzschild coordinates are used, but does not imply any singularity. The switch disappears in coordinates that are regular at the horizon, such as the Kruskal-Szekeres coordinates. That's why there is no physical singularity at the horizon.

"But where does the black hole mass come from? Where is the source of this mass?  $R_{\mu\nu} = 0$  seems to imply that there is no matter at all, and yet the thing has mass! Here, both L and C suffer from the misconception that a gravitational field cannot have a mass of its own. But Einstein's equations are non-linear, and this is why gravitational fields can be the source of **additional** amount of gravity,

so that a gravitational field can support itself. In particle theories (Sic! - D.C.), similar things can happen if fields obey non-linear equations, we call these solutions "solitons". A black hole looks like a soliton, but actually it is a bit more complicated than that.

"The truth is that gravitational energy plus material energy **together** obey the [energy conservation](#) law. And now there is a thing that L and C fail to grasp: a black hole can be seen to be formed when matter implodes. Start with a regular, spherically symmetric (or approximately spherically symmetric) configuration of matter, such as a heavy star or a star cluster. Assume that it obeys an equation of state. If, according to **this** equation of state, the pressure stays sufficiently low, one can calculate that this ball of matter will contract under its own weight. The calculation is not hard and has been carried out many times; indeed, it is a **useful exercise for students**. According to Einstein's equations, the contraction continues until the pressure is sufficiently high to stop any further contraction. If that pressure is not high enough, the contraction continues and the result is well-known: a black hole forms. Matter travels onwards to the singularity at  $r = 0$ , and becomes invisible to the outside observer. All this is **elementary** exercise, and not in doubt by any serious researcher."

[Ref. 2] Merced Montesinos, The double role of Einstein's equations: as equations of motion and as vanishing energy-momentum tensor, arXiv:gr-qc/0311001v1, <http://arxiv.org/abs/gr-qc/0311001>, pp. 4-5.

"This means that for this type of observers, there is a balance between the 'content' of energy and momentum densities and stress associated with the matter fields [ $\psi$ ] (which is characterized in  $T_{\mu\nu}$ ) and the 'content' of energy and momentum densities and stress associated with the gravitational field (which is characterized in [XXX])

$$\begin{aligned} & \text{--->--->--->--->} \\ & \text{<---<---<---<---<---} \quad (23) \end{aligned}$$

in a precise form such that both fluxes cancel, and thus leading to a vanishing 'flux', i.e.,  $t_{\mu\nu} = 0$ . Once again, the vanishing property of  $t_{\mu\nu}$  for the system of gravity coupled to matter fields is just a reflection of the fact that the **background metric is dynamical**.

"More precisely,  $t_{\mu\nu} = 0$  tells us that the 'reaction' of the dynamical background metric is such that it just cancels the effect of 'flux' associated with the matter fields. It is impossible (and makes no sense) to have a locally non-vanishing 'flux' in this situation. If this were the case, there would be no explanation for the origin of that non-vanishing 'flux'. Moreover, that hypothetic non-vanishing 'flux' would define privileged observers associated with it (**the ether would come back!**).

"It is important to emphasize that, in the case of having a dynamical background metric, the vanishing property of  $t_{\mu\nu} = 0$  is not interpreted here as a 'problem' that must be corrected somehow but exactly the other way around. In our opinion, there is nothing wrong with that property because it just reflects the double role that the equations of motion associated with the dynamical background play."

[Ref. 3] Angelo Loinger, Wrong "idees fixes" in GR, arXiv:physics/0403092v1 [physics.gen-ph], <http://arxiv.org/abs/physics/0403092>

*Idem*, The Black Holes do not exist - "Also Sprach Karl Schwarzschild", arXiv:physics/0402088v1 [physics.gen-ph], <http://arxiv.org/abs/physics/0402088>

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Subject: Gerard Hooft 't, The Conformal Constraint in Canonical Quantum Gravity, [arXiv:1011.0061v1](http://arxiv.org/abs/1011.0061v1) [gr-qc]

Date: Tue, 2 Nov 2010 05:41:05 +0200

From: Dimi Chakalov <dchakalov@gmail.com>

To: CEOFOP <g.thoof@uu.nl>  
Cc: Masato Nozawa <nozawa@gravity.phys.waseda.ac.jp>,  
Stephen Crothers <thenarmis@gmail.com>,  
Thibault Damour <damour@ihes.fr>

Gerardus,

After some tantalizing assumptions (p. 4), you boldly declared (p. 11): "Matter and dilaton then join smoothly together in a perfectly conformally invariant theory."

But then you acknowledged (p. 12): "The author believes that quantum mechanics itself will have to be carefully reformulated before we can really address this problem."

Welcome aboard,

<http://www.god-does-not-play-dice.net/#KS>

There is no need to invent the wheel: check out Schrodinger at the link.

As I said six and a half years ago ("energy-momentum flows from matter to grav. fields and back", see below), you can bring a horse to [the water](#), but cannot make him drink.

Dimi

----

On Thu, 11 Mar 2004 08:17:00 +0100, "Hooft 't G." wrote:

>

> Let me briefly explain. Following the conventional Einstein  
> equations, the matter-energy-momentum tensor is COVARIANTLY  
> conserved; it is not conserved if you replace covariant derivatives  
> by ordinary derivatives. This is how energy-momentum flows from  
> [matter to grav. fields and back](#).

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**Note:** Gerard 't Hooft has been generously "casting pearls to the swine" (exact quote -- see CEOFOP\_1.pdf in [CEOFOP\\_1.zip](#)) at

[http://www.phys.uu.nl/~thoof/gravitating\\_misconceptions.html](http://www.phys.uu.nl/~thoof/gravitating_misconceptions.html)

Check out a snapshot (2.11.2010) from the page above, [Gerardus\\_energy.jpg](#), and notice the splitting of "the metric  $g_{\mu\nu}$  into a background part,  $g^0_{\mu\nu}$ , for which we could take flat space-time, and a dynamical part: substitute in the Einstein-Hilbert action:  $g_{\mu\nu} = g^0_{\mu\nu} + g^1_{\mu\nu}$ . (...) Just require that the background metric  $g^0_{\mu\nu}$  obeys the gravitational equations itself; one can then remove from the Lagrangian all terms linear in  $g^1_{\mu\nu}$ . This way, one gets an action that starts out with terms quadratic in  $g^1_{\mu\nu}$ , while all its indices are connected through the background field  $g^0_{\mu\nu}$ ."

It is *utter madness* indeed. Notice that this person is Chief Editor of Foundations of Physics (CEOFOP), and maybe (hope not!) teaches GR. That's *really* scary.

As to the latest note by Gerard 't Hooft, entitled "The plane gravitational wave for beginners" ([Addendum 18/8/2010](#)), he failed to mention that, for a pp-wave, all curvature invariants vanish (Hans Stephani and John Stewart, *General Relativity*, Cambridge University Press, 1982; section [15.3](#)). That's 'for beginners'; I've said much more in [ExplanatoryNote.pdf](#). Just a hint: the proper calculation of '[the self force](#)' is not "miniscule" but shows the input of "dark energy" and the mechanism by which GWs transport energy and momentum; as Hermann Bondi stressed many years ago, "the question of the "reality" of the waves essentially concerned whether they transported energy. Such transport is a fundamentally nonlinear phenomenon." LIGO is manifestly blind and deaf to this inherently nonlinear phenomenon, and cannot measure anything related to [BMS group](#).

D.C.  
November 3, 2010

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Subject: Re: STRANGE MISCONCEPTIONS OF GENERAL RELATIVITY, by G. 't Hooft  
Date: Sun, 21 Mar 2010 04:16:04 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: [snip]  
Cc: [snip]

P.S. Please try to reconcile [CEOFOP](#)'s "true, real stress-energy-momentum tensor for gravity"

[http://www.phys.uu.nl/~thooft/gravitating\\_misconceptions.html](http://www.phys.uu.nl/~thooft/gravitating_misconceptions.html)

with L. Landau and E. Lifshitz, [The Classical Theory of Fields](#), Fourth Edition, 1980, Ch. 11, p. 301,

[http://www.god-does-not-play-dice.net/p\\_301.jpg](http://www.god-does-not-play-dice.net/p_301.jpg)

If you succeed, please *do* write me back.

D.

2010/3/18 Dimi Chakalov <dchakalov@gmail.com>:

>  
> Dear colleagues,  
>  
> If you wish to be removed from this thread, please say so.  
>  
> The whole issue about GR is very simple indeed; I managed to explain  
> it even to my teenage daughter,  
>  
> <http://www.god-does-not-play-dice.net/#Bahn>  
>  
> All the best,  
>  
> Dimi  
>

=====

Subject: Re: STRANGE MISCONCEPTIONS OF GENERAL RELATIVITY, by G. 't Hooft  
Date: Sun, 21 Mar 2010 13:01:24 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: "C. Y. Lo" <c\_y\_lo@yahoo.com>  
Cc: [snip]

Dear Lo,

> If you read my paper of 1995, you will know that 't Hooft is wrong.

Sure, I've read the Appendix. You also wrote (p. 422): "Note that E is unchanged if the Landau-Lifshitz "pseudotensor" is used in equation (3c)."

I have some comments on your Eq. 12a, but that's a different thread.

All the best,

Dimi

-----

Lo C. Y., Einstein's Radiation Formula and Modifications to the Einstein Equation, Astrophysical Journal 455, 421-428 (Dec. 20, 1995).

[http://www.god-does-not-play-dice.net/Lo\\_Dec\\_20\\_1995.pdf](http://www.god-does-not-play-dice.net/Lo_Dec_20_1995.pdf)

=====

Subject: Re: STRANGE MISCONCEPTIONS OF GENERAL RELATIVITY, by G. 't Hooft

Date: Sun, 21 Mar 2010 20:39:34 +0200

From: Dimi Chakalov <dchakalov@gmail.com>

To: "C. Y. Lo" <c\_y\_lo@yahoo.com>

Cc: [snip]

Dear Lo,

> Your comments would be appreciated. Thank you.

I opened this thread on March 16th,

<http://www.god-does-not-play-dice.net/#Gerardus>

As I said [below](#), my comments on your Eq. 12a will be a different thread, so I'd suggest to discuss it privately. If you find my opinion interesting, please reply to me only. Very briefly:

Firstly, you wrote ([p. 421](#)): "It seemed that only a covariant theory could be valid in physics (see Appendix)." But notice that the '[absolute structures in GR](#)', after Anderson,

<http://www.god-does-not-play-dice.net/#Brown>

can show up in GR \*only\* as some disguised "gauge-dependent" objects,

<http://www.god-does-not-play-dice.net/Greenberg.html#addendum>

Secondly, you grounded your paper on the assumption that Einstein's quadrupole radiation formula might be correct, and tried to modify the field equations instead ([p. 425](#)).

You wrote ([p. 423](#)): "In view of the fact that there is no existing gravity energy-stress tensor, it seems simple and natural to assume that the source tensor  $T_{ab}$  is zero in a vacuum."

Then you argued ([ibid.](#)) that "Einstein's radiation formula implies that his field equation must be modified so that the source tensor is nonzero in vacuum."

Why not have it [both ways](#)? Yes you can:  $T_{ab}$  (the energy momentum stress tensor of all matter and fields) can \*completely\* vanish/dissolve into the vacuum, and stay available there for any partial, full, or "over unity" recall, **if and when needed**. All you need is a new form of reality: see my note on the dynamics of GR at

<http://www.god-does-not-play-dice.net/#Bahn>

Again, all this will be a different thread, so please reply to me only.

All the best,

Dimi

=====

Subject: Re: STRANGE MISCONCEPTIONS OF GENERAL RELATIVITY, by G. 't Hooft  
Date: Wed, 17 Mar 2010 19:25:27 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Stephen Crothers <thenarmis@gmail.com>  
Cc: CEOFOP <G.tHooft@uu.nl>,  
"Szabados,L." <lbszab@rmki.kfki.hu>,  
"Dupre, Maurice J" <mdupre@tulane.edu>,  
Norbert Straumann <norbert.straumann@gmail.com>,  
Domenico Giulini <domenico.giulini@itp.uni-hannover.de>,  
Luca Bombelli <luca@phy.olemiss.edu>,  
Adam Helfer <adam@math.missouri.edu>,  
"C. Y. Lo" <c\_y\_lo@yahoo.com>,  
Merced Montesinos Velásquez <merced@fis.cinvestav.mx>,  
Angelo Loinger <angelo.loinger@mi.infn.it>

Dear Stephen,

Thank you for your prompt reply from Wed, 17 Mar 2010 23:15:09 +1000.

[snip]

> Let's not forget that Einstein's pseudo-tensor is a meaningless concoction of  
> mathematical symbols because it implies, by contraction, a linear  
> invariant that depends solely upon the components of the metric tensor  
> and their first derivatives. But G. Ricci-Curbastro and T. Levi-Civita  
> proved in 1900 that such invariants do not exist. Mr. 't Hoof does not  
> understand this.

The problem is that he is Chief Editor of Foundations of Physics, and also teaches GR. He can do a **lot of damage**, mostly to his students.

> Furthermore, 't Hooft concedes that the total energy  
> of Einstein's gravitational field is always zero. This implies that  
> the the field equations violate the usual conservation of energy and  
> momentum so well-established by experiment.

Textbook-level details from Amir M. Abbassi and Saeed Mirshekari, Energy-Momentum Density of Gravitational Waves, [arXiv:0908.0286v1 \[gr-qc\]](http://arxiv.org/abs/0908.0286v1), p. 2,

<http://www.god-does-not-play-dice.net/Gerard.html#Abbassi>

I will limit our discussion to its absolute minimum, hoping that your colleagues will also respond professionally.

> Mr. C

Nice done, Mr. C :-) I hope to receive a [paper](#) by "Mr. L" soon. Stay tuned.

All the best,

Dimi

> \_\_\_\_\_  
>  
> On 3/16/10, Dimi Chakalov <dchakalov@gmail.com> wrote:  
>>

>> On Tue, 2 Mar 2010 19:22:24 +0200, Dimi Chakalov <dchakalov@gmail.com>  
>> wrote:  
>>>  
>>> CEOFOP: All you need to prove me wrong is at  
>>>  
>>> <http://www.god-does-not-play-dice.net/#Jones>  
>>>  
>>> Go ahead Gerardus. Don't be shy. Make your best shot.  
>>>  
>>> D.  
[snip]

=====

Subject: Re: STRANGE MISCONCEPTIONS OF GENERAL RELATIVITY, by G. 't Hooft  
Date: Fri, 19 Mar 2010 02:09:34 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: "C. Y. Lo" <c\_y\_lo@yahoo.com>  
Cc: CEOFOP <G.tHooft@uu.nl>,  
[snip]

Dear Lo,

Thank you very much for your reply from Thu, 18 Mar 2010 16:43:12 -0700 (PDT).

> I read your email and the attachments

Thank you. My initial email is also posted at

<http://www.god-does-not-play-dice.net/#Gerardus>

> He needs help.

Definitely yes.

> please see my paper attached.

Thank you very much. I posted the abstract from your paper at

[http://www.god-does-not-play-dice.net/Eins\\_Hooft\\_Wave.pdf](http://www.god-does-not-play-dice.net/Eins_Hooft_Wave.pdf)

If you prefer, I can replace it with your full paper, in .pdf format.

With all good wishes,

Dimi

-----

Note: Dr. C. Y. Lo kindly agreed (Fri, 19 Mar 2010 12:12:39 -0700 (PDT)) to replace the abstract with the full version of his paper; check out also ref. [20] therein.

D.C.

=====

Subject: Re: STRANGE MISCONCEPTIONS OF GENERAL RELATIVITY, by G. 't Hooft  
Date: Tue, 16 Mar 2010 16:39:50 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: [CEOFOP](mailto:CEOFOP) <G.tHooft@uu.nl>,

"Szabados,L." <lbszab@rmki.kfki.hu>,  
"Dupre, Maurice J" <mdupre@tulane.edu>,  
Norbert Straumann <norbert.straumann@gmail.com>,  
Domenico Giulini <domenico.giulini@itp.uni-hannover.de>,  
Luca Bombelli <luca@phy.olemiss.edu>,  
Adam Helfer <adam@math.missouri.edu>  
Cc: Stephen Crothers <thenarmis@gmail.com>,  
"C. Y. Lo" <c\_y\_lo@yahoo.com>,  
Merced Montesinos Velásquez <merced@fis.cinvestav.mx>,  
Angelo Loinger <angelo.loinger@mi.infn.it>

P.S. [CEOFOF](#) also wrote at  
[http://www.phys.uu.nl/~thoof/gravitating\\_misconceptions.html](http://www.phys.uu.nl/~thoof/gravitating_misconceptions.html)

"A third player, DC, strongly supports L and C, and on the side asks me to seriously consider his theories about the 9-11 events: the two planes crashing into the Twin Towers have first been snatched by UFO's, their passengers were abducted, and the planes, without passengers and filled with explosives of an unknown type, were directed into the towers. All of this to explain why the towers collapsed in spite of their impeccable design. I can only try to guess who came up first with this theory, but I now use it to illustrate the level of my discussions with DC. "

To explain the level of my discussions with [CEOFOF](#), I invite you to check out the facts at my 9/11 web page,

[http://www.god-does-not-play-dice.net/9\\_11.html#Ward](http://www.god-does-not-play-dice.net/9_11.html#Ward)

[http://www.god-does-not-play-dice.net/9\\_11.html#Ritter](http://www.god-does-not-play-dice.net/9_11.html#Ritter)

D.C.

-----

**Note:** The only truth in [CEOFOF's statements](#) above is that I have indeed asked him (along with Prof. Brian Josephson) to seriously consider my theory about the 9/11 events: see my email from Fri, 25 Dec 2009 printed below.

All the rest -- "two planes crashing into the Twin Towers have first been snatched by UFO's, their passengers were abducted, and the planes, without passengers and filled with explosives of an unknown type, were directed into the towers" -- is untrue.

Why did [CEOFOF](#) (G. 't Hooft) write all this crap at his [web site](#), I wonder. He is fluent in English, so we have two alternatives. One explanation could be that he has somehow lost his intellect, but *very* selectively, only regarding my 9/11 web page. Another explanation would be that he had actually understood the simple text at my web page, but decided to lie about it, for unknown (to me) reasons.

In simple terms: he is either a selective moron, or just a bold liar. But *not* both.

I will leave the decision to his students in GR. If they come up with a third option, I will immediately post it here.

Meanwhile, check out L. Landau and E. Lifshitz, [The Classical Theory of Fields](#), Fourth Edition, 1980, Ch. 11, p. 301 (snapshot from p. 301 [here](#)), and compare it with CEOFOF's "true, real stress-energy-momentum tensor for gravity" [above](#).

D. Chakalov  
March 17, 2010

----

Subject: Merry Christmas  
Date: Fri, 25 Dec 2009 13:45:04 +0200

Message-ID:  
<bed37360912250345i2673cd82y35e969b267568d43@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Brian <bdj10@cam.ac.uk>, Gerard <g.thoof@uu.nl>

Dear Brian and Gerard,

I wish you and your families a very merry Christmas and all the best for 2010 and beyond.

May I use this opportunity to invite you to save human lives by taking action on the 9/11 issue,

<http://tinyurl.com/steel-evaporation>

With God, everything is possible.

Cordially yours,

Dimi

=====

Subject: Re: STRANGE MISCONCEPTIONS OF GENERAL RELATIVITY, by G. 't Hooft  
Date: Fri, 19 Mar 2010 15:01:04 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Stephen Crothers <thenarmis@gmail.com>  
Cc: [snip]

Dear Stephen,

> Mr. 't Hooft uses the linearised form of the field equations. He is  
> evidently ignorant of the fact that Hermann Weyl proved, in 1944, that  
> linearisation is inadmissible because it implies the existence of a tensor  
> that, except for the trivial case of being precisely zero, does not  
> otherwise exist.

Yes, many people ignore Hermann Weyl's 1944 article,

<http://www.sjcrothers.plasmareources.com/weyl-1.pdf>

I quoted from it at

<http://www.god-does-not-play-dice.net/Szabados.html#H6>

[http://www.god-does-not-play-dice.net/#SBG\\_new](http://www.god-does-not-play-dice.net/#SBG_new)

Perhaps G. 't Hooft should refer to Hermann Weyl as "Mr. W".

All the best,

Dimi

=====

Subject: Re: STRANGE MISCONCEPTIONS OF GENERAL RELATIVITY, by G. 't Hooft  
Date: Fri, 19 Mar 2010 08:00:32 -0500  
Message-ID: <4BA37570.5040601@math.missouri.edu>  
From: Adam Helfer <adam@math.missouri.edu>  
Reply-To: helfera@missouri.edu  
To: Dimi Chakalov <dchakalov@gmail.com>

Dear Dimi,

Please remove me from this thread.

Thanks,

[Adam Helfer](#)

Dimi Chakalov wrote:

Dear colleagues,

If you wish to be removed from this thread, please say so.

The whole issue about GR is very simple indeed; I managed to explain it even to my teenage daughter,

<http://www.god-does-not-play-dice.net/#Bahn>

All the best,

Dimi

--

Adam Helfer  
Department of Mathematics  
University of Missouri -- Columbia  
Columbia, MO 65211

tel. (573) 882-7283  
fax (573) 882-1869

=====

Subject: Re: STRANGE MISCONCEPTIONS OF GENERAL RELATIVITY, by G. 't Hooft  
Date: Fri, 19 Mar 2010 15:40:32 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Stephen Crothers <thenarmis@gmail.com>  
Cc: "C. Y. Lo" <c\_y\_lo@yahoo.com>

Dear Stephen,

> Concerning the quantity 'r' in the "Schwarzschild solution", Mr. 't Hooft,  
> in his lecture notes, calls it the shortest distance to the centre. He also  
> calls it the radial coordinate or coordinate radius. He even told me once  
> that it is a gauge choice that defines what 'r' is. It has never been  
> correctly identified by any proponent of the black hole nonsense. All these  
> concepts are false because it is irrefutably the inverse square root of the  
> Gaussian curvature of the spherically symmetric geodesic surface in the  
> spatial section and is thereby not even a distance in the related manifold.  
> Here is my detailed analysis of this:  
>  
> [http://www.ptep-online.com/index\\_files/2007/PP-09-14.PDF](http://www.ptep-online.com/index_files/2007/PP-09-14.PDF)  
>  
> [http://www.ptep-online.com/index\\_files/2008/PP-12-11.PDF](http://www.ptep-online.com/index_files/2008/PP-12-11.PDF)

Unfortunately, Adam Helfer quits:

<http://www.god-does-not-play-dice.net/#Helfer>

Please remove his email address from this thread.

All good wishes,

Dimi

=====

Subject: Stress-energy-momentum tensor for gravity: Casting pearls (G. 't Hooft) to the swine

Date: Sun, 15 Aug 2010 03:58:19 +0300

Message-ID:

<AANLkTin-9GH5asbLdRRpG9zXGEyK1+=D--yByYZSByxy@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: CEOFOP <G.tHooft@uu.nl> ,

Tobias Schwaibold <Tobias.Schwaibold@springer.com> ,

"Szabados,L." <lbszab@rmki.kfki.hu> ,

"Dupre, Maurice J" <mdupre@tulane.edu> ,

Norbert Straumann <norbert.straumann@gmail.com> ,

Domenico Giulini <domenico.giulini@itp.uni-hannover.de> ,

Luca Bombelli <luca@phy.olemiss.edu> ,

Adam Helfer <adam@math.missouri.edu> ,

Stephen Crothers <thenarmis@gmail.com> ,

"C. Y. Lo" <c\_y\_lo@yahoo.com> ,

Merced Montesinos Velásquez <merced@fis.cinvestav.mx> ,

Niall Ó Murchadha <niall@ucc.ie> ,

Robert M Wald <rmwa@midway.uchicago.edu> ,

Don Marolf <marolf@physics.ucsb.edu> ,

Malcolm MacCallum <m.a.h.maccallum@qmul.ac.uk> ,

Alan Rendall <rendall@aei.mpg.de> ,

Jose M M Senovilla <josemm.senovilla@ehu.es> ,

Jorge Pullin <pullin@lsu.edu> ,

Eduardo Guendelman <guendel@bgu.ac.il> ,

Sergio Doplicher <dopliche@mat.uniroma1.it> ,

Richard Price <Richard.Price@utb.edu> ,

Chris Isham <c.isham@imperial.ac.uk> ,

John Stachel <john.stachel@gmail.com>

Dear Colleagues,

Regarding the stress-energy-momentum tensor for gravity, introduced by [G. 't Hooft](#):

[http://www.phys.uu.nl/~thooft/gravitating\\_misconceptions.html](http://www.phys.uu.nl/~thooft/gravitating_misconceptions.html)

"One way to see how this works, is to split the metric  $g_{\mu\nu}$  into a background part, [X], for which we could take flat space-time, and a dynamical part: [XX].

.....

"The stress-energy-momentum tensor can then be obtained routinely by considering infinitesimal variations of the background part, just like one does for any other type of matter field; the infinitesimal change of the total action (the space-time integral of the Lagrange density) then yields the stress-energy-momentum tensor. Of course, one finds that [the dynamical part of the metric](#) indeed carries energy and momentum, just as one expects in a gravitational field. As hydro-electric plants and the daily tides show, there's lots of energy in gravity, and this agrees perfectly with Einstein's original equations."

Another quote from [CEOFOF](#):

"Any doubts about these facts are removed once the existence and properties of the Green functions for the linearized theory have been established. These Green functions can then be used to study systematic expansions to obtain the solutions of the complete, non-linear theory, to any required accuracy. Good theoretical physicists completely control the proper use of Green functions. (...) I did construct them, and found that, provided due attention is paid to the gauge freedom in the use of coordinates, these functions are well-behaved."

It is "casting pearls to the swine", says [CEOFOF](#) (Chief Editor Of Foundations Of Physics).

This is not a joke: check out the link above. The PDF file from his web page is available, too.

Final quote: "A third player, DC, strongly supports L and C, but his claims are too opaque for me to even address."

My "opaque" claims can be read at

<http://www.god-does-not-play-dice.net/#Alice>

<http://www.god-does-not-play-dice.net/ExplanatoryNote.pdf>

You'll be the judge.

Yours sincerely,

D. Chakalov

=====

Note: URL of the web page at

[http://www.phys.uu.nl/~thooft/gravitating\\_misconceptions.html](http://www.phys.uu.nl/~thooft/gravitating_misconceptions.html)

Download "Strange Misconceptions of General Relativity", by Gerard 't Hooft, version from January 4, 2010 (CEOFOF.zip) from

<http://www.god-does-not-play-dice.net/CEOFOF.zip>

And version from August 15th (CEOFOF\_1.zip) from

[http://www.god-does-not-play-dice.net/CEOFOF\\_1.zip](http://www.god-does-not-play-dice.net/CEOFOF_1.zip)

To get Gerard 't Hooft's "pearls" of wisdom, all you need is to **split** the metric  $g_{mv}$  into a "background part" (to obtain "flat space-time"), and a [dynamical part](#) that "carries energy and momentum", as "hydro-electric plants and the daily tides show". Just don't forget to use "well-behaved" [Green functions](#).

A colleague of mine offered only a brief comment: "It's madness, utter madness."

Notice another essay by CEOFOF, entitled: "Will the Higgs be found?",

[http://www.god-does-not-play-dice.net/Gerardus\\_predictions.pdf](http://www.god-does-not-play-dice.net/Gerardus_predictions.pdf)

He claims (May 12, 2010) that "theories without any Higgs particle are possible but ugly and have been practically ruled out by observations", but failed to comment on [Howard Georgi's](#) unparticles and my prediction from [January 9, 2003](#).

As [Howard Georgi](#) explained, "there could be a **scale-invariant world** separate from our own that is hidden from us". My comment: we can "see" this scale-invariant world with [our brains only](#), as we know since [Plato](#).

LHC is deaf and blind to the scale-invariant world, hence will only "see" that the number of quarks is

jumping to 8 *and more*, in a [Fibonacci sequence](#).



*Qui vivra, verra.*

D.C.

August 16, 2010

Last update: August 22, 2010

=====

Subject: STOP wasting taxpayers' money !  
Date: Thu, 8 Oct 2009 18:20:21 +0100  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Roger Blandford <rdb3@stanford.edu>  
Cc: Lynne Hillenbrand <lah@astro.caltech.edu>,  
Donald C Shapero <dshapero@nas.edu>,  
Caryn Knutsen <astro2010@nas.edu>,  
bpa@nas.edu,  
Tom Prince <prince@srl.caltech.edu>

Roger:

I do hope my preceding email messages have been safely received.

I wonder if you have discussed my objections to LIGO funding at your latest meeting

[http://sites.nationalacademies.org/BPA/BPA\\_049810#statement](http://sites.nationalacademies.org/BPA/BPA_049810#statement)

Keep in mind that the forthcoming scandal about LIGO will be enormous:

<http://www.god-does-not-play-dice.net/Szabados.html#SBG>

<http://www.god-does-not-play-dice.net/#NSF>

Just don't keep quiet, and don't ever say you knew nothing about it.

Sincerely,

D. Chakalov  
35 Sutherland St  
London SW1V 4JU, U.K.

=====

Subject: Astro2010 Survey Committee Meeting, [January 25-27, 2010](#)  
Date: Thu, 22 Oct 2009 02:43:57 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Martha Haynes <haynes@astro.cornell.edu>,  
Fiona Harrison <fiona@srl.caltech.edu>,  
Marcia J Rieke <mrieke@as.arizona.edu>,  
Lynne Hillenbrand <lah@astro.caltech.edu>,  
Caryn Knutsen <astro2010@nas.edu>,  
Lars Bildsten <bildsten@kitp.ucsb.edu>,  
John Carlstrom <jc@ddjob.uchicago.edu>,  
Timothy Heckman <heckman@pha.jhu.edu>,  
Jonathan Lunine <lunine@physics.arizona.edu>,  
Juri Toomre <jtoomre@jila.colorado.edu>,  
Scott Tremaine <tremaine@ias.edu>,  
John Huchra <huchra@cfa.harvard.edu>,  
Donald C Shapero <dshapero@nas.edu>,  
Roger Blandford <rdb3@stanford.edu>  
Cc: Paulett C Liewer <Paulett.C.Liewer@jpl.nasa.gov>,  
Bruce Goldstein <Bruce.Goldstein@jpl.nasa.gov>,  
NASA Official Thomas A Prince <prince@srl.caltech.edu>,  
8th International LISA Symposium <vdrew@stanford.edu>,  
Curt Cutler <Curt.J.Cutler@jpl.nasa.gov>,  
Michele Vallisneri <vallis@vallis.org>

Ladies and Gentlemen,

Please terminate the financial support for LIGO,

<http://www.god-does-not-play-dice.net/Szabados.html#SBG>

<http://www.god-does-not-play-dice.net/#NSF>

The sooner, the better.

Yours sincerely,

Dimi Chakalov  
35 Sutherland St  
London SW1V 4JU, U.K.

=====

Subject: [Copy] Email sent to Living Reviews in Relativity  
Date: Tue, 22 Sep 2009 04:08:26 +0200 (CEST)  
From: contact.lrr@livingreviews.org  
Message-Id: <20090922020826.C522424C0C3@escidoc2.escidoc.mpg.de>  
To: dchakalov@gmail.com

Hello Dimi Chakalov,

This is a copy of the email you sent to Living Reviews in Relativity. If appropriate to your message, you should receive a response quickly. You successfully sent the following information:

Email: dchakalov@gmail.com  
Phone:  
Website: <http://www.god-does-not-play-dice.net/#NB>  
Subject: To make a comment

Message:

Regarding [GW parapsychology](#):

<http://www.god-does-not-play-dice.net/Szabados.html#SBG>

Please confirm the receipt of this email.

Yours faithfully,

Dimi Chakalov

-----  
Other Data and Information:

Time Stamp: Tuesday, September 22nd, 2009 at 4:08 am

=====  
Subject: Re: "yes, I do understand GR, but cannot discuss that now."  
Date: Tue, 20 Oct 2009 23:46:37 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Stanley Deser <deser@brandeis.edu>  
Cc: Joel Franklin <jfrankli@reed.edu>,  
Richard Woodard <woodard@phys.ufl.edu>,  
Andrew Waldron <wally@math.ucdavis.edu>,  
Steven Carlip <carlip@physics.ucdavis.edu>,  
[John Baez](mailto:baez@math.ucr.edu) <baez@math.ucr.edu>,  
John W Barrett <john.barrett@nottingham.ac.uk>

Stanley:

On 31 March 2006, you claimed that you "do understand GR, but cannot discuss that now."

If this is indeed the case, then you should be able to find at least one error in my proposal at

<http://www.god-does-not-play-dice.net/#NB>

Please demonstrate that you understand GR.

I extend this request to your colleagues as well.

Regards,

Dimi

-----  
Subject: "yes, I do understand GR, but cannot discuss that now."  
Date: Fri, 31 Mar 2006 15:54:26 +0300

From: Dimi Chakalov <dimi@chakalov.net>  
To: Deser <deser@brandeis.edu>

No rush, take your time, I'm all yours.

D.C.

=====

Subject: Re: "yes, I do understand GR, but cannot discuss that now."  
Date: Wed, 21 Oct 2009 01:32:35 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Stanley Deser <deser@brandeis.edu>  
Cc: Joel Franklin <jfrankli@reed.edu>,  
Richard Woodard <woodard@phys.ufl.edu>,  
Andrew Waldron <wally@math.ucdavis.edu>,  
Steven Carlip <carlip@physics.ucdavis.edu>,  
John Baez <baez@math.ucr.edu>,  
John W Barrett <john.barrett@nottingham.ac.uk>

On Wed, Oct 21, 2009 at 1:14 AM, Stanley Deser <deser@brandeis.edu> wrote:  
>  
> Dear Sir,  
> I cannot spare the time for your proposals; why not submit to a journal &  
> see what happens? sd

Gladly.

Would you, or any of your colleagues, endorse the submission of my manuscript

<http://arxiv.org/help/endorsement> ?

The basic arguments are at

<http://www.god-does-not-play-dice.net/Szabados.html#SBG>

I will be happy to send you, or any of your colleagues, my manuscript, entitled: "[A Taxpayer's Perspective On GW Astronomy](#)".

Regards,

Dimi

=====

Subject: Re: "yes, I do understand GR, but cannot discuss that now."  
Date: Wed, 21 Oct 2009 02:20:01 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Stanley Deser <deser@brandeis.edu>  
Cc: Joel Franklin <jfrankli@reed.edu>,  
Richard Woodard <woodard@phys.ufl.edu>,  
Andrew Waldron <wally@math.ucdavis.edu>,  
Steven Carlip <carlip@physics.ucdavis.edu>,  
John Baez <baez@math.ucr.edu>,  
John W Barrett <john.barrett@nottingham.ac.uk>

On Wed, Oct 21, 2009 at 1:47 AM, Stanley Deser <deser@brandeis.edu> wrote:  
>

> **Not I!**

>

> <http://arxiv.org/help/endorsement> ?

But didn't you say that you "do understand GR"? You're the right person.

Would you, or any of your colleagues, like to help U.S. National Science Foundation?

<http://www.god-does-not-play-dice.net/#NSF>

Again, the simple arguments are at

<http://www.god-does-not-play-dice.net/Szabados.html#SBG>

I can write up a polite (not frank) paper and send it to you or any of your colleagues -- you all are experts in GR. I only need [endorsement](#) of my manuscript.

BILLIONS of U.S. dollars -- all taxpayers' money -- will be wasted by your LIGO "colleagues".

Looking forward to hearing from you at your earliest convenience,

Yours faithfully,

Dimi Chakalov

=====

Subject: Prince of darkness

Date: Fri, 16 Oct 2009 14:41:14 +0300

From: Dimi Chakalov <dchakalov@gmail.com>

To: Alex Murphy <a.s.murphy@ed.ac.uk>

Cc: [rminchin@naic.edu](mailto:rminchin@naic.edu), Jonathan.Davies@astro.cf.ac.uk, Mike.Disney@astro.cf.ac.uk, LangRH@cardiff.ac.uk, Sarah.Roberts@astro.cf.ac.uk, sabatini@mporzio.astro.it, BoyceP@cardiff.ac.uk, caj@jb.man.ac.uk, Wim.vanDriel@obspm.fr, benjamin.allanach@googlemail.com, s.sarkar@physics.ox.ac.uk, matthew.chalmers@iop.org, Plus@maths.cam.ac.uk, J.D.Barrow@damtp.cam.ac.uk, blanchet@iap.fr

Dear Dr Murphy,

I read with great interest your interview at

<http://physicsworld.com/cws/article/indepth/40654>

I wonder if your WIMP hypothesis can tackle the discrepancy between the generic formation of cusps of CDM

<http://spacetelescope.org/videos/html/mov/320px/heic0701f.html>

and the rotation curves, which seem to favor a constant density profile in the core (Blanchet and Le Tiec, [arXiv:0901.3114v2](#)).

Also, may I ask you and your colleagues to comment on John Barrow's explanation of the apparent "repulsive force associated with the cosmological constant",

Gravitational Force =  $-GMm/r^2 + m[\lambda]r$

<http://plus.maths.org/issue51/features/lambda/index.html>

It seems to me that his idea is a *bona fide* case of Murphy's Law No. 15. I suspect that [CDM and](#)

DDE are due to spacetime **acting upon itself**, hence the "acting agent" cannot \_in principle\_ be traced back to any concrete physical stuff,

<http://www.god-does-not-play-dice.net/#NB>

BTW you said in your interview that have done a café scientifique in Moscow, "which was pretty scary". Did you meet

<http://www.god-does-not-play-dice.net/russian.html> ?

Kindest regards,

Dimi Chakalov

----

Murphy's Law No. 15: Complex problems have simple, easy-to-understand wrong answers.

=====

Subject: Re: Prince of darkness  
Date: Fri, 15 Apr 2011 00:22:00 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Alex Murphy <a.s.murphy@ed.ac.uk>  
Cc: rminchin@naic.edu, Jonathan.Davies@astro.cf.ac.uk,  
Mike.Disney@astro.cf.ac.uk, Sarah.Roberts@astro.cf.ac.uk,  
BoyceP@cardiff.ac.uk, caj@jb.man.ac.uk, Wim.vanDriel@obspm.fr,  
benjamin.allanach@googlemail.com, s.sarkar@physics.ox.ac.uk,  
matthew.chalmers@iop.org, Plus@maths.cam.ac.uk,  
J.D.Barrow@damtp.cam.ac.uk, blanchet@iap.fr, michael.banks@iop.org

Hi Alex,

Did you really say, after the failure of XENON 100, that "a clear dark-matter signal could be just round the corner" ?

<http://physicsworld.com/cws/article/news/45697>

Would you like to learn why WIMPS are just an artifact from your essentially incomplete "standard model"?

The story begins with KS Theorem:

[http://www.god-does-not-play-dice.net/#Specker\\_addendum](http://www.god-does-not-play-dice.net/#Specker_addendum)

Shall I elaborate, or would you prefer to leave you waste your time with ZEPLIN III?

Dimi

=====

Subject: The Arrow of Time  
Date: Mon, 2 Nov 2009 05:55:52 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Claus Kiefer <kiefer@thp.uni-koeln.de>  
Cc: Laura Mersini-Houghton <mersini@physics.unc.edu>,  
Ruediger Vaas <ruediger.vaas@konradin.de>,  
Pankaj S Joshi <psj@tifr.res.in>,  
H D Zeh <zeh@uni-heidelberg.de>,  
Alan H Guth <guth@ctp.mit.edu>,

Jean-Pierre Luminet <jean-pierre.luminet@obspm.fr>,  
Adam Helfer <adam@math.missouri.edu>,  
Richard Lieu <lieur@cspars.uah.edu>

Dear Claus,

It seems to me that you are trying to explain one 'unknown' with another 'unknown'.

As you stated in [Ref. 1, p. 2], the topic of your essay -- the origin of the arrow of time -- is based on the singularity theorems of GR. Take Hawking-Penrose theorem, published in 1970. It presupposes some specific energy conditions [Refs. 2 and 3], which cannot hold in a world dominated by "dark energy"; see Rakhi and Indulekha at

<http://www.god-does-not-play-dice.net/#GR>

On top of everything, the hypothetical gravitational "collapse" is highly controversial in the first place [Ref. 4].

Perhaps it will be a good idea if you first sort out the unsolved mysteries in the basis of your essay [Ref. 1], as neither S. Hawking nor R. Penrose were anticipating some "dark energy" in 1970s.

I will appreciate your professional reply, as well as the comments from your colleagues.

Kindest regards,

Dimi

-----  
[Ref. 1] Claus Kiefer, Can the Arrow of Time be understood from Quantum Cosmology?  
arXiv:0910.5836v1 [gr-qc], to appear in "The Arrow of Time", ed. by L. Mersini-Houghton and R. Vaas, <http://arxiv.org/abs/0910.5836>

From the abstract: "Remarks are also made concerning (...) scenarios motivated by dark energy."

p. 2: "The question raised by the presence of all these arrows is whether a common master arrow of time is behind all of them.

...

"As indicated by the singularity theorems of general relativity, a consistent description of the Big Bang may require a new framework such as quantum gravity. The question then arises whether the origin of the arrow of time can be understood there. This is the topic of my essay.

...

p. 11: "Since our present Universe is dominated by dark energy, which for our purpose here can be approximated by a cosmological constant [ $\lambda$ ], ...

...

p. 12: "In the case of a non-vanishing cosmological constant ... "

[Ref. 2] Pankaj S. Joshi, On the genericity of spacetime singularities,  
arXiv:gr-qc/0702116v1, <http://arxiv.org/abs/gr-qc/0702116>

[Ref. 3] Carlos Barcelo, Matt Visser, Twilight for the energy conditions?  
arXiv:gr-qc/0205066v1, <http://arxiv.org/abs/gr-qc/0205066>

p. 2: "If you believe the recent observational data regarding the accelerating universe, then the [SEC](#) is violated on cosmological scales **right now!**"

See also: H. Epstein, V. Glaser and A. Jaffe, Nonpositivity of the energy density in quantized field theories, Nuovo Cim. 36(3) (1965) [1016-1022](#)

[Ref. 4] [Stephen J. Crothers](#), Geometric and Physical Defects in the Theory of Black Holes  
<http://www.sjcrothers.plasmareources.com/MSAST-Crothers.pdf>

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Note: Let's try to find out what we *know* that we *don't know* regarding '[The Arrow of Time](#)'.

1. Claus Kiefer speculated extensively about 'entropy' [[Ref. 1](#)], but we "do not have a rigorous definition of entropy for systems coupled to gravity" [[Ref. 5](#); see also the discussion of Eq. 1 on p. 7 therein].
2. We are also conditioned to believe that, since the Einstein field equations are "local", it would be impossible that "the global topology of the spatial section of an FLRW universe could have an effect on that universe's dynamics" [[Ref. 6](#)]. But Einstein field equations themselves are totally inadequate for addressing the main puzzle of **non-unitary emergence** of 'energy from empty space' -- see [above](#). This opens an opportunity to seek 'the arrow of time' in global topology [changes](#), to at least gather some hints as to how the Einstein field equations should be modified to tackle the *source* of "dynamic dark energy".
3. If we look at the "expanding" FRW universe [above](#), the first puzzle we should notice is that the cosmological time, as read by our wristwatch, should **not** be observable: while FRW equations describe the physical time evolution, the "observed" quantities are "not gauge invariant and therefore should **not** be observable in obvious contradiction to reality", cf. T. Thiemann [[Ref. 7](#)].
  - 3.1. [Thomas Thiemann](#) has argued that a tentative solution may be offered with some of those "scalar fields" introduced *ad hoc* [[Ref. 7](#)], to bypass the direct approach to the "[dark energy](#)" from the quantum vacuum. Unfortunately, all those "scalar fields" are red herring, firstly because there is no symmetry mechanism preventing their *strong* coupling -- see Sec. 2.2 in [[Ref. 8](#)].
  - 3.2. [Thomas Thiemann](#) offered an 'either - or' dilemma [[Ref. 7](#)], but the answer to the puzzle may be '**both**': the new physics that we're missing does affect QED, and of course the [predictions for LHC](#).
4. Notice that the "dark" effects from 'potential reality' *have to be camouflaged* in GR as "[gauge-dependent](#)". This should be expected, as present-day GR cannot handle '[absolute structures](#)' such as the *source* of '[energy from empty space](#)'. Surely "absolute structures carry no observable content" [[Ref. 9](#)]. Perfect!

Pity [Claus Kiefer](#) ignored my posting from [Dec. 26, 2008 @ 17:01 GMT](#): the Hilbert space problem (C. Kiefer, Quantum geometrodynamics: whence, whither?", [arXiv:0812.0295v1 \[gr-qc\]](#)) may be solved along with the 'problem of time' *en bloc*, as it should be done.

D. Chakalov  
November 2, 2009

#### References

[Ref. 5] [Sean M. Carroll](#), Is Our Universe Natural? arXiv:hep-th/0512148v1, <http://arxiv.org/abs/hep-th/0512148>

[Ref. 6] Boudewijn F. Roukema, Some spaces are more equal than others, arXiv:0910.5837v1 [astro-ph.CO], <http://arxiv.org/abs/0910.5837>

[Ref. 7] Thomas Thiemann, Solving the Problem of Time in General Relativity and Cosmology with Phantoms and  $k$  -- Essence, arXiv:astro-ph/0607380v1, <http://arxiv.org/abs/astro-ph/0607380>

"Either the mathematical formalism, which has been tested experimentally so excellently in other [gauge theories such as QED](#), is inappropriate or we are missing some new physics."

[Ref. 8] [Sean M. Carroll](#), Dark Energy and the Preposterous Universe, arXiv:astro-ph/0107571v2, <http://arxiv.org/abs/astro-ph/0107571>

[Ref. 9] Domenico Giulini, Some remarks on the notions of general covariance and background independence, arXiv:gr-qc/0603087v1, <http://arxiv.org/abs/gr-qc/0603087>

p. 4: "Transition functions relabel the points that constitute M, which for the time being we think of as recognizable entities, as mathematicians do. (For physicists these points are mere 'potential events' and do not have an obvious individuality beyond an actual, yet unknown, event that realizes this [potentiality](#).)

...

p. 11: "An absolute structure is a coordinate which takes the same range of values in each Diff(M) orbit and therefore cannot separate any two of them. If we regard Diff(M) as a gauge group, i.e. that Diff(M)-related configurations are physically indistinguishable, then absolute structures carry [no observable content](#)."

=====

Subject: How to quantize spacetime without affecting relativity

Date: Fri, 30 Oct 2009 10:25:10 +0200

From: Dimi Chakalov <dchakalov@gmail.com>

To: Giovanni Amelino-Camelia <amelino@roma1.infn.it>

Cc: Richard Lieu <lieur@cspars.uah.edu> ,

Jonathan Granot <j.granot@herts.ac.uk>

Hi Giovanni,

Regarding (i) your speculation from August 1998,

<http://www.nature.com/nature/journal/v398/n6724/abs/398216a0.html>

(ii) my email messages sent in the past three years (no reply from you), and (iii) the latest confirmation of [Lieu & Hillman](#)'s direct evidence against Planck-scale fluctuations in spacetime by Jonathan Granot,

<http://www.nature.com/news/2009/091028/full/news.2009.1044.html>

see

<http://www.god-does-not-play-dice.net/#NB>

Please don't ever say you knew nothing about it.

Dimi

=====

Subject: Re: How to quantize spacetime without affecting relativity

Date: Fri, 30 Oct 2009 12:13:16 +0200

From: Dimi Chakalov <dchakalov@gmail.com>

To: Giovanni.Amelino-Camelia@roma1.infn.it

Cc: Richard Lieu <lieur@cspars.uah.edu> , Jonathan Granot <j.granot@herts.ac.uk> ,

Hi Giovanni,

> the first point is that you describe the recent  
> Fermi-telescope result as a test of "Planck-scale  
> fluctuations in spacetime"

Nope. The common issue is the end result from two very different approaches, by Richard and Jonathan. That is what matters.

If you wish to say something, first read the story at

<http://www.god-does-not-play-dice.net/#NB>

- > I repeat: I shall be happy to offer more help
- > if the requests are respectful and reflect a serious
- > investment in the relevant literature

Please go ahead. The refuter of your speculations is one click away.

Take care,

Dimi

=====

Subject: Re: How to quantize spacetime without affecting relativity  
Date: Fri, 30 Oct 2009 16:59:10 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Richard Lieu <richardlieuuah@gmail.com>  
Cc: Giovanni.Amelino-Camelia@roma1.infn.it, amelino@roma1.infn.it,  
"Kouveliotou, Chryssa (MSFC-VP62)" <chryssa.kouveliotou@nasa.gov>,  
"sylvain.guiriec@lpta.in2p3.fr" <sylvain.guiriec@lpta.in2p3.fr>,  
"Veronique.Pelassa@lpta.in2p3.fr" <Veronique.Pelassa@lpta.in2p3.fr>,  
"ohnomasa272@gmail.com" <ohnomasa272@gmail.com>, rdb3@stanford.edu,  
James A Miller <millerja@uah.edu>, fixj@uah.edu, Rob Preece <Rob.Preece@nasa.gov>, Jonathan  
Granot <j.granot@herts.ac.uk>

Dear Richard,

- > I am truly grateful to all of you who wish to vindicate our 2003 work,
- > but note also that our paper was six years ago and times were
- > different. The Fermi limit is indeed unique, as they tested
- > systematic rather than random 1st order Planck scale effect. Giovanni
- > is right - the Fermi test was not about fluctuations, but real
- > dispersion.

Of course. What I did say in my preceding email was: "The common issue is the end result from two very different approaches, by Richard and Jonathan. That is what matters."

Maybe I should have added 'that is what matters to the question in the subject line'.

Regrettably, Giovanni can't see the forest for the trees. Details about 'the forest' at

<http://www.god-does-not-play-dice.net/#NB>

Kindest regards,

Dimi

=====

Subject: On the density perturbations of pre-inflationary red herrings  
Date: Fri, 14 Dec 2012 05:38:56 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Dick <richardlieuuah@gmail.com>, Tom <t.kibble@ic.ac.uk>  
Cc: rampf@physik.rwth-aachen.de,

thomas.maedler@obspm.fr,  
smajor@hamilton.edu,  
m.s.brown@soton.ac.uk,  
andre.leclair@gmail.com,  
jochen.zahn@univie.ac.at,  
dougs@csufresno.edu,  
mbeneke@physik.rwth-aachen.de,  
whzurek@gmail.com

Dick and [Tom](#),

Regarding your [arXiv:1212.3290v1 \[astro-ph.CO\]](#), check out some simple facts at

[http://www.god-does-not-play-dice.net/#red\\_herring](http://www.god-does-not-play-dice.net/#red_herring)

[http://www.god-does-not-play-dice.net/#KS\\_Mott](http://www.god-does-not-play-dice.net/#KS_Mott)

<http://www.god-does-not-play-dice.net/#Maia>

Any comments?

Dimi

=====

Subject: "Specifically, because of the Kocken-Specher theorem, ..." ([arXiv:0911.2135v1 \[gr-qc\]](#), p. 187)

Date: Thu, 12 Nov 2009 05:57:44 +0200

From: Dimi Chakalov <dchakalov@gmail.com>

To: [Cecilia Flori](#) <cecilia.flori@aei.mpg.de>

Cc: [Jan Plefka](#) <jan.plefka@physik.hu-berlin.de> ,

[Steven Vickers](#) <S.J.Vickers@cs.bham.ac.uk>

Dear Dr. Flori,

I've been reading your Ph.D. Thesis in the past three hours, and am truly amazed by your professional approach and perfectionism. You are a treasure.

Regarding KS Theorem, I think one can argue that the truth value of the propositions should be YAIN (Chris Isham [disagrees](#), for unknown to me reasons). In your spare time, please see an outline at

<http://www.god-does-not-play-dice.net/#NB>

I will appreciate your professional opinion, as well as the feedback from your distinguished colleagues.

With all good wishes,

Dimi Chakalov

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Note: Watch Cecilia Flori's lecture "Topos formulation of Consistent Histories", 14.01.2009, <http://pirsa.org/09010017>. She handles the topos theory and the ice hockey stick with agility and unmatched precision.

=====

Subject: Re: When are you going to respond professionally?  
Date: Sat, 24 Oct 2009 10:47:42 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Christian Corda <cordac.galilei@gmail.com>  
Cc: [lsfynn@psu.edu](mailto:lsfynn@psu.edu), [cornish@physics.montana.edu](mailto:cornish@physics.montana.edu), [vfaraoni@ubishops.ca](mailto:vfaraoni@ubishops.ca)

On Fri, 23 Oct 2009 20:24:45 +0200, [Christian Corda](mailto:cordac.galilei@gmail.com) <cordac.galilei@gmail.com> wrote:  
[snip]

> YOU DO NOT NOT UNDERSTAND GRAVITATION.

Prove it. My SBG argument is at the link below.

Sincerely,

D. Chakalov

On Fri, 23 Oct 2009 12:49:14 +0300, Dimi Chakalov <dchakalov@gmail.com> wrote:

>  
>> Gentlemen:  
>>  
>> I mentioned your names and recent papers at  
>>  
>> <http://www.god-does-not-play-dice.net/Szabados.html#SBG>  
[snip]

=====

Subject: [Taxpayer's perspective on GW astronomy](#)  
Date: Mon, 26 Oct 2009 12:44:06 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Laszlo Szabados <lbszab@rmki.kfki.hu>,  
Robert M Wald <rmwa@midway.uchicago.edu>,  
Joel Franklin <jfrankli@reed.edu>,  
Richard Woodard <woodard@phys.ufl.edu>,  
Andrew Waldron <wally@math.ucdavis.edu>,  
Steven Carlip <carlip@physics.ucdavis.edu>,  
[John Baez](mailto:baez@math.ucr.edu) <baez@math.ucr.edu>,  
John W Barrett <john.barrett@nottingham.ac.uk>,  
[Chris Isham](mailto:c.isham@imperial.ac.uk) <c.isham@imperial.ac.uk>

Dear colleagues,

I wonder if you would agree to endorse the submission of my manuscript to [gr-qc],

<http://arxiv.org/help/endorsement>

The basic arguments are at

<http://www.god-does-not-play-dice.net/Szabados.html#SBG>

I will be happy to send you my manuscript, entitled: "[Taxpayer's perspective on GW astronomy](#)". Will be brief and *utterly* polite (not frank, as at my web site).

Kindest regards,

Dimi Chakalov

-----

Note: Excerpts from <http://arxiv.org/help/endorsement> :

**"The endorsement process is not peer review.** You should know the person that you endorse **or** you should see the paper that the person intends to submit. We don't expect you to read the paper in detail, or verify that the work is correct, but you should check that the paper is appropriate for the subject area. You should not endorse the author if the author is unfamiliar with the basic facts of the field, or if the work is entirely disconnected with current work in the area."

[Stanley Deser](#) refused to even consider endorsing my manuscript. I do hope some of his colleagues will agree.

If you, my dear reader, have papers "that have been submitted between three months and five years ago" to [gr-qc] or [astro-ph] domains, and would agree to [endorse the submission of my manuscript](#), please contact me by email *as soon as possible*, and I will send you my manuscript.

D. Chakalov

October 27, 2009

=====

Subject: Re: Taxpayer's perspective on GW astronomy

Date: Tue, 3 Nov 2009 23:24:06 +0200

From: Dimi Chakalov <dchakalov@gmail.com>

To: Jonathan Thornburg <jthorn@astro.indiana.edu>

Cc: Jim Isenberg <isenberg@uoregon.edu>

Hi Jonathan,

Thanks for your reply. I regret that you refused to endorse the submission of my manuscript to [gr-qc]. As you put it in [lrr-2007-3](#),

"The event horizon is a global property of an entire spacetime and is defined [nonlocally in time](#): The event horizon in a slice is defined in terms of (and cannot be computed without knowing) the full future development of that slice."

... provided we know the source of DDE,

<http://www.god-does-not-play-dice.net/#GR>

Take care,

Dimi

>> I wonder if you would agree to endorse the submission of my manuscript

>> to [gr-qc] or [astro-ph],

>>

>> <http://arxiv.org/help/endorsement>

>>

>> The basic arguments are at

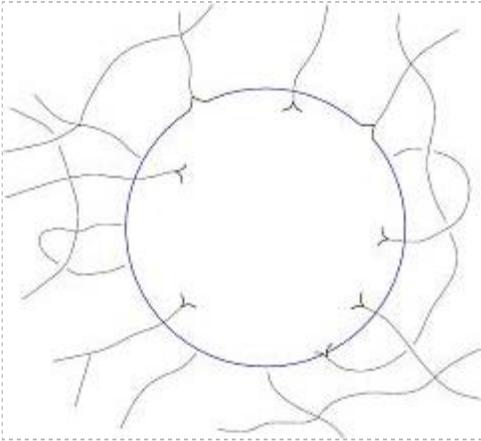
>>

>> <http://www.god-does-not-play-dice.net/Szabados.html#SBG>

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**Note:** Forty years have passed since Roger Penrose suggested the so-called Cosmic Censorship Conjecture (CCC), and people continue to ground their efforts on it (cf. [Jonathan Thornburg](#) and

Michael I. Cohen *et al.*, [p. 2](#)) and [offer bets](#) and drawings of "[quantum horizon geometry](#)".



Notice that the methods for finding an **accurate history** of the so-called event horizon (you need the "event horizon" (EH) in order to speculate about "black holes" viz. "binary black hole mergers" as "one of the most astrophysically common sources of gravitational radiation for detectors [such as LIGO](#)", cf. [Mike Cohen et al.](#)) require complete knowledge of "the **full future evolution** of the spacetime before the EH can be determined exactly" ([ibid.](#)).

Which is why you need to address the global dynamics of spacetime: the *increasing emergence* of [energy-of-empty-space due to DDE](#).

Just one "closed timelike curve" (CTC) or "[time-like naked singularity](#)" in the past 13.7B years would have destroyed everything, and since there are no *strict* bans on such catastrophic events (they simply have never happened, just like the [ultraviolet catastrophe](#)), "prohibited" only by people's belief in the current "[dynamics](#)" of GR and CCC in particular, recall that those "famous" singularity theorems are from 1970s, when [nobody was aware of the flux of DDE](#).

Two examples: Geroch's theorem regarding CTCs (Robert Geroch, *Topology in general relativity*, *J. Math. Phys.* 8, 782-786 (1967)) and Tipler's theorem, which stipulates that, given the (obvious) positiveness of the energy-momentum tensor, there can be no changes in the topology of spacetime, hence the causal structure of spacetime is secured (Frank J. Tipler, *Singularities and causality violation*, *Ann. Phys.* 108, 1-36 (1977)), are from the old days of GR [without DDE](#).

As Alan Rendall stated ([p. 14](#)), "The study of these matters is still in a state of flux." Which is why I requested [endorsement of my manuscript](#).

So far two physicists have replied ([J. Thornburg](#) and [S. Deser](#)), the rest ([73](#)) have not even confirmed the receipt of my email (sent between October 26th and October 28th). Same story in [September 2008](#). I'm talking to a [brick wall](#).

D. Chakalov  
November 4, 2009  
Last update: April 6, 2011

=====

Subject: Re: GR17, Session D1  
Date: Mon, 2 Nov 2009 19:08:46 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Thomas Thiemann <tthiemann@perimeterinstitute.ca>, thomas.thiemann@aei.mpg.de

Cc: Ismolin@perimeterinstitute.ca,  
Curt.Cutler@aei.mpg.de,  
brien.nolan@dcu.ie

Thomas,

I quoted from your astro-ph/0607380 at

<http://www.god-does-not-play-dice.net/#note>

Five years ago, you decided to bury my report into an evening poster session, and granted [Lee Smolin](#) three oral presentations: on Monday, July 19th ("Background independent approach to M theory", D2), on Tuesday, July 20th ("The low energy behavior of loop quantum gravity", D1), and finally on Friday, July 23rd ("Inflation in loop quantum gravity", B2i).

What you did to me was bloody unfair. Typical for a DDR communist.

Dimi

-----  
Subject: Re: GR17, Session D1  
From: Dimi Chakalov <dimi@chakalov.net>  
Date: Sun, 06 Jun 2004 22:59:15 +0300  
To: tthiemann <tthiemann@perimeterinstitute.ca>  
CC: Curt.Cutler@aei.mpg.de, brien.nolan@dcu.ie

Dear Thomas,

Please inform me about possible upgrade of my poster presentation to talk. I'm encountering tremendous difficulties in transforming my GR17 paper to poster. Feel like having my mouth shut with duck tape.

Best - Dimi

=====  
Subject: A fourth road to quantum gravity  
Date: Fri, 6 Nov 2009 16:10:45 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Mark Buchanan <buchanan.mark@gmail.com>  
Cc: [Didier Sornette](mailto:dsornette@ethz.ch) <dsornette@ethz.ch>,  
[Lee Smolin](mailto:Ismolin@perimeterinstitute.ca) <Ismolin@perimeterinstitute.ca>,  
[Chris Isham](mailto:c.isham@imperial.ac.uk) <c.isham@imperial.ac.uk>

Dear Dr. Buchanan,

I would like to make two comments on your online article "In search of the black swans" [[Ref. 1](#)].

I'm interested in proactive management of emerging risks, type "[black swans](#)". With the benefit of hindsight, it seems to me that the event of 9/11 could not have been predicted, for reasons entire different than Max Planck's discovery; please see

<http://tinyurl.com/steel-evaporation>

The second comment pertains to the subject of this email: I believe Lee Smolin [Refs. [2](#) and [3](#)], and all of his colleagues, have completely missed a fourth road to quantum gravity, from Erwin Schrödinger,

<http://www.god-does-not-play-dice.net/#NB>

Please feel free to pass this email to 'whomever it may be concerned'. The direct link:

<http://www.god-does-not-play-dice.net/#Buchanan>

Kindest regards,

Dimi Chakalov  
35 Sutherland St  
London SW1V 4JU, U.K.

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[Ref. 1] Mark Buchanan (April 1, 2009), In search of the black swans  
<http://physicsworld.com/cws/article/indepth/38468>

"In 1890 an electricity company enticed the German physicist Max Planck to help it in its efforts to make more efficient light bulbs. Planck, as a theorist, naturally started with the fundamentals and soon became enmeshed in the thorny problem of explaining the spectrum of black-body radiation, which he eventually did by introducing the idea — a "purely formal" assumption, as he then considered it — that electromagnetic energy can only be emitted or absorbed in discrete quanta. The rest is history. Electric light bulbs and mathematical necessity led Planck to discover quantum theory and to kick start the most significant scientific revolution of the 20th century.

....

"... it is not the normal events, the mundane and expected "white swans" that matter the most, but the outliers, the completely unexpected "black swans". In the context of history, think [11 September 2001](#) or the invention of the Web."

[Ref. 2] [Lee Smolin](#), (June 2, 2009), The unique universe  
<http://physicsworld.com/cws/article/indepth/39306>

"Time in the Newtonian schema is a parameter used to label points on a trajectory describing the system evolving in configuration space. When the system is small and isolated, this time parameter refers to the reading of a clock on the wall of the observer's laboratory, which is not a property of the system. When we try to apply this notion to the universe as a whole, the time parameter must disappear (see [John Baez](#) - D.C.). Some have attempted to argue that this means that time itself does not exist at a cosmological scale, but that is the wrong conclusion. What disappears is not time, but the clock outside of the system -- which would be an absurd object since the system is [the whole universe](#)."

[Ref. 3] [Lee Smolin](#), *Three Roads to Quantum Gravity*, Phoenix, 2000;  
Ch. 14, What chooses the laws of nature?,

p. 205: "One of the biggest mysteries is that we live in a world in which it is possible to look around, and see as far as we like."

p. 206: "God is nothing but the power of the universe as a whole to organize itself."

-----

Note: Nothing from the text [above](#) is original. The legacy of Erwin Schrödinger and [Henry Margenau](#) is anything but some unpredictable "black swan". For comparison, if someone has been offering the *guiding principles* for [HTTP protocol](#) to the people at CERN, but they were [refusing to develop it](#), the invention of the Web [[Ref. 1](#)] would have never happened.

One can only hope that the upcoming sixth consecutive failure of LSC to detect GWs with the "[Enhanced LIGO](#)" will shake up the established theoretical physics community. If not, we will have to wait for the seventh consecutive failure of LSC in 2015, with their "[Advanced LIGO](#)".

What a terrible waste of time. And money.

Does anyone care?

D. Chakalov  
November 16, 2009

=====

Subject: [Re: Tue 24 Nov 13:30pm - 14:30pm](#)  
Date: Tue, 24 Nov 2009 20:06:09 +0000  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Jonathan Halliwell <j.halliwell@ic.ac.uk>  
Cc: Roland Omnes <roomnes@wanadoo.fr>,  
Amihay Hanany <a.hanany@imperial.ac.uk>,  
Helen Fay Dowker <f.dowker@imperial.ac.uk>,  
Chris Isham <c.isham@imperial.ac.uk>

Dear Jonathan,

It was a pleasure to attend your talk.

I'm also glad you quoted Roland's monograph, "The Interpretation of Quantum Mechanics", in which he demonstrated that by introducing the decoherence functional you're automatically confined to Boolean logic -- a clear indication for Murphy's Law No. 15, "Complex problems have simple, easy-to-understand wrong answers."

Since you mentioned in your talk the case depicted on Fig 1 from your arXiv:0909.2597v1 [gr-qc], I wonder whether you would, in such kind of "space", be able to look around and **see as far as you like** ([Lee Smolin](#), "Three Roads to Quantum Gravity", Phoenix, 2000, p. 205). The test of the pudding, you know.

Fay: I'm glad you chose (synchronicity?) to sit next to me. If some day you decide to talk about the topology of space (with or without its "[dark energy](#)"), please drop me a line. I'll be delighted to attend.

Lastly, may I use this opportunity to invite all of you to join the new research program outlined at

<http://www.god-does-not-play-dice.net/#NB>

I believe it strictly follows Chris Isham's program, [Type IV](#) (arXiv:gr-qc/9310031v1).

If you have questions, please do write me back.

Wishing you all the best,

Dimi

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Dimi Chakalov  
35 Sutherland St  
SW1V 4JU

=====

Subject: Re: Tue 24 Nov 13:30pm - 14:30pm  
Date: Thu, 26 Nov 2009 21:38:33 +0000  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: J M Yearsley <james.yearsley03@imperial.ac.uk>  
Cc: Roland Omnes <roomnes@wanadoo.fr>,  
Amihay Hanany <a.hanany@imperial.ac.uk>,

Helen Fay Dowker <f.dowker@imperial.ac.uk>,  
Chris Isham <c.isham@imperial.ac.uk>,  
Jonathan Halliwell <j.halliwell@ic.ac.uk>

Dear Dr. Yearsley,

I attended Jonathan's talk, and a few hours later emailed him a proposal to verify the Decoherent Histories (DH) hypothesis [Ref. 1]; please see 'the proof of the pudding' at

<http://www.god-does-not-play-dice.net/#Halliwell>

Suppose you have a clear night sky, and fix your eyes, for 1 min, on a star that is/was 4M light years away. The star looks the same during the whole time of 1 min, and is always at the place you see it.

Now, if the spacetime were governed by DH hypothesis [Ref. 1], what kind of irregularities MUST have been imposed on photon's pathway? I suppose you can perform the calculations and find it out for yourself.

Please feel free to join the research project outlined at

<http://www.god-does-not-play-dice.net/#NB>

Kindest regards,

Dimi Chakalov  
35 Sutherland St  
SW1V 4JU

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[Ref. 1] J.J. Halliwell, The Interpretation of Quantum Cosmology and the Problem of Time, <http://arxiv.org/abs/gr-qc/0208018>

"Central to both the classical and quantum problems is the notion of an entire trajectory. At the classical level it appears to be the appropriate reparametrization-invariant notion for the construction of interesting probabilities. At the quantum level, the decoherent histories approach appears to handle the problem in a natural way, perhaps because it readily incorporates the notion of trajectory."

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D. Giulini and C. Kiefer, The Canonical Approach to Quantum Gravity, <http://arxiv.org/abs/gr-qc/0611141>

"What about the semiclassical approximation and the recovery of an appropriate external time parameter in some limit? (...) The discussion is also connected to the question: Where does the imaginary unit  $i$  in the (functional) Schrödinger equation come from? The full Wheeler-DeWitt equation is real, and one would thus also expect real solutions for [PSI]."

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M. Bojowald, Canonical Relativity and the Dimensionality of the World, <http://arxiv.org/abs/0807.4874>

"If the theory does not allow us, even in principle, to extend solutions arbitrarily far in one direction, it may be difficult to view this direction as a dimension of the world."

=====

Subject: "Einstein gravity is an emergent phenomenon" (Harvey R. Brown, [arXiv:0911.4440v1](http://arxiv.org/abs/0911.4440v1) [gr-qc], pp. 8-9)

Date: Mon, 30 Nov 2009 16:45:01 +0200

From: Dimi Chakalov <dchakalov@gmail.com>  
To: Harvey R Brown <harvey.brown@philosophy.ox.ac.uk>  
Cc: Norbert Straumann <norbert.straumann@gmail.com>,  
Domenico Giulini <domenico.giulini@itp.uni-hannover.de>,  
Oliver Pooley <oliver.pooley@philosophy.ox.ac.uk>,  
J Brian Pitts <jpitts@nd.edu>,  
Jose Natario <jnatar@math.ist.utl.pt>,  
Timothy Adamo <tim.adamo@gmail.com>,  
Stanley Deser <deser@brandeis.edu>,  
Jacob D Bekenstein <bekenste@vms.huji.ac.il>,  
Hans C Ohanian <hohanian@einsteinmistakes.com>,  
Igor Novikov <novikov@tac.dk>,  
Dmitri Novikov <d.novikov@imperial.ac.uk>,  
Tatyana Shestakova <shestakova@sfnu.ru>,  
Natalia Kiriushcheva <nkiriush@uwo.ca>,  
S V Kuzmin <skuzmin@uwo.ca>,  
Kirill Krasnov <kirill.krasnov@nottingham.ac.uk>

Dear Dr. Brown,

I fully endorse your statement, for reasons explained at

<http://www.god-does-not-play-dice.net/#GR>

Please notice that the source of DDE (see 'GR with DDE' at the link above) is assumed to play the role of 'reference fluid' and Anderson's 'absolute structures' (James L. Anderson, *Principles of Relativity Physics*, Academic Press, New York, 1967, p. 73). The latter (i) do not obey the 'generalized principle of action and reaction' (ibid., p. 339), and (ii) can be revealed in Quantum Theory as 'potential reality',

<http://www.god-does-not-play-dice.net/#NB>

It seems to me that all the pieces of the jigsaw puzzle of quantum gravity snap to their places -- effortlessly.

Should you or any of your colleagues disagree, please bark back. The "curious incident" with my web site is that nobody is willing to comment on these very simple (and certainly not original) ideas.

Kindest regards,

Dimi Chakalov

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"Is there any other point to which you would wish to draw my attention?"

"To the curious incident of the dog in the night-time."

"The dog did nothing in the night-time."

"That was the curious incident."

Sherlock Holmes, "The Adventure of Silver Blazes"

=====

Subject: A New Scenario, by Sergio Doplicher  
Date: Tue, 1 Dec 2009 14:23:42 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Sergio Doplicher <dopliche@mat.uniroma1.it>  
Cc: Luciano Maiani <luciano.maiani@roma1.infn.it>,  
Ray Streater <raymond.streater@kcl.ac.uk>,  
Owen Maroney <o.maroney.physics@gmail.com>,

Bogdan Damski <bogdan.damski@gmail.com>,  
Haitao Quan <quan@lanl.gov>,  
Wojciech Hubert Zurek <whzurek@gmail.com>

Dear Professor Doplicher,

I have deep respect and admiration for your perfectionism and scrupulous intellectual honesty.

Regarding your Scenario (arXiv:0911.5136v1 [math-ph], [pp. 29-30](#); arXiv:hep-th/0608124v1, [p. 7](#)), and the puzzle identified by Lee Smolin,

<http://www.god-does-not-play-dice.net/#Buchanan3>

please notice my proposal at

<http://www.god-does-not-play-dice.net/#Brown>

I will appreciate your critical opinion, as well as the feedback from your colleagues.

May I ask a question. I noticed that you'll teach QM,  
[http://www.mat.uniroma1.it/mat\\_cms/pres\\_corso.php?corso\\_da\\_presentare=1259](http://www.mat.uniroma1.it/mat_cms/pres_corso.php?corso_da_presentare=1259)

Would you discuss my interpretation of QM with your students?

I believe kids have the right to know everything we know. If you consider Nevill Mott's paper (arXiv:0911.5136v1 [math-ph], [p. 18](#)) and the alleged "time-dependent decoherence factor" (W.H. Zurek et al., [arXiv:0911.5729v1 \[quant-ph\]](#)), I believe your students will grasp the ultimate puzzle of our good old asymptotically flat spacetime, and will never waste their life with chasing ghosts.

Kindest regards,

Dimi Chakalov

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Note: Contrary to what you may hear from [Jonathan Halliwell](#), it is impossible to explain the trace of a charged particle in a bubble chamber, after Nevill Mott (see S. Doplicher, p. 18), with the current QM and GR textbooks. The problems from QM (A. Teta, [arXiv:0905.1467v1](#), "possible histories", pp. 12-14) are swept under the carpet. Moreover, the problems from '[GR without DDE](#)' are overwhelming. One is that we can't explain 'the energy-momentum density of generic background quantum states' (see [below](#)): "points become *fuzzy* and *locality looses any precise meaning*" (S. Doplicher, p. 21). More puzzles from M. Consoli and E. Costanzo, arXiv:0709.4101, [Sec. 3](#): Is the vacuum a *preferred frame*? Could be. But if we model the vacuum as '[potential reality](#)', there is no way to observe motion with respect to it: the usual expression from 1930s -- "the only Lorentz-invariant tensor" (*ibid.*, Eq 13); see also G. Marsh, arXiv:0711.0220v2, [Eq 2](#) -- does **not** apply to '[potential reality](#)'. The latter is needed to explain '[GR with DDE](#)'.

In the textbook version of '[GR without DDE](#)', the 'coordinate time' read by your wristwatch, and the very notion of '[energy conservation](#)' during some interval from that 'coordinate time', cannot be rigorously defined. The tacit presumption is that 'space' itself does not "move" anywhere, simply because there is no "outer space" in which our 3-D space could "expand into". But only the second part from this tacit presumption is correct, since our 3-D space can indeed "move" or rather "emerge" (C. Isham, gr-qc/9310031, [Option IV](#)): the *intrinsic dynamics* of space -- here we enter '[GR with DDE](#)' -- can **only** be defined with respect to a hypothetical **global** mode of spacetime, which is hidden [between](#) the "points" of the **local** mode of spacetime. The latter stands as a genuine *perfect continuum* (the "dark gaps" from the global mode are hidden by the so-called 'speed of light'), and has been studied in STR and in '[GR without DDE](#)'.

If we wish to think as proper relativists, this is *the only* choice we may have: see my email to Harvey R Brown [above](#). Many people [hate it](#) and spit insults on me; other just [keep quiet](#), but nobody has so far offered any viable alternative.

But is there any alternative to '[the arrow of spacetime](#)'?

Back in 1772, on the occasion of the fall of meteorites, the French Academy of Sciences adopted a resolution categorically rejecting such ridiculous phenomena. The obvious reason had been that rocks cannot fall from the sky, simply because there are no rocks there. Likewise, when you look at the sky, you will never think that the *space itself* could possibly "move", in any way whatsoever. But once the "dark energy" from '[empty space](#)' was confirmed, the intrinsic dynamics of 3-D space, hence '[GR with DDE](#)', are unavoidable. Your good old wristwatch does read the dynamics of "dark energy" along [the arrow of spacetime](#).

*E sarà mia colpa se così è?* (Niccolò Machiavelli)

D.C.

December 1, 2009

Last update: December 7, 2009

Sergio Doplicher, The Principle of Locality. Effectiveness, fate and challenges. [arXiv:0911.5136v1](#) [[math-ph](#)]

p. 18: "The coherence between the different outcomes, in principle still accessible with the measurement of the nearly vanishing interference terms (vanishing exactly **only** in the limit  $N \rightarrow [\text{inf}]$ ), will be totally inaccessible in practice as soon as  $N$  is sufficiently large, as the number of molecules in a bubble from the trace of a charged particle in a bubble chamber."

...

pp. 19-20: "The conventional picture of the measurement process in Quantum Mechanics, as an instantaneous jump from a pure state to a mixture, which affects the state all over space at a fixed time in a preferred Lorentz frame, appears, in the scenario we outlined, as the result of several limits:

"1. the time duration  $T$  of the interaction giving rise to the measurement (which, in an exact mathematical treatment, would involve the whole interval from minus infinity to plus infinity, as all scattering processes) is set equal to zero;

"2. the number of microconstituents of the amplifying part of the measurement apparatus is set equal to infinity, thus allowing **exact** decoherence;

"3. the volume involved by the measurement apparatus in its interaction with the system (thus occupied by the microscopic part of the apparatus) tends to the whole space, allowing the reduction of wave packets to take place **everywhere**;

"In the conventional picture, some form of nonlocality is unavoidable, albeit insufficient for transmission of perturbations (hence not contradicting local commutativity) or even of information [58]: for a given observer, a *coherent superposition* of two possibilities might be changed, instantaneously in some preferred Lorentz frame, to a state where only one possibility survives, by the measurement performed by another observer in a very far spacelike separated region.

...

p. 21: "Thus points become *fuzzy* and *locality loses any precise meaning*. We believe it should be replaced at the Planck scale by an equally sharp and compelling principle, yet unknown, which reduces to locality at larger distances.

...

p. 27: "But locality is lost. There is no meaning to "E1 and E2 are spacelike separated", unless we pick a point  $o$  in  $E$ , and limit ourselves to a special wedge  $W$  associated to  $o$  and its spacelike complement  $-W$ . In this special case locality survives for free fields, but is bound to be destroyed by interactions on QST.

"That remnant of locality has been exploited to construct deformations of local nets for which the two particle S matrix is nontrivial [70, 71], at the price of losing locality in terms of fields localised in bounded regions. The various formulations of interaction between fields, all equivalent on ordinary Minkowski space, provide inequivalent approaches on QST; but all of them, sooner or later, meet

problems with Lorentz covariance, apparently due to the nontrivial action of the Lorentz group on the centre of the algebra of Quantum Spacetime.

"On this point in our opinion a deeper understanding is needed.

...

p. 29: "The common feature of all approaches is that, due to the quantum nature of spacetime at the Planck scale, locality is broken, even at the level of free fields, and more dramatically by interactions. Which, as far as our present knowledge go, lead to a breakdown of Lorentz invariance as well.

...

"One might expect that a complete theory ought to be covariant under general coordinate transformations as well. This principle, however, is grounded on the conceptual experiment of the falling lift, which, in the classical theory, can be thought of as occupying an *infinitesimal neighborhood* of a point. In a quantum theory the size of a "laboratory" must be large compared with the Planck length, and this might pose limitations on general covariance. One might argue that such limitations ought to be taken care of by the quantum nature of Spacetime at the Planck scale.

...

"But the energy distribution in a generic quantum state will affect the Spacetime Uncertainty Relations, suggesting that the commutator between the coordinates ought to depend in turn on the metric field. This scenario could be related to the large scale thermal equilibrium of the cosmic microwave background, and to the non vanishing of the Cosmological Constant [79, 80].

p. 30: "This might well be the clue to restore Lorentz covariance in the interactions between fields on Quantum Spacetime."

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ref. [80]: Sergio Doplicher, Quantum Field Theory on Quantum Spacetime, [arXiv:hep-th/0608124v1](http://arXiv:hep-th/0608124v1).

p. 7: "A New Scenario. The Principle of Gravitational Stability ought to be fully used in the very derivation of Space Time Uncertainty Relations, which would then depend also on the energy-momentum density of generic background quantum states; this leads to commutation relations between Spacetime coordinates depending in principle on the metric tensor, and hence, through the gravitational coupling, on the interacting fields themselves. Thus the commutation relations between Spacetime coordinates would appear as part of the equations of motions along with Einstein and matter field Equations.

"In other words we may expect that, while Classical General Relativity taught us that Geometry *is* dynamics, Quantum Gravity might show that also Algebra *is* dynamics.

"This new scenario [12] appears extremely difficult to formalise and implement, but promises most interesting developments."

-----

=====

Subject: The [Hamiltonian formulation of GR](#) is wrong.

Date: Tue, 26 Jan 2010 17:28:31 +0200

From: Dimi Chakalov <dchakalov@gmail.com>

To: Hanno Sahlmann <sahlmann@particle.uni-karlsruhe.de> ,

Jacob D Bekenstein <bekenste@vms.huji.ac.il> ,

Mordehai Milgrom <moti.milgrom@weizmann.ac.il> ,

J M Pons <pons@ecm.ub.es> ,

D C Salisbury <dsalisbury@austincollege.edu> ,

K A Sundermeyer <ksun@gmx.de> ,

George F R Ellis <George.Ellis@uct.ac.za>

Dear colleagues,

If we accept the challenge of "dark energy" and "dark matter", I believe it will be wrong to use the Hamiltonian formulation of GR. It is not possible to quantize Einstein gravity in four dimensions either (Hanno Sahlmann, [arXiv:1001.4188v1 \[gr-qc\]](https://arxiv.org/abs/1001.4188v1)).

The problem is that we need to unravel a new degree of freedom pertaining to the NEW dynamics of spacetime: see R. Rakhi & K. Indulekha and S. Carroll, "more space comes into existence",

<http://www.god-does-not-play-dice.net/#GR>

<http://www.god-does-not-play-dice.net/#Brown>

Only people like George F R Ellis would ignore these bold facts.

Should you have questions, please don't hesitate to write me back.

Yours sincerely,

Dimi Chakalov

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**Note 1:** I really cannot understand why people believe that the **source** of "dark energy" should necessarily have *positive energy density* ("Treated as a fluid, this component has negative pressure (assuming positive energy density), ... "

[T. Padmanabhan](#)), and be "invariant under Lorentz transformations" ([E. Santos](#)).

In the model presented [here](#), these two self-imposed presumptions are dropped, and the **source** of "dark energy" is non-existent in the **local** mode of spacetime. None. Zero. Zilch. You can safely set it to zero, just as you usually treat the vacuum energy density in [QFT](#).

Yet the **source** of "dark energy" can take *any value* in the **global** mode, depending on the particular cosmological stage of the universe, because **T** (the energy momentum stress tensor of all matter and fields *other* than gravity, with positive energy density) can *completely* vanish/dissolve into the vacuum, and stay available there for any partial, full, or "**over unity**" recall, [if needed](#).

How? Because it is [potential reality](#). Only people like [George Ellis](#) cannot grasp it.

All we can physically observe is that 3-D space is [acting upon itself](#). We cannot trace back this 'energy from [empty space](#)', which is why some people called it "[dark](#)". In the same vein, the human mind would be considered "[dark](#)", because all we can observe is that the brain is being acting 'upon itself', by thinking *about* the brain, *with* the brain.

Gerard 't Hooft had a brilliant guess about the negative energy states, but his Ph.D. student Stefan Nobbenhuis ruined it, upon his guidance, by assuming that "there is no coupling *other than gravitational* (emphasis added - D.C.) between the normal matter fields and their ghost counterparts, otherwise the Minkowski vacuum would not be stable" ([arXiv:gr-qc/0411093v3](https://arxiv.org/abs/gr-qc/0411093v3), p. 10). But the quantum vacuum can be stable without any gravitational coupling **whatsoever**, because gravity applies **only** to the explicated/physical form of reality, while the *absolute value* of energy stored in the vacuum is [potential reality](#).

The misleading adjective "dark" ([Mike Turner](#)) comes from treating the *potential vacuum reality* as 'physically real'. In the case of John Wheeler's '[cloud](#)', only this *last explicated* physical reality will be subject to gravitational interactions, like the *explicated* [Casimir energy](#). The 'cloud' has been explicated by an [emerging context](#), while in the case of the "dark" energy from the quantum vacuum we encounter an *emerging boundary*: the energy here is **not** "[boundary sensitive](#)". It is 'the whole universe as ONE' (global mode of spacetime) that fixes the "boundary terms", so that we can only see a "cloud" with [strictly positive mass](#). Surely the explicated "cloud" changes along the cosmological time arrow, but its "dark" driving force cannot be unraveled from the fleeting "cloud" (denoted with **a** in [[Ref. 1](#)]), just as we cannot unravel *the* [UNdecidable Kochen-Specker quantum state](#) from its colorizable projections. This is the legacy of Schrödinger and [Margenau](#) (see [below](#)), which I was hoping to explain on [November 27, 2002](#).

Notice that in GR you inevitably need to introduce some **additional structure** [Ref. 2] compensating for the absence of the global mode of spacetime. To understand the origin of these of *additional* structures, recall the prerequisites that necessitate 'time' regarded as 'change': we need two different and distinguishable states of a physical system, and some *background* w.r.t.w. the difference between the two states can be identified. In STR, the task looks quite easy: take two consecutive, instantaneous, point-like states of a Frisbee along its continuous trajectory, defined w.r.t. the fixed background of Minkowski space, and you're done. In 'GR without DDE', the background is the 3-D space itself, which is allowed to change its "curvature" **only**, following the bi-directional "talk" between matter and space: "Space acts on matter, telling it how to move. In turn, matter reacts back on space, telling it how to curve" (John Wheeler). But because of the Equivalence Principle adopted in GR, gravity **must** be able to vanish completely "inside" an infinitesimal "point", hence there is no localizable point-like gravitational energy *density* in such "point" and across its infinitesimally small neighborhood, to compute derivatives (Bjoern Schmekel). Hence the notion of 'time', conceived as 'change' from point-like state A to point-like state B (defined w.r.t. a background of 3-D space), becomes terribly complicated because of its dual, non-linear duties: "the metric is treated as a field which not only affects, but also is (**at the same time** - D.C.) affected by, the other fields" (John Baez). Notice the notion suggested by Viktor Denisov and Anatol Logunov: 'physicogeometric dualism'.

Under these circumstances, people need to introduce some *additional* structures to define some "boundaries" of the whole spacetime; for example, some "fall-off conditions of the curvature in appropriate coordinate systems at infinity" [Ref. 2], because, in the case of the Einstein equations alone, "there are no physically motivated boundary conditions" (Alan Rendall). But notice that the background of 3-D space is still *always there*, in the sense that in 'GR without DDE' the space *itself* doesn't "move" (Robert Geroch). But once we endow the space *itself* with an additional degree of freedom, as in 'GR with DDE', it acquires new dynamics (arrow of spacetime), and those 'additional structures' that were introduced by hand [Ref. 2] should be *derived* from the "dark" ("no observable content", Domenico Giulini) global mode of spacetime.

Don't try to bridge the two "mirror" worlds (introduced by symmetries or quasi-symmetries [Ref. 2]) with any *physical* stuff whatsoever. Don't try to explain the **self-acting** faculty of 3-D space with the physical, "colorizable projections" that can only show up with positive energy density. You will be baffled by the driving force of the cosmological time arrow [Ref. 1] and the cosmological "constant" problems *forever* (cf. Amedeo Balbi), or at least until you quietly retire.

D.C.

January 27, 2010

Last update: February 2, 2010

[Ref. 1] T. Padmanabhan, Why Does the Universe Expand? [arXiv:1001.3380v1](https://arxiv.org/abs/1001.3380v1) [gr-qc]

<sup>2</sup> The phrase 'cosmological arrow of time' means different things to different people; I will use it in the sense that  $a(t)$  being a monotonic function of  $t$  with  $\dot{a} > 0$ , gives a direction for  $t$  from the evolution of  $a$ .

[Ref. 2] J. L. Jaramillo, E. Gourgoulhon, Mass and Angular Momentum in General Relativity, [arXiv:1001.5429v1](https://arxiv.org/abs/1001.5429v1) [gr-qc]. To appear as proceedings in the book "Mass and Motion in General Relativity", eds. L. Blanchet, A. Spallicci and B. Whiting

p. 6: "Once the non-local nature of the gravitational energy-momentum and angular momentum is realised, the conceptual challenge is translated into the manner of determining the appropriate physical parameters associated with the gravitational field in an extended region of spacetime. An unambiguous answer has been given in the case of the total mass of an isolated system. However, the situation is much less clear in the case of extended but finite spacetime domains.

"In a broad sense, existing attempts either enforce some additional structure that restricts the study to an appropriate subset of the solution space of General Relativity, or alternatively they look for a genuinely geometric characterisation aiming at fulfilling some expected **physical** requirements. In

this article we present an overview of some of the relevant existing attempts and illustrate the kind of **additional** structures they involve.

...

pp. 9-10: "The characterisation of an isolated system in General Relativity aims at capturing the idea that spacetime becomes flat when we move sufficiently far from the system, so that spacetime approaches that of Minkowski. However, the very notion of far away becomes problematic due to the absence of an a priori background spacetime. In addition, we must consider different kinds of infinities, since we can move away from the system in space-like and also in null directions. Different strategies exist in the literature for the formalization of this asymptotic flatness idea, and not all of them are mathematically equivalent. Traditional approaches attempt to specify the adequate fall-off conditions of the curvature in appropriate coordinate systems at infinity. (...) The whole picture is inspired in the structure of the conformal compactification of Minkowski spacetime.

...

pp. 35-36: "But it must be acknowledged (...) that the status of the quasi-local mass studies is in a kind of post-modern situation in which the devoted intensive efforts have resulted in a plethora of proposals with no obvious definitive and entirely satisfying candidate.

...

"The moral of the whole discussion in this article is that the formulation of meaningful global or quasi-local mass and angular momentum notions in General Relativity **always** needs the introduction of some **additional** structure in the form of symmetries, quasi-symmetries or some other background structure."

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**Note 2:** Recently, J. M. Pons, D. Salisbury, and K. Sundermeyer (PSS) tried to solve the paradoxes of "frozen time" and "nothing happens" ([arXiv:1001.2726v1 \[gr-qc\]](https://arxiv.org/abs/1001.2726v1)), stressing the difference b/w the gauge generator and the Hamiltonian (p. 5):

"These gauge transformations define equivalence classes within  $S$ , which we call gauge orbits. A gauge orbit represents a unique physical state (footnote 5), and its different points correspond to different coordinatizations.

--

Footnote 5: "Note that this state is **the whole spacetime**."

"... in the space of on-shell field configurations the gauge generator moves from one point  $p$  to another  $p'$ , whereas the Hamiltonian works within every point  $p$ , which already represents **an entire spacetime** (emphasis added - D.C.)."

In another paper ([arXiv:0902.0401v1 \[gr-qc\]](https://arxiv.org/abs/0902.0401v1), p. 4), PSS illustrated their ideas with a "spatially homogeneous isotropic cosmological model", and acknowledged that "this model possesses the curious property that the only physical variable that changes **in time is time itself!**" (emphasis added - D.C.).

Which makes this "time" unobservable, or rather 'observable only with respect to itself'. Pity PSS didn't ask [Karel Kuchar](#) to comment on their speculations, nor mentioned the new dynamics of 3-D space due to its "dark" energy acting on **the whole spacetime** *en bloc*.

When will the [Hamiltonian formulation of GR](#) address this task? When pigs fly.

D.C.

January 31, 2010

=====

Subject: The schizophrenic behavior of gravity (SBG)

Date: Tue, 9 Feb 2010 05:16:20 +0200

From: Dimi Chakalov <dchakalov@gmail.com>

To: Nikolai Mitskievich <nmitskie@gmail.com>

Cc: kip@tapir.caltech.edu, weinberg@physics.utexas.edu, [LSC Spokesperson](#) <reitze@phys.ufl.edu>, [Beverly Berger](#) <bberger@nsf.gov>, [Tom Carruthers](#) <tcarruth@nsf.gov>, [Denise S Henry](#)

<dshenry@nsf.gov>, [Ramona Winkelbauer](mailto:Ramona.Winkelbauer@nsf.gov) <rwinkelb@nsf.gov>, GW\_comp@olegacy.gsfc.nasa.gov

Dear Dr. Mitskievich,

I think you shouldn't regret that you missed the chance to educate Kip Thorne [[Ref. 1](#)] about the inevitable failure of his LIGO project and the whole "GW astronomy". Arguments similar to yours have been spelled out by Steven Weinberg seven years ago (25 Feb 2003), after which he added: "I often find that people who say silly things actually do correct calculations, but are careless in what they say about them."

Not just Kip Thorne, but the whole LIGO Scientific Collaboration (LSC) are saying silly things, but because they use the linearized approximation of GR, they do "correct calculations".

However, if you use the same linearized approximation of GR, you can prove "GW astronomy" wrong by *reductio ad absurdum*:

<http://www.god-does-not-play-dice.net/Szabados.html#SBG>

Either way, with GR or with its linearized approximation, LIGO is for the birds.

Trouble is, some people from NSF continue to dump hundreds of million U.S. dollars -- all taxpayers' money -- into this GW nonsense.

Typical for a socialist country.

Yours sincerely,

Dimi Chakalov

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[Ref. 1] Nikolai V. Mitskievich, On a new category of physical effects, arXiv:1002.1421v1, <http://arxiv.org/abs/1002.1421>

"The gravitational deformation in general relativity does in fact belong to the kinematic effects, when it is described without the use of geodesic deviation equation. Thus, for example, the interferometric detection of gravitational waves cannot give a non-zero result, since the scales of all types of equally oriented lengths do change in gravitational fields in the same proportion, and the numbers of light wavelengths fitting along the alternative arms of interferometer cannot suffer changes in a passing gravitational wave.

"I am regretful not to tell these considerations to Kip S. Thorne more than two decades ago, simply because of a kind of awkward modesty."

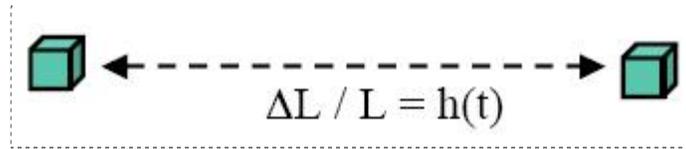
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Note: See what happens if you don't tell your students [everything you know](#).

Example: Jim Hartle. Recently, a young theoretical physicist, Gareth Jones, defended his [Ph.D. Thesis](#) on "Searching for gravitational waves... ". He looked at Ch. 23 from Jim Hartle's textbook, "Gravity, an introduction to Einstein's General Relativity", to eventually understand the dimensionless GW amplitude (Eq. 1.64, [p. 15](#)) that would "cause a periodic strain (i.e., stretching and contraction) of the proper distance between points (Sic! - D.C.) in spacetime" (*ibid.*, [p. 182](#)).

But you can't hide the *dimensionality* of GW amplitude in 3-D space: check out SBG [here](#). In order to prove LSC (at least [679](#) people) **wrong**, all you need is to drive the "background" in the linearized approximation of GR to its absurdity, as with the [SBG argument](#). Not sure?

Please explain the *dimensionality* of GW amplitude (h) in Kip's mantra:



Something with [\[meter\]](#) maybe? Or some "creative analogies" from [EM radiation](#)?

If you look at [Wiki](#), GW amplitude "is not the quantity which would be analogous to what is usually called the amplitude of an electromagnetic wave (...)."

The alleged GW has frequency, [wavelength](#), and speed -- all defined with proper dimensionality. Only the *action* of geometry on matter, embodied in the mantra above, is a dimensionless **ghost** that shows up only with ... "2.3×10<sup>-26</sup>" , say.

How can Gareth Jones change his Ph.D. brain, to think as a physicist? Surely the entity that fixes a 'meter' cannot itself be defined with what it *produces* -- a 'meter'. Can he notice the intrinsic parapsychology of statements like "our best (lowest) upper limit on [gravitational wave amplitude](#) is 2.3×10<sup>-26</sup>" ?

I think Jim Hartle (along with [Bernie Schutz](#)) should be blamed for Gareth Jones' professional career. It may be wasted by chasing **ghosts** with real, [taxpayers' money](#).

In my opinion, the "dimensionality" of GW amplitude is just like that of quantum waves. And just like the de Broglie waves (cf. Franco Selleri [above](#)), in [present-day GR](#) these GWs cannot show up either, simply because they cannot transport energy-momentum to any physical system in the [spacetime of GR textbooks](#).

Neither quantum waves (recall the [quantum vacuum](#)) nor gravitational waves are "empty" by themselves. Pity [nobody cares](#).

D.C.

February 10, 2010

Last update: March 17, 2010

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Subject: Re: The schizophrenic behavior of gravity (SBG)

Date: Tue, 2 Mar 2010 04:55:21 +0200

Message-ID:

<bed37361003011855j1eb9c7f1rca2fa10ef89ac6c1@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: kip@tapir.caltech.edu, weinberg@physics.utexas.edu, marx\_j@ligo.caltech.edu, bberger@nsf.gov, tcarruth@nsf.gov, dshenry@nsf.gov, rwinkelb@nsf.gov, GW\_comp@olegacy.gsfc.nasa.gov, takahasi@th.nao.ac.jp, matthew@astro.gla.ac.uk, gareth.jones@astro.cf.ac.uk, [Curt.J.Cutler](#)@jpl.nasa.gov, [vallis](#)@vallis.org, sigg\_d@ligo.caltech.edu, Holger.Pletsch@aei.mpg.de, Bruce.Allen@aei.mpg.de, [bernard.schutz](#)@aei.mpg.de, info@ligo.caltech.edu, LSC Spokesperson <reitze@phys.ufl.edu>, IGUS Jim <hartle@physics.ucsb.edu>

P.S. Update at

<http://www.god-does-not-play-dice.net/#Jones>

D.C.

=====

Subject: [arXiv:1002.1410v1 \[quant-ph\]](#)  
Date: Tue, 9 Feb 2010 05:57:41 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Ronnie Hermens <ronnie.hermens@gmail.com>  
Cc: landsman@math.ru.nl, maassen@math.ru.nl

Dear Mr. Hermens,

It is a real pleasure to read your Thesis.

Just a brief comment. You wrote (p. 46): "The claim of Meyer that the Kochen-Specker Theorem has been nullified leads to the question what it is exactly that the Kochen-Specker Theorem states. A common notion is that the theorem states that (at any given time) not all observables can be assigned definite values that are independent of the measuring context."

Long before John Bell, Schrödinger explained the crux of the matter (November 1950),

<http://www.god-does-not-play-dice.net/#NB>

<http://www.god-does-not-play-dice.net/Szabados.html#Hilbert>

I suppose none of your senior colleagues have mentioned to you anything about my numerous email messages, with links to my web site. And that is **not** fair.

If I'm wrong about them, please write me back.

Kindest regards,

Dimi Chakalov

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**Note 1:** All kids, Ronnie Hermens included, have the right to know everything we know. This doesn't mean that they should accept our opinions. But in order to make educated decision about their professional career, we should kindly offer them all our knowledge and opinions. Otherwise it's just not fair.

Ronnie, here's a story from Uncle Dimi. Suppose you're in a pitch dark room. You hold a torch in your hand, but want to "see" how *the darkness itself* looks like *before* you observe it with the torch. As you might have guessed, 'the darkness itself' stands for the 'UNdecidable quantum potential reality' that cannot be fitted into [any Hilbert space whatsoever](#); more from [Uncle John](#).

Obviously, your task is not feasible. With your torch, you can only "see" the **classical presentations** of 'the dark room', which have been "filtered" through the classical spacetime at the scale of tables and chairs. So, what do you do? You use some QM textbook recipes for calculating probabilities for observing the dark room with your torch. NOT *the dark room itself*. And if you "look" with Hilbert space with dimensions 2, you may never notice any problems with your torch observations, as you can always **infer** what sorts of objects *should have been* in the dark room, *before* you turned on the torch and brought them into the classical spacetime of tables and chairs (recall the "[quantum computing](#)" mess).

The real fun with QM starts when [KS Theorem](#) comes to play: your torch observations do not make sense. You cannot **infer** anymore what kinds of objects *should have been* in the dark room *before* you turned on the torch. (In the context of "[quantum computing](#)", quantum states **both** 'partly exist' as context-evoked latent observables **and** 'partly do not exist', being UNdecidable quantum state (never in plural) **as well**. It's an "eigentümlichen, klassisch nicht beschreibbaren" (W. Pauli), *indivisible* bundle of 'both [ONE](#) and many'. Capiche?)

The essential ONE-"part" from the objects in *the dark room* will always remain unaccounted for. You can say NOTHING about it. It is UNSpeakable. You just can't fit it into *any* Hilbert space on which you make your torch observations. It is the ultimate quantum reality 'out there', which I simply call '[potential reality](#)'.

You can say **nothing** about it, because *any* statement of yours refers exclusively to what you can "see" with your torch. This is my answer to your question "what it is exactly that the [Koehen-Specker Theorem](#) states", as [you put it](#).

Your mentor, Nicolaas Landsman, has tried some [toposification](#) of quantum theory, but notice that this is [just another torch](#). [Chris Isham](#) also plays with that topos torch. Other people try another, '[non-commutative spacetime](#) torch'.

The math jungle is staggering. Don't go there, it's endless. How do I know?

Because there is only **one** way to solve *both* the measurement problem of QM *and* the [cosmological "constant" problem](#). Both problems, *en bloc*. Just recall the basic tenet of Copenhagen [[Ref. 1](#)], and compare it with the interpretation of QM discussed [here](#) and the [arrow of spacetime](#): the instantaneous state of Die Bahn (trajectory) of all physical objects, at [all length scales](#), is nothing but the *local mode* of spacetime, as it evolves from "point" A to "point" B, following the [expansion of space](#) due to the "dark" energy of the vacuum.

Locally, Die Bahn [[Ref. 1](#)] is like a [single flash](#) or "point" with infinitesimal duration. The whole 'local mode of spacetime' is comprised of such [already-correlated](#) "points" with infinitesimal duration, all of which are explicated with a *carpe diem* **unit probability**, in line with the [PR interpretation of QM](#). If you can imagine an instantaneous cross-section of the arrow of spacetime, the *local mode* will be a frozen flat 3-D space with total gravitational energy [precisely zero](#) (see [above](#)): the *potential reality* itself (the infinite "shop", see below) does **not** gravitate (cf. "[yes you can](#)"). Any of these 3-D "snapshots" constitutes a legitimate 'universe' by itself, but as the arrow of spacetime "moves" forward, [we are led to consider a chain of such snapshots](#), and then it looks like the universe is somehow '[acting upon itself](#)', because the "dark gaps" from the *global mode* are *precisely sealed off*, making the local mode a *perfect continuum* (notice the *emergence* of "waves" [below](#)). Of course we cannot locate the *source* of this "dark energy", call it **X**, *inside* the very thing that is being produced by **X**: the 3-D space of the *local mode* of spacetime. Which is why some (otherwise serious) people called it "[dark](#)", while [other](#) speculate about some mysterious "[dark flow](#)" and "[axis of evil](#)", as pictured [here](#).

A few days ago, I tried to explain Die Bahn [[Ref. 1](#)] to my [teenage daughter](#) (she is the 'test bed' for my [DVD video tutorials](#)) as follows. Picture the [quantum vacuum](#) as an infinitely "large" cash-and-carry shop, from which you can get everything and anything (that caught her attention, as expected). You buy some stuff for your diet, but you can shop (i) [only](#) if you're "[off the train](#)", and (ii) only for [your one-day](#) meal. This 'one-day meal' is just one **point** from a perfectly legitimate universe -- the *local mode* of spacetime at the **global** instant 'now'.

Such "horizontal" cross-section of the arrow of spacetime takes only one *sliding* point 'now' from the ("vertical") arrow of spacetime. But because you [inevitably chain](#) your 'daily points' along a [perfectly continuous trajectory](#) (the "dark gaps" of the global mode of spacetime are completely sealed off due to '[the speed of light](#)'), you get an *emergent* Bahn with 'potential future' and 'irreversible past', as it [emerges](#) due to the arrow of spacetime, while the infinite shop, with all its ([latent](#)) stuff that you did **not** buy, will always remain "dark".

Imagine also that every day you're buying *more* stuff: if some theoretical physicists compare *only* your daily meals during a week (they can't glance at the "dark gaps"), they will claim that you've been getting 'more stuff' throughout the whole week from some "dark source". (If they include the infinite shop in their calculations, they will inevitably face their [cosmological "constant" paradox](#).)

Also, notice that all people in the universe are shopping from the same "dark shop": they shop for their 'one-day meal' to cook up their common 'local mode of spacetime', but have to do it *relationally* (there is [no background whatsoever](#) in the local mode of spacetime), and also in a [pre-correlated](#) (EPR-like) fashion, in line with the Bootstrap Rule 'think globally, act locally'. The result is a ([quantum-gravitational](#)) **wave** of [pre-correlated](#) 'one-day meals' that also [emerges](#) during Die Bahn. Nothing is "[waving](#)" to emit these waves. They just *emerge*. [Capiche?](#)

Okay, let me try it this way. Do you remember how we played Frisbee on the beach? That poor Frisbee was too large and heavy to take advantage of its potential UNdecidable [KS states](#), and since it also managed to ignore the effects of gravity, we could imagine some fictitious "fixed grid" (Minkowski spacetime) on which we can draw its Bahn. Had the Frisbee been a quantum-gravitational object, it would have all its instantaneous one-point "meals" correlated (recall the [two hands](#)) with 'everything else in the universe' ("[off the train](#)", in the *global mode* of 'the Frisbee *per se*'). Then the

real Frisbee would be flying like a fish from a [correlated shoal of fish](#), only you can't see the rest of fish from the shoal, and therefore can't see its *wave-like* movement, like the waves of the correlated centipede's legs. Simple, no?

I didn't try to explain why LSC may only unravel the blueprints from *relic* GWs cast in the distant past, but cannot *observe* 'the *emergent* wave' [online](#), as it evolves along the arrow of spacetime. That would have been too much for her.

Finally, notice that if you take the whole stack of "[Photoshop layers](#)" (all your 'one-day meals') and **flatten** them onto one (.JPG) image, you will end up with a [timeless "trajectory"](#) immersed in a dead frozen 4-D "block universe", in which "time" can evolve just as much as "space" can: "There is no dynamics *within* space-time itself: nothing ever moves therein; nothing happens; nothing changes" ([R. Geroch](#)). Our ([mischievous](#)) wristwatches do in fact read the global cosmological time of 'Die Bahn', but because you can only use a physical "[torch](#)", you are deceived by a **flatten image** of all 'one-day meals': in Fig. 1 below, there are three consecutive 'one-day meals' or "points" from Frisbee's trajectory, connected **by** the **pre-geometric plenum**, while Fig. 2 shows the stack of "[Photoshop layers](#)" consisting of three different, **re-created** 4-D universes in their *local mode*, as they evolve along *Die Bahn* (the red arrow of spacetime, **w**). The [quantum-and-gravitational waves](#) "travel" along **w** (Fig. 2), which is why they cannot be detected on the flatten image (Fig. 1): regarding GWs, the linearized approximation of GR is a "shadow without power" ([Hermann Weyl](#)).

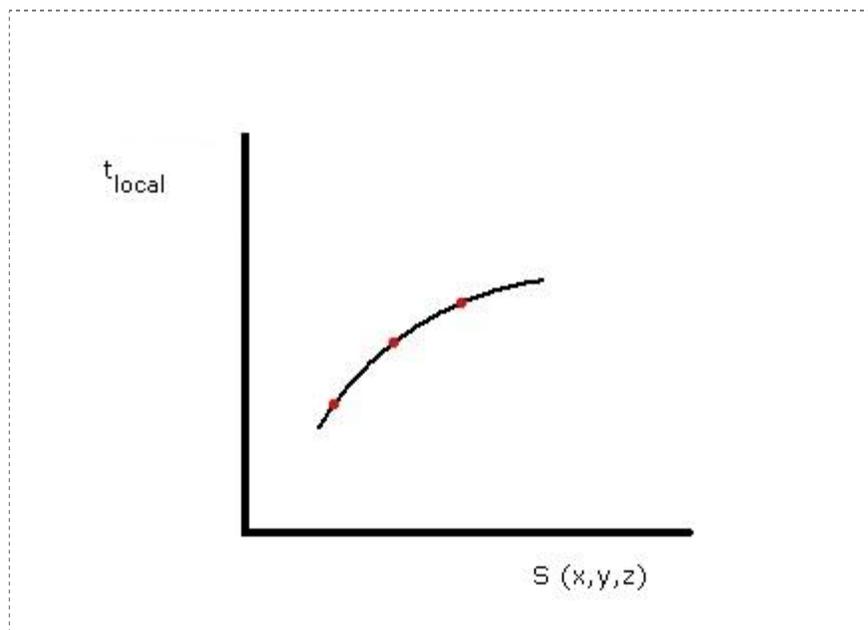


Fig. 1

[Notice the misleading "dark" energy and "curvature" of spacetime](#)

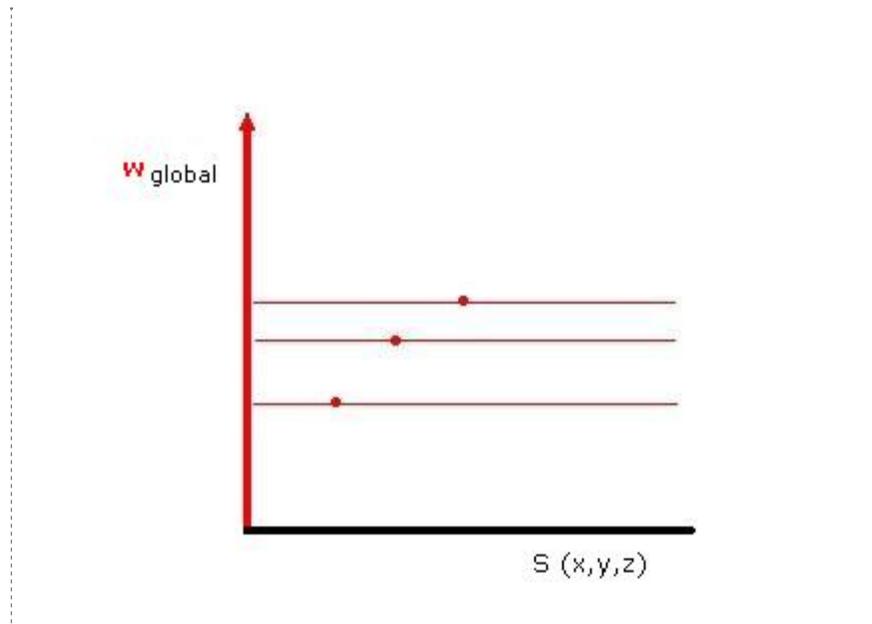


Fig. 2

Notice the three **red** 'one-day meals', or three 'sayings', being connected by the pre-geometric plenum; its quantum version is the UNdesirable KS state. In GR, the pre-geometric plenum "connects" all points from the local mode of spacetime with 'the undivided universe as ONE', which is being multiplied as *infinitely many* points in the local mode.

With the current GR and diff geometry textbooks, you can explore only *one* instant 'now' from the arrow of spacetime. Even if you try to introduce some "infinitesimal coordinates shift" [Ref. 2, Eq. 4.1], as in today's GR textbooks, you will nevertheless be dealing with a frozen *one-instant* "trajectory", and can never solve the Cauchy problem for the Einstein equations: the "dark background" of 'the reference fluid' of GR is missing from GR textbooks. You can use such 'calculated-from-one-instant trajectories' only in classical physics and STR (e.g., the trajectory of a Frisbee, calculated from some of its instantaneous states).

To resolve the genuine dynamics of GR, we need to make the 3-D space dynamical: the global cosmological time originates from the dynamics of space. First of all, we have to replace the familiar expression 'with respect to the rest of the Universe' [ibid., p. 263] with a Machian "absolute" reference frame, which works as 'the reference fluid' of GR -- the global mode of spacetime. Recall also the idea of "breathing" (inhaling/exhaling) Universe, and imagine the elementary step/cycle of the arrow of spacetime (cf. Fig 2 above) as the "negotiation" of the two hands in Escher's drawing below: an inhaling ("offer") quantum-gravitational wave is being emitted in the *global mode* of spacetime from each and every "point" from the local mode, followed by an exhaling ("confirmation") quantum-gravitational wave converging on the **next** point from the **next** horizontal layer.

What is the duration of this "breathing" cycle in the local mode of spacetime? **ZERO**. This is the meaning of the phrase 'Your Global Time is **ZERO**'. The local mode of spacetime is a *perfect continuum*. But that's too much for you, isn't it?

D.C.

February 10, 2010

Latest update: March 30, 2010

Tuesday, March 30th, 2010  
 Your Local Time: 27 minutes past 7 P.M.  
 Your Global Time is **ZERO**

[Ref. 1] W. Heisenberg (23 March 1927): "Die Bahn entsteht erst dadurch, daß wir sie beobachten",

in: Über den anschaulichen Inhalt der quantentheoretischen Kinematik und Mechanik, *Z. Phys.* 43, 172-198 (1927).

[Ref. 2] Patrick Marquet, The Generalized [Warp Drive](#) Concept in the EGR Theory, *The Abraham Zelmanov Journal*, vol. 2 (2009) 261-287.

<http://zelmanov.ptep-online.com/html/zj-2009-12.html>  
<http://zelmanov.ptep-online.com/papers/zj-2009-12.pdf>

p. 263: "The principle of space travel while locally "at rest", is analogous to galaxies receding away from each other at extreme velocities due to the expansion (and contraction) of the Universe.

"Instead of moving a spaceship from a planet A to a planet B, we modify the space between them. The spaceship can be carried along by a local spacetime "singular region" and is thus "surfing" through space with a given velocity with respect to the rest of the Universe.

.....

§1.2.1, 'The (3+1) Formalism: the Arnowitt-Deser-Misner ([ADM](#)) technique'

p. 265: "In 1960, Arnowitt, Deser, and Misner [5] suggested a technique based on decomposing the space-time into a family of space-like hypersurfaces and parametrized by the value of an arbitrarily chosen time coordinate  $x^4$ .

"This "foilation" displays a proper-time element  $d\tau$  between two **nearby** (emphasis added - D.C.) hypersurfaces labelled  $x^4 = \text{const}$  and  $x^4 + dx^4 = \text{const}$ . The proper-time element  $d\tau$  must be proportional to  $dx^4$ .

.....

p. 267: "The main advantage of the ADM formalism is that the time derivative is **isolated** (emphasis added - D.C.) and it can be used in further specific computations.

.....

p. 275: "This horizon first appears for the occupants of the spaceship, who are unable to "see" beyond the distortion, and therefore cannot communicate with the outer universe.

.....

p. 280: "Let us consider the infinitesimal coordinates shift

$$x'^a = x^a + N^a, \quad (4.1)$$

=====

Subject: The infinitesimal coordinates shift -- with respect to 'the rest of the Universe'

Date: Fri, 19 Mar 2010 14:31:11 +0200

From: Dimi Chakalov <dchakalov@gmail.com>

To: Patrick Marquet <patrick.marquet6@wanadoo.fr>

Cc: Larissa Borissova <borissova@ptep-online.com> ,

Tatyana Shestakova <shestakova@phys.rsu.ru> ,

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Serge Krasnikov <gennady.krasnikov@pobox.spbu.ru> ,

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[Miguel Alcubierre](#) <malcubi@nuclecu.unam.mx> ,

Michael Pfenning <mitchel@cosmos2.phy.tufts.edu> ,

Larry Ford <ford@cosmos.phy.tufts.edu> ,

Allen Everett <everett@cosmos2.phy.tufts.edu> ,

William A Hiscock <hiscock@physics.montana.edu> ,

Chris Van Den Broeck <vdbroeck@nikhef.nl> ,

Thomas A Roman <roman@ccsu.ctstateu.edu> ,

Robert M Wald <rmwa@midway.uchicago.edu> ,

Robert Geroch <geroch@midway.uchicago.edu>

Dear Professor Marquet,

I greatly admire your Extended formulation of GR ([EGR](#)), particularly the so-called "residual" (true) field tensor. Yet it seems to me that the infamous "infinitesimal coordinates shift" in ADM presentation, which you used in your latest article cited below, is seriously flawed, as hinted in the subject line.

As an alternative to ADM speculations, please see

<http://www.god-does-not-play-dice.net/#Bahn>

Details at

<http://www.god-does-not-play-dice.net/#quiz>

I will highly appreciate your professional comments, as well as the feedback from your colleagues.

Kindest regards,

Dimi Chakalov

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Patrick Marquet, The Generalized Warp Drive Concept in the EGR Theory, The Abraham Zelmanov Journal, vol. 2 (2009) 261-287; cf. Eq. 4.1.

<http://zelmanov.ptep-online.com/html/zj-2009-12.html>

=====

Subject: Re: PTI, by Ruth Kastner  
Date: Fri, 5 Mar 2010 04:54:05 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Ruth <rkastner@umd.edu>, John <jcramer@uw.edu>  
Cc: Adrian Kent <a.p.a.kent@damtp.cam.ac.uk>,  
Joseph Berkovitz <dwyer@umbc.edu>,  
Tim Maudlin <maudlin@rci.rutgers.edu>,  
Huw Price <huw@mail.usyd.edu.au>,  
Jeremy <jb56@cam.ac.uk>,  
Sergiu Klainerman <seri@math.princeton.edu>,  
Sergio Doplicher <dopliche@mat.uniroma1.it>

Dear Ruth,

You said (Feb 16th) that "will take a look" at my note on KS Theorem, yet in your latest [arXiv:1001.2867v3 \[quant-ph\]](#), co-authored with John Cramer, there is not even a hint to it.

Regarding the UNabsorbed offer wave, you and John argued (footnote 9) that "it is the uncommitted (to a particular basis) nature of the offer wave which gives it its flexibility and thus its ability to explore "all possibilities at once." "

How would you (and John) tackle these 'all possibilities at once' if they pertain to the UNdecidable KS state? How can you, or anyone else, derive the Born Rule in the case of KS state?

Can you possibly derive \*anything\* resembling 'probabilities' in the case of KS state?

<http://www.god-does-not-play-dice.net/#KS>

I will appreciate the opinion of your colleagues as well.

All the best,

Dimi

On Tue, Feb 16, 2010 at 9:04 PM, <rkastner@umd.edu> wrote:

>  
> Thanks Dimi! I will take a look.  
>  
> Best  
> Ruth  
>

=====

Subject: Re: PTI, by Ruth Kastner  
Date: Fri, 5 Mar 2010 14:43:10 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Ruth <rkastner@umd.edu>  
Cc: John <jcramer@uw.edu>

On Fri, Mar 5, 2010 at 8:03 AM, <rkastner@umd.edu> wrote:

>  
> OK, it's the [Peres-Mermin](#) version of KS.

Excuse me?

I wrote: "Nothing -- not even some "contextuality" -- can save Harry (or Dick, or Tom) from the case in which he (or Dick, or Tom) **must not** possess any hands."

And also: "NB: There is nothing "probabilistic" or "stochastic" in the quasi-local UNdecidable quantum state that *neither* 'is' *nor* 'is not'. Can't fit it in any Hilbert space."

> This is similar to the GHZ example, These are all "no hidden variables" proofs.

It isn't about "hidden variables" of any kind whatsoever. It is about how TI/PTI would address this KS state: please read my email from [Fri, 5 Mar 2010 04:54:05 +0200](#).

> I certainly did read this when you first sent it to me, as I said that I did

Then please prove my interpretation wrong:

<http://www.god-does-not-play-dice.net/#KS>

John: Would you please help Ruth?

D.

-----  
Subject: Footnote 15, [arXiv:1107.1678v1 \[quant-ph\]](#)

Date: Mon, 11 Jul 2011 13:01:31 +0300

Message-ID:

<CAM7EkxkHd9-O6WROr=xW02LX=dvHkVNpwfcsjZWM5Q5Gb3Br2w@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Ruth <rkastner@umd.edu>

Cc: Huw Price <huw@mail.usyd.edu.au> ,

John <cramer@phys.washington.edu> ,

Tim Maudlin <maudlin@rci.rutgers.edu> ,

Abner Shimony <abner.shimony@gmail.com> ,

Philip Pearle <ppearle@hamilton.edu> ,

Peter Evans <peter.evans@sydney.edu.au>,  
avshalom.elitzur@weizmann.ac.il

It won't work for GR, Ruth.

The "infinite" velocity of the "phase wave aspect" corresponds to the \*global mode of time\* in which the "talk" b/w matter and space "take place": "Space acts on matter, telling it how to move. In turn, matter reacts back on space, telling it how to curve" (John Wheeler),

<http://www.god-does-not-play-dice.net/Esher.jpg>

Physically, we observe a continuum of 'end results' (local mode of time) from this "talk"; details at

<http://www.god-does-not-play-dice.net/#Evans>

Check out the UNSpeakable substance of spacetime with your own brain at

[http://www.god-does-not-play-dice.net/#Leydesdorff\\_101](http://www.god-does-not-play-dice.net/#Leydesdorff_101)

All the best,

Dimi

-----  
Tuesday, March 30th, 2010  
Your Local Time: 27 minutes past 7 P.M.  
Your Global Time is ZERO

**Note:** Nothing in the *local mode* of spacetime can (nor have to) *wait* "... **until** the conserved quantities are transferred and the potential quantum event becomes real", as [John Cramer](#) put it.

We see only the end result from already-completed *atemporal* "handshaking" transactions, and of course we cannot trace **it** "back" to the *global mode* of spacetime -- all the negotiations between the offer-and-confirmation wave **is** one single *event* in the local mode of spacetime. In the local mode of spacetime, its "duration" is **zero** -- just like the proper time of photon's flight "between" its emission-and-absorption; see [Kevin Brown](#).

In the *local mode* of spacetime, all this "happens" over a "**point**". Which is why there is no "source" of the quantum-gravitational waves that is "waving", as stressed by [Anthony Zee](#).

The second case of fixing the physical constituents at *this same* "point" concerns GR: we need to examine the "negotiations" of matter and geometry, which also "take place" in the *global mode* of spacetime: "Space acts on matter, telling it how to move. In turn, matter reacts back on space, telling it how to curve" ([John Wheeler](#)).

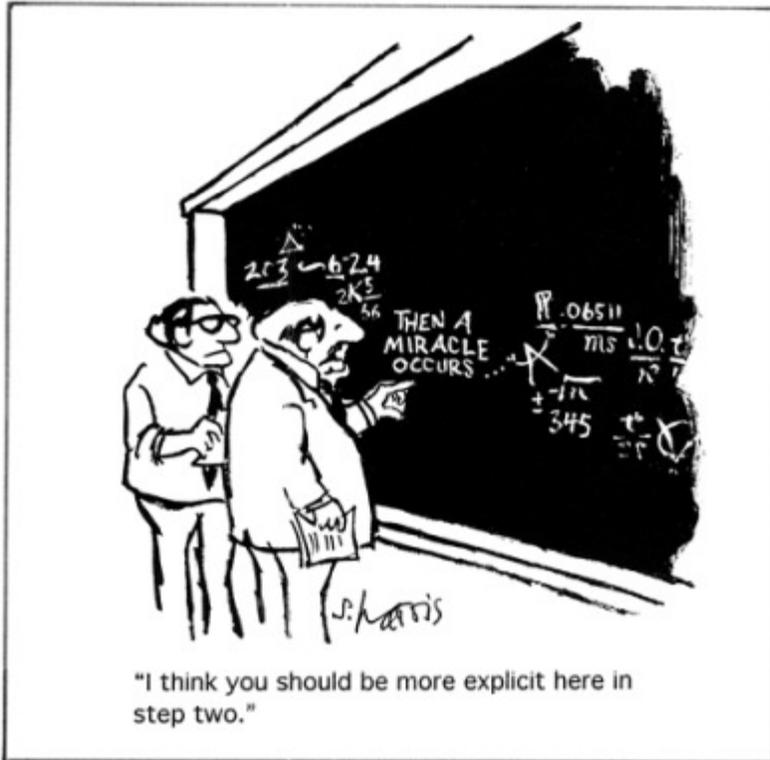
In GR, the offer-and-confirmation wave pertains to the "dipole radiation", and as it "converges" on the **next** point from Die Bahn above, it fixes the **positivity** of mass in the local mode of spacetime. According to [RSP](#), we can imagine "two" such waves only in the global mode, as they "run" in two opposite "directions": from the macro-world of classical mechanics toward **S** and **L**, and *vice versa*.

In my (perhaps very biased) opinion, these "two" (offer and confirmation) waves should determine the instantaneous inertial reaction "forces" as well. Currently, GR says nothing about the origin and mechanism of (Machian) inertial "forces".

Nobody likes "miracles" in GR, so I very much hope we can find 'the *right* answer to the *right* question', to paraphrase [MTW, p. 467](#), and understand the origin of inertia and the affine structure of space.

Regarding the geodesic hypothesis, [Alan Rendall](#) acknowledged: "In elementary textbooks on general

relativity we read that the Einstein equations imply that small bodies move on geodesics of the spacetime metric. It is very hard to make this into a mathematically precise statement which refers to actual solutions of the Einstein equations (and not just to some formal approximations)." Notice that [Alan Rendall](#) didn't even mention those 96% of the stuff in the universe, which is "dark" and moves on some weirdly modified geodesics.



Yes, Sidney Harris is right: the **re**-creation of the local mode of spacetime, along the [arrow of spacetime](#), does look like a "**miracle**", perhaps because we know nothing about the so-called 'speed of light' that is **hiding** the *global* mode from any direct view from the *local* mode. All we can observe is 'the world of *facts*' with unit probability, which has **already**, *post-factum* being cast in the past, as in the example with the [Sun](#): we cannot observe the actual state of the Sun, but only its state that has been 'actual' some 8 min *before* we looked at the Sun.

The local mode of spacetime is a perfect continuum, because the "dark gaps" from the global mode are *completely* sealed off by the so-called 'speed of light'. We also have a pocket of propensity-states (KS states; see [below](#)) to choose from, which *cannot* be fully derived from our past only -- this is the lesson from the [Free Will Theorem](#). Sorry for repeating this all over again.

D.C.  
 March 5, 2010  
 Last update: March 30, 2010

=====

Subject: Question 1 (existence): Does there exist any [smoothness structure](#) on \*any\* topological manifold?  
 Date: Tue, 30 Mar 2010 04:52:54 +0300  
 From: Dimi Chakalov <dchakalov@gmail.com>  
 To: Torsten Asselmeyer-Maluga <torsten.asselmeyer-maluga@dlr.de>  
 Cc: Carl H Brans <brans@loyno.edu>,  
 Helge Rose <rose@first.fhg.de>

Dear Dr. Asselmeyer-Maluga,

Regarding your latest [arXiv:1003.5506v1 \[gr-qc\]](https://arxiv.org/abs/1003.5506v1) and the [footnote on p. 3](#) from your book with [Dr. Brans](#), may I offer you my views on the subject at

<http://www.god-does-not-play-dice.net/#Bahn>

Should you or your colleagues have questions, please don't hesitate.

Kindest regards,

Dimi Chakalov

---

**Note:** Let me quote from Robert Wald's [arXiv:gr-qc/0511073](https://arxiv.org/abs/gr-qc/0511073), "Teaching General Relativity", p. 5 (emphasis added): "First, one needs a mathematically precise notion of the "set of points" that constitute spacetime (or that constitute a surface in ordinary geometry). The appropriate notion is that of a manifold, which is a set that (...) but has no metrical or other structure. The **points** of an n-dimensional manifold can thereby be labeled *locally* by coordinates ... ."

This last sentence is a total Jabberwocky. How did we get these "points" that can be "labeled *locally* by coordinates", such that we can, and also *have to*, [shuffle](#) these coordinates to extract some [GR observables](#)?

Contemporary relativists begin by postulating a Hausdorff topological space that has been somehow "[connected](#)", but usually mention this miracle in footnotes (e.g., Chris Isham, *Modern Differential Geometry for Physicists*, [p. 61](#), footnote 1). They would denote this *connected* topological space with  $\mathbf{M}$ , and introduce a second postulate: a *differential structure* on  $\mathbf{M}$ , such that  $\mathbf{M}$  is promoted to a four-dimensional manifold. Then the third step is obvious: introduce a metric, and they are ready to [teach GR](#) (cf. Diego Meschini *et al.*, [Sec. 2.1](#)) and muse over the [exotic differentiable structures](#) and the puzzle posed by [Carl Brans](#):

$\text{topological space} \xrightarrow{??} \text{smooth manifold}$

Perhaps one first needs a mathematically precise notion of the "set of points" that constitute a [line \(1-D Euclidean space\)](#), to elucidate how these "points" are [connected](#) in such way that [the law of continuity](#), as defined in the standard calculus texts of the 1800's, is fully obeyed: the consecutive points of the same line should *succeed* each other without *any* interval or 'point in-between' them.

However, how should the topological space *itself* be "connected", in order to evolve into a *perfectly smooth* manifold? Specifically, does there exist *any* 'smoothness structure' on *any* topological manifold? I'm not aware of such beast in differential topology textbooks; hence my email [above](#).

But here's the catch: on the one hand, the 'point-connecting agent' (called here [pre-geometric plenum](#)), which makes a Hausdorff topological space "[connected](#)", must not be *anything* that may, in **any** imaginable way, exist within the [line](#) made by "zero-dimensional" points. It can't be some "special middle point" or "special separating interval", because inside a [line](#) we have only points, and *nothing* but points. These points don't have any special hooks or handles that can determine the principle of locality and the so-called "[speed](#)" of light.

On the other hand, the [pre-geometric plenum](#) must somehow exist in order to "separate" the points and preserve their individual, albeit fleeting, physical content: "For example,  $\phi$  is a scalar field on the manifold and  $x$  represents the space-time coordinate of a particle, then although  $\phi(x)$  has no physical meaning (if  $x$  is a point in the space-time manifold) nevertheless  $\phi(X)$  *does* have a meaning: ie you can talk in a Diff(M)-invariant way about the value of a field where a particle 'is', and similarly for a [trajectory](#)" (Chris Isham, private communication).

The only way out from this conundrum is to use the new (to contemporary relativists) form of reality, as explained in the case of the [human brain](#) and the [quantum world](#). The *potential reality* does **not**

exist in the local mode (cf. [Fig. 1](#)), hence the latter is a *perfect* continuum -- the "gaps" are *completely* sealed off by the so-called speed of light, because the "duration" of the transition from one "point" to the nearest "point" is **zero**: check out Kevin Brown [above](#).

All this may sound like some metaphysical exercise devoid of any mathematical implications, but recall that in mathematics you have to follow the obvious and intuitively clear metaphysical ideas, or else will sink in a jungle with [no way out](#).

Not to mention the *infinite* amount of energy packed in the [quantum vacuum](#).

Now, people from the [mathematical community](#) disagree with the [arrow of space](#) and *pre-geometric plenum*. They postulate some "smooth" structure ([66 times](#)), and adhere to the "splitting" of spacetime, just like ADM [[Ref. 1](#), pp. 479-486].

But how would you "quantize" a **Riemannian manifold** [[Ref. 1](#), p. 425] and gravitational "field" represented by Riemannian metric? How would you specify a Poisson structure of the "dynamical system", as driven by [[we-do-not-know-it](#)]?

D. Chakalov

March 30, 2010

Last update: August 4, 2010

[Ref. 1] Ralph H. Abraham and Jerrold E. Marsden, *Foundations of Mechanics*, Second Edition, Addison-Wesley, 6th printing, 1987. [ISBN: 080530102X](#)

p. 31: "The basic idea of a manifold is to introduce a **local** object that will support differentiation process and then to patch these local objects together **smoothly**.

....

p. 37: "(W)e obtain a vector bundle by **smoothly** patching together local vector bundles.

.....

p. 443: "This, or something like it, seems to be the final step in quantization. It is a crucial problem that has not yet found a satisfactory answer."

=====

Subject: International Quantum Foundations Workshop

Date: Tue, 20 Apr 2010 14:23:06 +0100

Message-ID:

<r20bed37361004200623i76b7e4bbs89ed7b343d1e7aa2@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Mike Towler <mdt26@cam.ac.uk>

Cc: Karl Svozil <svozil@tuwien.ac.at> ,

F David Peat <dpeat@fdavidpeat.com> ,

Guido Bacciagaluppi <g.bacciagaluppi@abdn.ac.uk> ,

Herman Batelaan <hbatelaan2@unl.edu> ,

Andrew Bennett <afbennett@peak.org> ,

Jeffrey Bub <jbub@umd.edu> ,

Jeremy Butterfield <jb56@cam.ac.uk> ,

Samuel Colin <s.colin@griffith.edu.au> ,

Murray Daw <daw@clemson.edu> ,

Maaneli Derakhshani <maanelid@yahoo.com> ,

Chris Dewdney <chris.dewdney@port.ac.uk> ,

Maurice de Gosson <maurice.de.gosson@univie.ac.at> ,

Jonathan Halliwell <j.halliwell@imperial.ac.uk> ,

Lucien Hardy <lhardy@perimeterinstitute.ca> ,

Basil Hiley <b.hiley@bbk.ac.uk> ,

Adrian Kent <apak@cam.ac.uk>,  
Martin Korth <martin.korth@gmail.com>,  
Creon Levit <creon.levit@nasa.gov>,  
Tim Maudlin <maudlin@rci.rutgers.edu>,  
Alberto Montina <amontina@perimeterinstitute.ca>,  
Wayne Myrvold <wmyrvold@uwo.ca>,  
Gillie Naaman-Marom <gilliem@bezeqint.net>,  
Travis Norsen <norsen@marlboro.edu>,  
Xavier Oriols <xavier.oriols@uab.cat>,  
Roger Penrose <penroad@herald.ox.ac.uk>,  
Alejandro Perez <perez@cpt.univ-mrs.fr>,  
Patrick Peter <peter@iap.fr>,  
Nelson Pinto-Neto <nelsonpn@cbpf.br>,  
Paavo Pylkkanen <paavo.pylkkanen@his.se>,  
Anton Ramsak <anton.ramsak@fmf.uni-lj.si>,  
Peter Riggs <peter.riggs@anu.edu.au>,  
Carlo Rovelli <rovelli@cpt.univ-mrs.fr>,  
Simon Saunders <simon.saunders@philosophy.ox.ac.uk>,  
Maximilian Schlosshauer <schlosshauer@nbi.dk>,  
Lee Smolin <lsmolin@perimeterinstitute.ca>,  
Rob Spekkens <rspekkens@perimeterinstitute.ca>,  
Ward Struyve <ward.struyve@fys.kuleuven.be>,  
Jos Uffink <uffink@phys.uu.nl>,  
Lev Vaidman <vaidman@post.tau.ac.il>,  
Antony Valentini <a.valentini@imperial.ac.uk>,  
[Chris Isham](mailto:c.isham@imperial.ac.uk) <c.isham@imperial.ac.uk>,  
Abner Shimony <abner.shimony@gmail.com>,  
Steve <adler@ias.edu>,  
Huw Price <huw@mail.usyd.edu.au>,  
Sergio <dopliche@mat.uniroma1.it>,  
Landsman <landsman@math.ru.nl>,  
Roland <roomnes@wanadoo.fr>

RE: International Quantum Foundations Workshop  
Saturday 28th August - Saturday 4th September 2010  
The Apuan Alps Centre for Physics @ TTI, Vallico Sotto, Tuscany  
[www.vallico.net/tti/tti.html](http://www.vallico.net/tti/tti.html)

Dear Dr. Towler,

Perhaps you and your colleagues may wish to check out an ontological interpretation of KS Theorem at

<http://www.god-does-not-play-dice.net/#KS>

Please notice that the UNdecidable KS state (called 'potential reality') has been interpreted as '**pre-quantum reality**'.

For comparison, a similar task has been undertaken by Antony Valentini, at the expense of introducing some "signal nonlocality" [Ref. 1] and "hidden variables" [Ref. 2].

Unlike Valentini's theory, I trust every physicist can check out the interpretation of KS Theorem at the link above, and find out whether there is an error in it.

Should you or any of your colleagues find an error, please do write me back. If you cannot find such error, please be assured that I would be delighted to attend your Workshop and explain the so-called 'PR interpretation of QM'.

BTW please note that the human brain (not mind) can unmistakably handle such UNSpeakable potential reality,

<http://www.god-does-not-play-dice.net/#context>

Perhaps all we may need is to model the whole universe as a 'brain'.

No need to introduce any hidden ghosts,

<http://demonstrations.wolfram.com/CausalInterpretationOfTheDoubleSlitExperimentInQuantumTheory>

The so-called 'potential reality' is known after Plato and Aristotle.

Looking forward to hearing from you and from your colleagues,

Yours sincerely,

Dimi Chakalov  
35 Sutherland St  
London SW1V 4JU  
Phone [snip]

References

[Ref. 1] Antony Valentini,  
[http://en.wikipedia.org/wiki/Antony\\_Valentini](http://en.wikipedia.org/wiki/Antony_Valentini)

"Valentini has been working on an extension of David Bohm's "ontological interpretation" of quantum theory that would allow "signal nonlocality" that is forbidden in orthodox quantum theory. "Signal nonlocality" allows nonlocal quantum entanglement to be used as a stand-alone communication channel without the need of a classical light-speed limited retarded signal to unlock the entangled message from the sender to the receiver. This would be a major revolution in physics ... "

[Ref. 2] When Reality is Real: An Interview with Antony Valentini  
By Jill Neimark, Anthony Valentin

<http://www.metanexus.net/magazine/tabid/68/id/7405/Default.aspx>

"What is so unusual about Antony Valentini? Just this: he's resurrected a theory that undoes the central tenet of quantum mechanics, and gives relativity theory a good punt to left field as well. The theory follows quantum math, but at the same time allows for new possibilities beyond conventional quantum mechanics.. It's a theory that says there is indeed an objective reality behind the things we observe -- that quantum uncertainty is not fundamental. And that somewhere, somehow, time is universal -- not relative. Goodbye, ghostly probabilities, with their strange propensity for collapsing into real things while apparently sort of holding back and remaining always a bit coy and ghostly... hello, hidden variables that are objective.

"And Antony's particular twist on the theory suggests a new explanation for the uniformity of the early universe -- where, he suggests, quantum law might not have applied, where stuff could interact faster than the speed of light -- and where those interactions were actually visible.

"There's no proof, of course -- at least not yet. But it's fun to think about.

.....

"Q: How are you going to convince anybody of this?

"A: We need to find a violation of quantum mechanics in the early universe. We need to find a non-

quantum distribution of particles. There may be particles floating around in space now which were left over from that very early time. People are looking for particles of dark matter left over from the early universe, and some of these may be good candidates. Another possibility is relic gravitons, particles associated with gravity that are believed to have stopped interacting with other particles at a very early time. Perhaps these relic gravitons from the early universe don't obey quantum mechanics.

.....

"Q: How does the pilot wave theory view time and space?

"A: It goes against relativity theory, because it has faster-than-light processes, and in relativity nothing is supposed to go faster than light. So it seems to me that we may have to revise relativity theory and end up with a notion of **universal time**. In relativity, different observers at different speeds have their own time and there is no absolute time. But in this theory, distant observers can communicate instantaneously if they have control at this fundamental level of non-quantum particles. So they would be able to synchronize their clocks instantaneously even if they were millions of light years apart. Of course, some people don't like the idea, and that's a problem."

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Note: I haven't yet received feedback from Mike Towler and from his colleagues regarding my email sent [three days ago](#). Surely the KS Theorem poses very tough challenges regarding the crux of 'quantum reality'.

Luckily, [Chris Isham](#) has recently produced a clear explanation -- check out his [arXiv:1004.3564v1](#), Sec. 5.1, 'The Kochen-Specker theorem and contextuality', p. 20:

"... the implication of the discussion above is that the value ascribed to B (resp. the result of measuring B) depends on whether it is considered together with A1, or together with A2. In other words the value of the physical quantity B is *contextual*. This is often considered one of the most important implications of the Kochen-Specker theorem."

The immediate question is this: What remains **invariant** in 'the quantity B' upon changing its "color" (see 'KS Theorem for teenage girls' [below](#)), to qualify as 'quantum reality of *the* quantity B'?

My proposal: [pre-quantum reality](#). In the framework of Chris Isham's approach, the so-called pseudo-states ([ibid.](#), p. 16) are 'as close as we can get' to the UNSpeakable pre-quantum reality (called here 'potential reality'). In the case of the [human brain](#), you can "measure" the latter with three (or more) sayings ("pseudo-states"), yet can never "collapse" the ultimate *potential reality* from which these "contextual" quantum states [emerge](#).

Regardless of how you tackle such "pseudo-states" with some topos approach, the solution to the [measurement problem in QM](#) requires that you offer some 'peaceful coexistence' (Abner Shimony) of this pre-quantum reality and STR, as explained at this web site. Recall its motto: Dead matter makes quantum jumps; the living-and-quantum matter is smarter. We could have sorted out this bundle of issues [eight years ago](#), but I guess [Chris Isham](#) had a different agenda.

Anyway; here's an anecdotal story from 1970s ([ibid.](#), footnote 3, p. 6):

"I have a fond memory of being in the audience for a seminar by John Wheeler at a conference on quantum gravity in the early 1970s. John was getting well into the swing of his usual enthusiastic lecturing style and made some forceful remark about the importance of the quantum principle. At that point a hand was raised at the back of the lecture room, and a frail voice asked "What **is** the quantum principle?". John Wheeler paused, looked thoughtfully at his interlocutor, who was Paul Dirac, and answered "Well, to be honest, I don't know". He paused again, and then said "Do you?". "No" replied Dirac."

If you, my dear reader, cannot find an error in the interpretation of KS Theorem [below](#), I will be happy to offer you my version of 'the quantum principle' and the origin of the quantum of action.

But if you [aren't interested](#) -- that's perfectly fine with me.

["just another crank"](#) D.C.

April 23, 2010

=====

Subject: Re: International Quantum Foundations Workshop  
Date: Sat, 24 Apr 2010 16:50:32 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Mike Towler <mdt26@cam.ac.uk>  
Cc: [49 recipients]

Hello Mr Towler,

On Sat, 24 Apr 2010 13:56:55 +0100 (BST), you wrote:

> As I'm sure you are aware, sending unsolicited emails to large numbers of  
> famous people asking what they think of your theory is not only widely  
> considered to be appallingly rude but to be the hallmark of a crackpot.

It is not about my "theory", as you put it.

I'm afraid there is a large number of "famous people" who ignore the legacy of Schrödinger and [Margenau](#), and cannot grasp the basic basics of KS Theorem and CK Free Will Theorem,

<http://www.god-does-not-play-dice.net/#KS>

If you and the rest of these "famous people" consider this "appallingly rude" and "the hallmark of a crackpot", I can only wish you a quiet a peaceful retirement.

Alternatively, if you and the rest of these "famous people" wish to get professional, please don't hesitate to write me back, with \*specific arguments\* refuting the interpretation of KS Theorem offered at the link above.

Just please reply professionally.

Thank you very much in advance.

Yours sincerely,

D. Chakalov

> On Fri, 23 Apr 2010, Dimi Chakalov wrote:  
>  
>> P.S. An explanatory note, with excerpts from the latest paper by C.  
>> Isham, has been posted at  
>>  
>> [http://www.god-does-not-play-dice.net/#Towler\\_note](http://www.god-does-not-play-dice.net/#Towler_note)  
>>  
>> A penny for your thoughts!  
>>  
>> D.C.  
>>

=====

Subject: Quasi-local Mass and Angular Momentum in General Relativity (November 1981)  
Date: Mon, 26 Jul 2010 18:37:45 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Roger Penrose <penroad@herald.ox.ac.uk>

Cc: Peter van Nieuwenhuizen <vannieu@insti.physics.sunysb.edu>,  
Glenn Starkman <glenn.starkman@case.edu>,  
Alex Vikman <alexander.vikman@nyu.edu>,  
David Jacobs <dmj15@case.edu>,  
Chiang-Mei Chen <cmchen@phy.ncu.edu.tw>,  
G Nester <nester@phy.ncu.edu.tw>,  
Xiaoning Wu <wuxn@phy.ncu.edu.tw>,  
Laszlo Szabados <lbszab@rmki.kfki.hu>,  
Adam Helfer <adam@math.missouri.edu>,  
Massimo Pauri <pauri@pr.infn.it>,  
Luca Lusanna <lusanna@fi.infn.it>,  
[snip]

Dear Roger,

Back in [November 1981](#), you acknowledged that "several problems of interpretation remain to be solved". May I offer you some help with an 'arrow of space',

[http://www.god-does-not-play-dice.net/#Zinkernagel\\_note](http://www.god-does-not-play-dice.net/#Zinkernagel_note)

Are you still interested in GR?

Regards,

Dimi

=====

Subject: Re: "But success, I think, can only be granted by scrupulous intellectual honesty."

Date: Fri, 26 Nov 2010 00:03:33 +0200

From: Dimi Chakalov <dchakalov@gmail.com>

To: [Roger Penrose](#) <penroad@herald.ox.ac.uk>

Cc: Thomas Thiemann <thiemann@theorie3.physik.uni-erlangen.de>,  
Lee Smolin <lsmolin@perimeterinstitute.ca>,  
Karel V Kuchar <kuchar@physics.utah.edu>,  
Chris Isham <c.isham@imperial.ac.uk>,  
Claus Kiefer <kiefer@thp.uni-koeln.de>,  
Norbert Straumann <norbert.straumann@gmail.com>,  
Domenico Giulini <domenico.giulini@itp.uni-hannover.de>,  
Henk van Elst <hvanelst@karlshochschule.de>,  
Sergio Doplicher <dopliche@mat.uniroma1.it>,  
Jorge Pullin <pullin@lsu.edu>,  
Laszlo Szabados <lbszab@rmki.kfki.hu>,  
Luca Bombelli <luca@phy.olemiss.edu>,  
Andreas Döring <andreas.doering@comlab.ox.ac.uk>,  
Robert M Wald <rmwa@midway.uchicago.edu>,  
Carlo Rovelli <rovelli@cpt.univ-mrs.fr>

Hi Roger,

Ever since 1988, I've been having great difficulties with our communication, so I left my feedback to your latest essay, [arXiv:1011.3706v1 \[astro-ph.CO\]](#), at

<http://physicsworld.com/cws/article/news/44388>

And since some people may delete it, I'll attach it [here](#).

More at

<http://www.god-does-not-play-dice.net/Margenau.html>

All the best,

Dimi

On Thu, 25 Nov 2010 00:03:37 +0200, Dimi Chakalov <dchakalov@gmail.com> wrote:

>  
> Hi Carlo,  
>  
> I quoted your statement in the subject line at  
>  
> <http://www.god-does-not-play-dice.net/Margenau.html>  
>  
> If you disagree with my critical remarks and/or wish to comment on my  
> proposal, please don't hesitate to write me back.  
>  
> I will be happy to hear from your colleagues as well. Will keep the  
> discussion private and confidential -- provided it is professional.  
>  
> All the best,  
>  
> Dimi  
>

=====

Subject: "Hiding quantum information" is b\*\*\*\*\* .  
Date: Thu, 8 Jul 2010 12:41:44 +0300  
Message-ID:  
<AANLkTineDYbgszwc6iROtr6gt4nVJyGL8fQO1MINUWBq@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Todd Brun <tbrun@usc.edu>  
Cc: Bilal Shaw <bilalsha@usc.edu>,  
Steve Adler <adler@ias.edu>,  
Jeffrey Bub <jbub@umd.edu>,  
[Chris Isham](mailto:c.isham@imperial.ac.uk) <c.isham@imperial.ac.uk>,  
David Schroeren <davidschroeren@cantab.net>,  
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shulman@math.uchicago.edu, urs.schreiber@gmail.com,  
s.willerton@sheffield.ac.uk

Hi Todd:

Pity you didn't take seriously my email from Thu, 19 Sep 2002 16:47:38 +0300 (cf. below).

The alleged "innocent cover state" [[Ref. 1](#)] and secret "quantum information" may be fused with 'the UNdecidable quantum state'.

In the case of your \*brain\*, you can grasp the latter by comparing the following two statements:

1. You can't hide a piece of broccoli in a glass of milk.
2. Don't wear polka dot underwear under white shorts.

The UNdecidable quantum state of your \*[brain](#)\* (not mind) is **not** about broccoli, underwear, milk, or shorts.

More from Schrödinger, [Margenau](#), and KS Theorem at

<http://www.god-does-not-play-dice.net/#KS>

Should you and/or any of your colleagues cannot understand the arguments at the link above, please write me back.

Take care,

Dimi

[Ref. 1] Bilal A. Shaw, Todd A. Brun, Hiding Quantum Information in the Perfect Code, arXiv:1007.0793v1 [quant-ph], <http://arxiv.org/abs/1007.0793>

"The day may come when quantum networks are ubiquitous. An advantage that steganography has over standard encryption schemes is that private information could be transmitted over a long time through a network, completely undetected and even unsuspected by other users. Steganographic techniques may also be useful as a way of authenticating quantum communications in distributed quantum information processing; such uses of classical steganography for authentication are often called "watermarking." Quantum steganography has far reaching consequences, and may provide a measure of security beyond what classical steganography can afford.

....

"Alice and Bob conceal their communication from Eve, hiding their message as errors in a codeword for an "innocent" cover state  $|\psi_c\rangle$ , and using the resource of a shared secret random key. (Shared entanglement would work as well, or even better.)"

-----

Subject: [Think globally, act locally](#)  
Date: Thu, 19 Sep 2002 16:47:38 +0300  
From: Dimi Chakalov <dchakalov@surfeu.at>  
To: Todd Brun <tbrun@ias.edu>  
CC: adler@ias.edu,  
[snip]

Dear Todd:

Reading your recent "Computers with closed timelike curves can solve hard problems", gr-qc/0209061 [Ref. 1], is a real pleasure.

=====

**Note:** Recall also the elusive Event Horizon -- a global property of an entire spacetime, which should be somehow "defined nonlocally in time" ([J. Thornburg](#), Irr-2007-3). The mythical "black holes" cannot be defined rigorously in GR, so try the global, Heraclitean, and [non-Archimedean time](#) of the *UNdecidable* quantum state of 'the universe as a brain'. Or trust [Chris Isham](#).

D.C.

July 8, 2010

=====

Subject: Weyl's principle: Comoving reference frame & proper time  
Date: Fri, 9 Jul 2010 20:07:23 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>

To: S E Rugh <rugh@symposion.dk>, H Zinkernagel <zink@ugr.es>

Dear colleagues,

Thank you for your clarification of Weyl's principle [[Ref. 1](#)]. I believe it is obvious that the dynamics of space, as being "expanded" by itself (DDE of "empty space"), is missing in GR,

<http://www.god-does-not-play-dice.net/#Blanchard>

I think the human brain may possess such self-acting faculty, but if you try to pinpoint its mind, it will inevitably turn out to be "dark", just like the UNdecidable quantum state,

<http://www.god-does-not-play-dice.net/#Brun>

If you know how to model a universe that can [act upon itself](#), please do write me back.

Kindest regards,

Dimi Chakalov

-----

[Ref. 1] Svend E. Rugh, Henrik Zinkernagel, Weyl's principle, cosmic time and quantum fundamentalism, arXiv:1006.5848v1 [gr-qc],

<http://arxiv.org/abs/1006.5848v1>

p. 2: "Weyl's principle: The world lines of galaxies, or 'fundamental particles', form (on average) a spacetime-filling family of non-intersecting geodesics converging towards the past.

"The importance of Weyl's principle is that it provides a reference frame based on an expanding 'substratum' of 'fundamental particles'. In particular, if the geodesic world lines are required to be orthogonal to a series of space-like hypersurfaces, a comoving reference frame is defined in which constant spatial coordinates are "carried by" the fundamental particles. The time coordinate is a cosmic time which labels the series of hypersurfaces, and which may be taken as the proper time along any of the particle world lines."

-----

**Note:** Time does not originate from 'change *in* space' ([coordinate time](#), [Kodama time](#), *etc.*; see [Julian Barbour](#)), but from [chance of space](#) (cf. [Fig. 2](#)). Example with the Hubble Law [here](#).

It is the arrow of **space** (AOS) that makes 'more and more space' to *emerge* ([Isham and Butterfield](#)) from [[we-do-not-know-it](#)], hence "the distances between all elements of the cosmic substratum (or, fluid) grow with **time**" ([Michal Chodorowski](#)), and we enjoy 'arrow of spacetime'. Were it possible to *physically* trace back the entity called [[we-do-not-know-it](#)], it won't be "dark" anymore, and the Aristotelian First Cause would be shifted one step further.

Notice that the arrow of **space** (AOS) leads directly to [Machian quantum gravity](#), as the motion of *any individual body* is to be defined with respect to [the entire universe](#) (E. Mach, *The Science of Mechanics* (1883), Open Court, 1960, pp. 286-287). It has "infinite extent" (J. Barbour, [arXiv:1007.3368v1 \[gr-qc\]](#), p. 26), being in *the* state of **ONE-ness** (global mode of spacetime, cf. [Fig. 2](#)) that keeps "the last remnant of physical objectivity" ([A. Einstein](#)).

Physicists hate the Aristotelian metaphysics, however. They relentlessly try to picture [[we-do-not-know-it](#)] as some physical stuff with [positive energy density](#), and end up with searching for an 'elephant in a china shop', only to find out that the elephant must be many orders of magnitudes larger than the store itself.

The AOS-driven dynamics of living and quantum/gravitational systems will inevitably produce a *self-acting* action, because the non-linear bi-directional negotiation between every "fish" and '[the rest of fish from the shoal](#)' is "dark" in the [local mode of spacetime](#). Sorry for repeating this again; I know it's boring.

If you disagree with the arrow of space (AOS), just try to define *quasi-local* quantities in asymptotically flat spacetime wrapped with (flexible?) "boundaries" at *spatial infinity*, yet keeping the splitting of spacetime ([ADM](#)) into two entities, one of which (called 'time') would refer to things that "evolve" with respect to something fixed, called 'space'. As R. Penrose acknowledged in [November 1981 \[Ref. 2\]](#), "several problems of interpretation remain to be solved".

Fuggedaboutit, [Roger](#). Time can "evolve" just as much as space can; hence the arrow of *space* viz. arrow of spacetime endowing the [conservation](#) of *quasi-local* observables of Type I matter fields (Eq. 1 [below](#)), [bootstrapped by gravity](#). Direct observation of "**pure** gravitational field" (cf. Dupre and Tipler [below](#)) is like direct observation of the human mind, while acting on its brain. Gravity makes all matter fields *self-interacting*, hence the proper [GW detector](#) should be endowed with the faculty of self-acting, that is, capable of [acting on its own potential states](#) along the arrow of spacetime.

We should drop the "[no prior geometry](#)" assumption in GR and derive [the ether](#) from [Quantum Theory](#) -- the vanishing of the covariant divergence of the stress-energy tensor (not "[pseudotensor](#)") is a [quantum-gravitational phenomenon](#).

According to today's GR (Mario Goto *et al.*, [arXiv:1007.4846v1 \[gr-qc\]](#)), "the Strong Equivalence Principle postulates that at every space-time point in a arbitrary gravitational field it is possible to choose a locally inertial coordinate system [such that](#), within a **sufficiently small** (notice the poetry - D.C.) region of the point in question, the laws of the nature take the same form as in unaccelerated Cartesian coordinate systems in the absence of gravitation. On the other hand, the Weak Equivalence Principle is nothing but a restatement of the observed equality of gravitational and inertial mass."

**NB:** *When and how* does 'the [finite small](#)' shift to "[sufficiently small](#)", [such that](#) (operational definition) you "may erect a locally inertial coordinate system in which matter satisfies the laws of special relativity" ([Steven Weinberg](#), pp. 62-68)? The laws of STR are applicable only if the so-called "[sufficiently small](#)" has **already** become a *bona fide* geometrical point from the global, Heraclitean, and [non-Archimedean](#) realm. On the other hand, the effects of gravity apply **only** to the Archimedean realm of **finite** things, such as 'one second' (see the drawing [below](#)) or 'one meter'. The bi-directional "talk" of matter and geometry ("space acts on matter, telling it how to move; in turn, matter reacts back on space, telling it how to curve", John Wheeler) is the ultimate "talk" of the Archimedean (local) and non-Archimedean (global) realms of spacetime. The cornerstone puzzle of GR is that your wristwatch *does indeed* read this "talk", and the covariant divergence of the stress-energy tensor does indeed disappear, or rather "dissolves" in the purely geometrical, [non-Archimedean](#) realm of "[sufficiently small](#)", staying available to *re-emerge*, as a [quantum-gravitational phenomenon](#).

On [September 21, 2008](#), I suggested '*necessary and [sufficient conditions](#) for spacetime*': the former condition concerns physical substratum with [positive energy density](#), while the latter condition refers to a global, Heraclitean, and [non-Archimedean](#) state of the whole universe as ONE -- a *pre-geometric plenum* "connecting" the geometrical "points". It is totally removed from the [local mode](#) of spacetime **by** the so-called '[speed of light](#)', making the local mode a [perfectly smooth manifold](#). Einstein, and many other physicists, called this *pre-geometric plenum* "[ether](#)".

If you disagree with the *pre-geometric plenum*, try to 'connect the dots' in the drawing of '[one second](#)' by using only Archimedean geometry and physical stuff that is invariant under "[active diffeomorphisms](#)". Or explain the vanishing of the covariant divergence of the stress-energy tensor. [Good luck](#).

D.C.

July 10, 2010

Last update: August 20, 2010

[Ref. 2] R. Penrose, Quasi-local Mass and Angular Momentum in General Relativity, *Proc. R. Soc.* A381 [53-63](#) (1982); cf. p. 53:

It is perhaps ironic that *energy conservation*, a paradigmatic physical concept arising initially from Galileo's (1638) studies of the motion of bodies under gravity, and which now has found expression in the (covariant) equation

$$\nabla_a T^{ab} = 0 \quad (1)$$

– a cornerstone of Einstein's (1915) general relativity – should nevertheless have found no universally applicable formulation, within Einstein's theory, incorporating the energy of gravity itself. The energy tensor  $T^{ab}$ , providing the right-hand side to the Einstein field equation, describes the complete local energy, this being the sum of the energy densities of all *non-gravitational* fields. Gravitational (field) energy, on the other hand, contributes non-locally to the total energy, its presence being manifested in the fact that (1) does not, by itself, give rise to an integral conservation law. To do so, (1) would have had to have had the form of a divergence of a vector – like the equation expressing conservation of electric charge:

$$\nabla_a J^a = 0 \quad (2)$$

– rather than of a valence-2 tensor.

R. Penrose, General-relativistic energy flux and elementary optics, in: *Perspectives in Geometry and Relativity: Essays in Honor of Václav Hlavatý*, ed. by Banesh Hoffmann, Indiana University Press, Bloomington, 1966, [pp. 259-274](#)

p. 259: "By definition,  $T_{uv}$ (Matter) describes all the local energy, so any energy due to the [Weyl tensor] must be nonlocal in character. The existence of nonlocal energy is also manifest in the fact that the local [conservation law](#)

$$T_{uv}{}^{;v} = 0$$

is a covariant curved space equation. One cannot just integrate  $T_{uv}$ (Matter) over a 3-space to obtain a conserved total energy-momentum. The total energy-momentum of a system must, therefore, involve [nonlocal contributions](#) due, perhaps, to the presence of Weyl tensor or to nonlocal interactions (e.g. Newton's potential energy) between the  $T_{uv}$ 's at [different points](#) (...). The nonlocality of the gravity energy was then exhibited in the local dependence of the pseudo-tensor on the choice of coordinate system."

R. Penrose, *The Road to Reality: A Complete Guide to the Physical Universe*, Jonathan Cape, London, 2004; [ISBN: 0224044478](#)

p. 458: "The contributions of gravity to [energy-momentum conservation](#) should somehow enter non-locally as corrections to the calculation of total energy-momentum. (...) From this perspective, gravitational contributions to energy-momentum, in a sense, '[slip in through the cracks](#)' that separate the local equation  $[XXX] = 0$  from an integral conservation law of total energy momentum.

....

p. 777: "Thus, any non-constancy in  $[\lambda]$  would have to be accompanied by a [compensating non-conservation](#) of the mass-energy of the matter."

Luca Lusanna *et al.*, [arXiv:1007.4071v1 \[gr-qc\]](#)

"Almost a century after the birth of GR there is yet no universal consensus on how energy, momentum and other conserved quantities should be defined in it from a fundamental viewpoint. (...) The main reason to defend covariant conserved quantities in GR is that, according to the general covariance principle, if conserved quantities were intrinsically non-covariant they would be irrelevant to the description of Nature.

....

"To be precise, the general covariance principle claims that the description of Physics can be done independently of any a priori coordinate fixing. It does not exclude that in particular situations one

has a posteriori preferred coordinates, preferred splittings between space and time, or preferred observers; see [2], [3], [4], [5]. One very well-known example of such a situation is Cosmology: in Friedmann-Robertson-Walker solutions one has canonical clocks (e.g. the temperature of the cosmic background radiation) that not only break Lorentz invariance defining a cosmic (global) time but break the Galilei invariance defining observers which are **at rest** with respect to the cosmic background radiation."

Luca Lusanna and Massimo Pauri (6 March 2005), General Covariance and the Objectivity of Space-time Point-events,  
<http://philsci-archive.pitt.edu/archive/00002224/>

Chiang-Mei Chen and James M. Nester, *Gravitation & Cosmology* 6, 275 (2000);  
[arXiv:gr-qc/0001088v1](http://arxiv.org/abs/gr-qc/0001088v1)

"Via their energy-momentum density, material sources generate gravitational fields. Sources interact with the gravitational field locally, hence they should be able exchange energy-momentum with the gravitational field -- locally. From this physical conception we are led to expect the existence of a local density for gravitational energy-momentum."

[Maurice J. Dupre](http://arxiv.org/abs/1007.4572), Frank J. Tipler, General Relativity As an Aether Theory, July 28, 2010,  
arXiv:1007.4572v1 [gr-qc]  
<http://arxiv.org/abs/1007.4572>

"Most of the leading relativists in the early twentieth century, for examples Eddington [18] and even Einstein himself [19], claimed that general relativity was an æther theory, but they gave no mathematical demonstration of their claim.

....

"According to Einstein, in his Autobiography [12], the most natural choice for the tensor  $S_{\mu\nu}$  is the stress-energy tensor. Einstein was uncomfortable with adding the term [xxx] to the Ricci tensor, saying it was only introduced for 'technical reasons,' required by the vanishing of the covariant divergence of the stress-energy tensor.

.....

"The vanishing of the divergence of the stress energy tensor is derived in Minkowski space using all the symmetries of Minkowski space. But leaving Minkowski space for a general spacetime means losing the symmetries that allowed the derivation of  $T_{[xxx]} = 0$  to start with!

.....

"As MTW emphasize, the requirement that there is no "prior geometry"— that the metric is entirely determined by the field equations for gravity — actually fathered general relativity.

.....

"A central point of Lorentz's 1904 paper, in which he derived the Lorentz transformations, was that the Maxwell equations — for Lorentz, the equations of the æther — do not allow an absolute time to be defined. This is of course now obvious since the speed of light in the vacuum is a constant, independent of a inertial observer.

"So the æther can be thought of as defining a time direction **different** from what we may have thought of as Newtonian absolute time.

.....

"If space is not spatially flat, then the spatial Riemannian metric will define a metric connection, and we might thus have two connections, one from the spatial metric, and one in the time direction only.

.....

"We suspect, but do not attempt to prove, that maintaining the distinction between two such connections would be **very difficult**.

"Essentially, the requirement that the connection arise entirely from the metric is nothing but the "no prior geometry" assumption, which, as we pointed out earlier, is the only assumption that will allow the geometry to be determined by the matter distribution and the boundary conditions. Once again, MTW have emphasized that the "no prior geometry" assumption is the basic assumption of general relativity. It is also an essential assumption of the curved ætherial Newtonian gravity theory we develop here.

.....

"The question is, what should we select for the tensor  $S_{\mu\nu}$ . According to Einstein in his Autobiography: "On the right side [of the Einstein equations] we shall then have to place a tensor also in place of [the mass density]. Since we know from the special theory of relativity that the (inertial) mass equals energy, we shall have to put on the right side the tensor of energy-density—more precisely the entire energy-density, insofar as it does **not** belong to the **pure gravitational field** ([12], p. 75.)."

=====

Subject: The vanishing of the covariant divergence of the [stress-energy tensor](#) is a quantum-gravitational phenomenon

Date: Mon, 2 Aug 2010 20:05:20 +0300

Message-ID:

<AANLkTikaKMYEERCfKuyv7RxDdYXiYNgRWrx7gTuS0o6Z@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Angelo Loinger <angelo.loinger@mi.infn.it> ,

Tiziana Marsico <martiz64@libero.it> ,

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Claus Gerhardt <gerhardt@math.uni-heidelberg.de> ,

Adam Helfer <adam@math.missouri.edu>

Dear colleagues,

It had been suggested to Einstein by Levi-Civita, who had pointed out that, by virtue of [Bianchi identities](#), the covariant divergence of the stress-energy tensor of matter and fields \*has to\* be equal to zero, in order to satisfy the dynamical laws of continuous media, as known in 1915:

Angelo Loinger, Einstein, Levi-Civita, and Bianchi relations,

arXiv:physics/0702244v1 [physics.gen-ph]

<http://arxiv.org/abs/physics/0702244>

However, 'time' in dynamical laws does not come from 'change in space', but from 'change **of** space',

[http://www.god-does-not-play-dice.net/#Zinkernagel\\_note](http://www.god-does-not-play-dice.net/#Zinkernagel_note)

(Example with the Hubble Law at the link above.)

Hence we enjoy 'arrow of space', driven by some "dark" [\[we-do-not-know-it\]](#). The (covariant

divergence of the stress-energy tensor of) matter and fields can \*completely\* vanish/dissolve into the quantum vacuum, and stay available there for any partial, full, or "over unity" recall, if and when needed.

All this requires a new form of reality, after Schrödinger, [Margenau](#), and KS Theorem:

<http://www.god-does-not-play-dice.net/#KS>

My next talk will be in Munich, on Wednesday, 25 November 2015. Meanwhile, check out the implications for LIGO, Virgo, GEO, LCGT, and LISA at

<http://www.god-does-not-play-dice.net/ExplanatoryNote.pdf>

Sincerely,

Dimi Chakalov

-----

**Note:** Since we represent matter by "a wooden nose in a snowman" ([A. Einstein](#)), what actually "vanishes" is completely outside present-day GR. Perhaps it is safe to say that the confusion about *what* becomes 'quasi-local' due to gravity, and exactly *how*, is enormous -- check out [Carl Hofer](#), [Roger Penrose](#), Babak and Grishchuk [[Ref. 1](#)], and Einstein's Equivalence Principle ([Okon and Callender](#); [Hans Ohanian](#)): the *wegtransformierbar* faculty of gravity ([Hermann Weyl](#)) over a "point", in the [non-Archimedean](#) realm of 'the grin of the cat without the cat', as observed by Alice.



Both the Riemannian space and Minkowski space can *only* accommodate **facts**. In the latter case, you have insurmountable problems with [reconciling QM with STR](#). In the former case of Einstein's GR, the only event that can qualify as 'fact' is the *already-completed* [bi-directional "talk" of matter and geometry](#) over a "point". This is the origin of "the laws of an instant" ([Karel Kuchar](#)). But we may derive dynamical laws from 'an instant' only in Minkowski space; see what happens in GR [here](#) and [here](#).

To be precise: I believe there exists a concealed, [yet-to-be-identified object](#), which plays a **dual role** in GR, as it shows up as *either* "components of the metric tensor" *or* "gravitational field variables" [[Ref. 1](#)]. In plain words: "the metric is treated as a field which not only affects, but also is (at the *very same* instant - D.C.) affected by, the other fields" (John Baez). And from Laszlo Szabados: "the metric has a double role: it is a field variable and defines the geometry at **the same time**". Therefore, if you employ some classical space that can *only* accommodate **facts**, and try to apply the [Equivalence Principle](#), you are destined to a blind alley: on the one hand, the "ether" must *not* "come back" ([M. Montesinos](#)), but on the other hand -- the gravitational (field) energy "contributes non-locally to the total energy" ([R. Penrose](#)), and you're back in murky waters, since November 1915. People are very reluctant to acknowledge that the gravitational "field" is **not** a [classical field](#). Instead, they either keep quiet ([Chris Isham](#)) or offer their "pearls" of wisdom, like [Gerard 't Hooft](#).

I think the introduction of some "flat space" in GR ([CEOPOP](#), p. 25), as well as a "true, real stress-energy-momentum tensor for gravity" (see [above](#)), is *not even wrong*. Yet such ideas deserve publishing, because students should be made aware how vulnerable the mathematical formulation of GR is to ridiculous ideas -- see CEOPOP's "pearls" [above](#).

Let me try to explain my viewpoint, in the framework of 'the universe modeled as a [brain](#)'. I take for granted that matter can *interact* with matter only. Corollary: any *direct* action of geometry on matter (e.g., [Feynman's "sticky beads"](#)) is banned. It is like direct action of the human mind on its brain or other physical systems. In this context, the action of the alleged GW strain on physical bodies

([LIGO's arms](#)) should be considered 'GW psychokinesis'. To avoid such parapsychology, we should investigate how matter *interacts* with matter in a [Machian universe](#), in which the non-linear negotiation and feedback from 'everything else' is encoded in the *emergence* of what has been called in GR 'geodesics'.

Regarding GWs: the *omnipresent* "direction" of GW propagation takes place in the [global mode](#) of spacetime; it correlates every "fish" with the whole [school of fish](#), hence such [AOS-driven dynamics](#) will produce an *emergent* quasi-local geodesic of every "fish", and will induce **geodesic waves**, much like the waves of the legs of a [centipede](#). Of course, we are confined in the *local mode* of spacetime, and cannot observe these *emergent* geodesics waves.

In the *local mode*, no fish could register any "deviation" from *anything*, just as in the example with four [pre-correlated dice](#); details in '[the quantum principle](#)'.

The "Gespensterfelder" (EPR-like) "action" from 'the whole school' on every quasi-local fish will show up as "dark", because it cannot be traced back from any quasi-local fish. LIGO is not endowed with the faculty of [self-acting](#), and cannot detect such "dark energy from empty space".

Recall the game of '20 questions', courtesy from [John Wheeler](#) [[Ref. 2](#)]. The *quasi-local* object 'cloud' cannot be represented by a [tensor](#), because it is **not** an '[objective reality out there](#)'. It brings the quasi-local quantum-gravitational contributions -- just the *contributions* -- to matter and fields in the r.h.s. of [Einstein equation](#). These contributions are being converted, in the [global mode](#) of spacetime, to *bona fide* type I matter fields; they just acquire an additional degree of freedom due to the bootstrapping faculty of gravity, resembling the geodesic hypothesis ([A. Rendall](#)) in today's GR (summary from [K. Koehler](#), [B. Mashhoon](#), and [N. Dadhich](#)).

To explain these quasi-local quantum-gravitational *contributions*, think of the object 'cloud' as a fish from [the school of fish](#): at each and every instant from their collective quasi-local "geodesics", we have [local conservation](#) of energy and momentum to every *closed* (finite infinity, [G.F.R. Ellis](#)) system [matter & [cloud](#)], but this **local** conservation pertains only to one "horizontal" snapshot from the [arrow of space](#) -- cf. Figs 1 and 2 from '[Die Bahn](#)'.

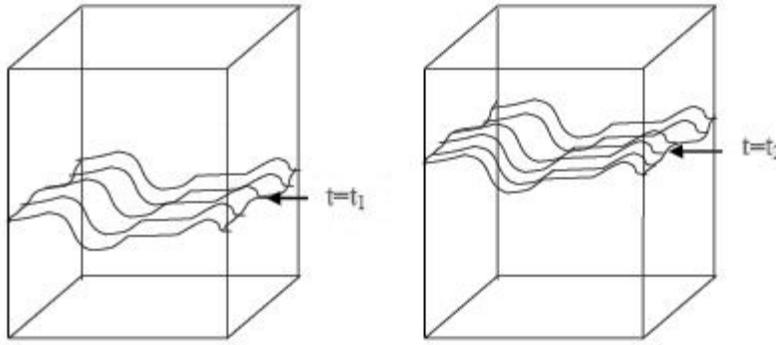
Thus, "the covariant divergence of the stress-energy tensor" ([Wiki](#)) does indeed vanish, because at *each and every instant* from the arrow of space (hence arrow of spacetime) the bi-directional talk of matter and geometry (cf. the double role of Einstein's equations, [M. Montesinos](#)) has been **already** completed, and in such already-correlated instantaneous snapshot all "nonlocal" and "dark" stuff has **totally vanished**.

Hence the "freely falling" bodies can indeed follow geodesics, as "the stress-energy has **zero** divergence" ([Kenneth R. Koehler](#)) at each and every instant 'now' from the **local mode** of spacetime (cf. [Fig. 1](#)). Picture these "horizontal" (local mode) sections of the arrow of spacetime as Photoshop layers stacked on the **w** arrow (cf. [Fig. 2 above](#)): the requirement 'stress-energy must have **zero** divergence' is indeed fulfilled, along with the Equivalence Principle, but **only** "during" an instant 'now' from the *local* mode.

However, because we inevitably **flatten** all "Photoshop layers" due to the so-called "[speed of light](#)", we see a [perfect continuum](#) of *already*-correlated facts, chained along a *perfectly continual* trajectory (e.g., the trajectory of a [Frisbee](#) on Minkowski space) or *perfectly continual geodesic*. In order to follow a *geodesic* ([Alan Rendall](#)), the Frisbee will have to obtain all quantum-gravitational *contributions* to its path from 'the rest of the universe', and then it will move like a fish from a [school of fish](#). Most importantly, such quasi-local fish will always have strictly [positive inertial mass](#).

(On [March 27, 2007](#), Prof. Warren W. Johnson, [LSU](#), wrote: "Ah ha, caught you lying! You do have a radically different "theory" to compete with Einstein's theories." But LIGO fellow Warren W. Johnson is wrong. I strictly follow [Einstein's GR](#), and am trying to remove all "miracles" in GR (resembling the projection postulate in QM), which preclude us from understanding the *geodesic hypothesis*, as explained by [Alan Rendall](#). If you agree with Warren Johnson, or trust [Chris Isham](#), try to uncover some "**total field** of as yet [unknown structure](#)", and send your proposal to [Alan Rendall](#). I hope he will then re-write his online [article](#).)

Notice that the vanishing property of  $t_{\mu\nu}$  ([M. Montesinos](#)) is manifestation of the so-called 'problem of time': nothing can possibly "move" in such block universe; cf. [G.F.R. Ellis](#) below.



**Figure 4:** *Different time surfaces in a curved block space-time. General relativity allows any 'time' surfaces that intersect all world lines locally. The spacetime itself is also curved. Future and past physics, including the spacetime itself, are locally determined from the data on any such surface.*

The warrant for this view in the case of special relativity is the existence and uniqueness theorems for the relevant fields on a fixed Minkowski background spacetime; for example, the existence and uniqueness theorems for fluid flows, for Maxwell's equations, or for the Klein Gordon equation (see Hadamard 1923; Wald 1984: 243-252). In the case where gravity is significant, the warrant is the existence and uniqueness theorems of general relativity for suitable matter fields (Hawking and Ellis 1973: 226-255; Wald 1984: 252-267). They show that for such matter, initial data at an arbitrary time determines all physical evolution, including that of the spacetime structure, to the past and the future equally, because we can predict and retrodict from that data up to the Cauchy horizon. The present time has no particular significance; it is just a convenient time surface we chose on which to consider the initial data for the universe. We could have equally chosen any other such surface.

If you believe in the Riemannian space of 'facts' and use only [Archimedean geometry](#), you will inevitably encounter *insurmountable* problems with the [conservation of energy and momentum](#) in [present-day GR](#), as well as tug-of-war "dark" effects of gravity, dubbed [CDM and DDE](#).

My suggestion is to zoom on the "infinitesimal variables" [[Ref. 3](#)] and reveal the interplay of matter and geometry -- their bi-directional "talk" on the **interface** of the Archimedean (material) and [non-Archimedean](#) (geometrical) realms. The end result is a [perfect continuum](#) in the local mode of spacetime.

**NB:** This can **only** happen if there is a **physical** mechanism producing such [perfectly smooth](#) spacetime manifold, based on the so-called [speed of light](#): the "duration" of the bi-directional "talk", in the [local mode](#) of spacetime, is **zero**.

This is the meaning of the statement 'Your Global Time is [ZERO](#)'. More in my talk on Wednesday, 25 November 2015. My [first talk](#) didn't attract the attention of the theoretical physics community, but once the "enhanced" and "advanced" LIGO fail miserably by November 2015, I hope people will get serious about GR:

"The representation of matter by a [tensor](#) was only a fill-in to make it possible to do something temporarily, a wooden nose in a snowman." (Albert Einstein's Last Lecture, April 14, 1954)

D. Chakalov  
 August 6, 2010  
 Last update: September 6, 2010

[Ref. 1] S. Babak and [L. Grishchuk](#), The Energy-Momentum Tensor for the Gravitational Field, *Phys.*

Rev. D61 (2000) 024038; [gr-qc/9907027 v2](#).

"The search for the gravitational energy-momentum tensor is often qualified as an attempt of looking for "the right answer to the wrong question". [cf. C.W. Misner, K.S. Thorne and J.A. Wheeler, Gravitation (W. H. Freeman and Company, New York, 1973), p. 467 - D.C.]

...

"In traditional field theories, one arrives, after some work, at the energy-momentum object which is: 1) derivable from the Lagrangian in a regular prescribed way, 2) a tensor under arbitrary coordinate transformations, 3) symmetric in its components, 4) conserved due to the equations of motion obtained from the same Lagrangian, 5) free of the second (highest) derivatives of the field variables, and 6) is unique up to trivial modifications not containing the field variables. There is nothing else, in addition to these 6 conditions, that we could demand from an acceptable energy-momentum object, both on physical and mathematical grounds.

...

"In the geometrical formulation of the general relativity, the components  $g_{mn}(x^a)$  play a **dual role**. From one side they are components of the metric tensor, from the other side they are considered gravitational field variables. If one insists on the proposition that "gravity is geometry" and "geometry is gravity", then, indeed, it is impossible to derive from the Hilbert-Einstein Lagrangian something reasonable, satisfying the 6 conditions listed above."

[Ref. 2] John and Marry Gribbin, *In Search of Schrödinger's Cat*, Black Swan, London, 1998, p. 209

"There had been a plot *not* to agree on an object to be guessed, but that each person, when asked, must give a truthful answer concerning some real object that was in his mind, and which was *consistent with all the answers that had gone before*. With only one question left, John Wheeler guessed: "Is it a **cloud**?" The answer was "Yes!"

[Ref. 3] [Eric Schechter](#) (5 December 2009), Infinity: [Introduction](#) and [History](#).

Comment: [Eric Schechter](#) wrote that "if you take a medium-sized number and divide it by an enormous number, you get a number very close to 0."

Since the notions of infinity and [infinitesimal](#) are, in some ([yet to be explained](#)) sense, reciprocal, the latter can be illustrated with the following expression (notice that this is just an illustration of the puzzle stressed by [Lucretius](#)):

$$1/\infty \rightarrow 0$$

We take a medium-sized number, **1**, to represent a *finite Archimedean* thing (e.g., one meter or [one second](#)), and divide it by ... *what kind* of infinity? Potential infinity or [completed/actual infinity](#)? No matter what we choose, we cannot **recover** the *finite Archimedean* thing by multiplying "zero" by "infinity". We are "[bartenders](#)" (recall Thompson's lamp [paradox](#)).

That's the puzzle of the *finite Archimedean* entities called 'space' and 'time' (local mode). Viewed from the local mode of spacetime, the infinitesimal -- the atom of geometry -- is *the* instantaneous state of [Zeno's arrow](#). It is in 'absolute rest' with respect to all relativistic systems, hence we can define *the* elementary increment of physical variables ([ds and dt](#)) with respect to such "[ether](#)". I call it 'geometrical point', and stress that it is a [non-Archimedean](#) entity (global mode of spacetime), which builds up 'the grin of the can without the cat' ([Alice](#)), in line with the Continuum Hypothesis (CH). The latter is *neither* provable *nor* disprovable -- cf. [Kurt Gödel](#). Why? Because *the continuum emerges* from the [non-Archimedean](#) realm of 'the universe as ONE', in which our mundane notions of "zero" and "infinity" do not hold anymore. They are simply not-applicable.

All we can say is that, depending on the "direction" we look at 'the universe as ONE', it looks like either *infinitely small* or *infinitely large*, as it wraps up the whole Archimedean 3-D space of present-day GR. Hence we can enjoy "self-contained" [isolated systems](#), the asymptotic spacelike regime included ([Adam Helfer](#)).

The recipe is simple and unique. How else can you remove the jejune poetry in mathematical GR and

differential geometry textbooks, encoded in expressions like "sufficiently small" and "smooth" (Piotr Chrusciel), and in stipulations that the Hausdorff topological space has somehow been made "connected" (Chris Isham)? There is no matter at the primordial level of 'pure geometry' to enable such "connection", which would show up as the affine connection (Graham Nerlich).

"It is extremely difficult to induce penguins to drink warm water", says John Coleman.

I hope these brief (and frank) comments can explain the idea about bi-directional "talk" of the Archimedean (material) and [non-Archimedean](#) (geometrical) realms. Forget about [tensors](#).

More on Wednesday, 25 November 2015. GR "[bartenders](#)" are cordially invited.

D.C.

August 9, 2010

Last update: August 11, 2010

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Point set topology is a disease from which the human race will soon recover.

[Henri Poincaré](#)

=====

Subject: Request for paper

Date: Wed, 29 Sep 2010 15:57:22 +0300

From: Dimi Chakalov <dchakalov@gmail.com>

To: Jochen Rau <jochen.rau@q-info.org>,  
Jochen Rau <jrau@th.physik.uni-frankfurt.de>

Cc: Jürgen Audretsch <juergen.audretsch@uni-konstanz.de>,  
Klaus Nagorni <nagorni@ev-akademie-baden.de>

Dear Dr. Rau,

If possible, please send me a copy from your paper/slides "How to infer a quantum state from imperfect data", November 19, 2010. I trust you'll mention KS Theorem,

<http://www.god-does-not-play-dice.net/#KS>

Regarding your 1993 article "On the metric structure of space-time", [arXiv:1009.5523v1 \[gr-qc\]](#), and Prof. Audretsch's article "Riemannian structure of space-time as a consequence of quantum mechanics" from [1983](#) ("quantum mechanics must contain classical particle mechanics as a [limiting case](#)", Jürgen Audretsch), please notice my efforts in quantum cosmology,

<http://www.god-does-not-play-dice.net/#consciousness>

Outline in Sec. Summary, pp. 35-36, in

<http://www.god-does-not-play-dice.net/ExplanatoryNote.pdf>

Perhaps one can define God mathematically. It's all about 'Die Wirklichkeit des Möglichen in der Physik' ([Jürgen Audretsch](#)).

Kindest regards,

Dimi Chakalov

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Comments on 'primitive concepts' in spacetime structures, prompted by Jochen Rau's 1993 article [[Ref. 1](#)] and  $R = R(\mathbf{t})$  from [Brian Dolan](#):

The key assumption, which Jochen Rau calls 'deformability', is that "the event manifold's physical structure is allowed to vary freely" [[Ref. 1](#)]. Precisely what is implied by "freely"?

In GR, there are no **fixed** paths in the "time" variable in  $R = R(\mathbf{t})$  from [Brian Dolan](#) -- paths are

being made by "walking" ([Antonio Machado](#)) along the [Heraclitean \(non-Archimedean\) time](#): "You cannot step into the same river twice, for [fresh waters](#) are ever flowing in upon you." In GR parlance, "[more and more space ... appears](#)."

Thus, the event manifold itself should be endowed *from the outset* with the *flexibility* to be modified at each and every **next** event from 'the world lines of galaxies' ([Weyl's principle](#)). Precisely *what* is implied by such flexibility?

Here Jochen Rau and I agree only on "it depends on the distribution of matter in the universe (and on boundary conditions)" [[Ref. 1](#)]. However, in a [Machian-type universe](#) the *flexibility* of the event manifold should **not** be constrained to Lorentzian metric. We may picture some [emergent Lorentzian signature](#) only [within/during](#) *one* fleeting instant from the [Arrow of Space](#).

To cut the long story short, the 'no-prior-geometry' demand fathered GR (MTW, [p. 431](#)), but by doing so it also fathered a century of confusion. No aspect of the geometry of spacetime should be "fixed immutably", i.e., "cannot be changed by changing the distribution of gravitating sources" (MTW, [p. 429](#)). Any fixed background, such as the topology of space (not determined in [current GR](#)) and the **fixed** relations of 'inside' vs. 'outside' in 3-D space (local mode), must be made (i) [dynamical](#) and (ii) totally removable in the *global mode* of spacetime. And that's why we need the *global mode* of spacetime: the "dark gaps" from the global mode are rendered/reduced to **zero** in the *local mode*, by the [Arrow of Space](#) and the so-called '[speed of light](#)'. The physical/observable result is a *perfect* continuum, at *all* length scales. We don't have any other choice.

To resolve the century of confusion, I plan to suggest a [virtual geodesic path formulation of GR](#) on Wednesday, 25 November 2015 -- DeWitt's "[many worlds](#)" will be placed in our common '[potential reality](#)', and the *selection* of '**one** among infinitely many' worlds with [emergent Lorentzian signature](#) - - one-at-a-time -- will be made by 'the whole universe as ONE', in line with so-called [biocausality](#).



As the old saying goes, you pay your money and you take your choice; but assume well-defined concepts of (i) [energy density](#) in GR and (ii) trajectory of quantum particles (quantum [flexibility](#), not "fluctuations"), your choices narrow greatly. Regarding (ii), all particles simultaneously explore all *potential* paths ("smells all the paths in the neighborhood", *The Feynman Lectures on Physics*, Vol. II, Ch. 19, The Principle of Least Action) **before** (= [global mode](#)) they jointly make *the* elementary ([dt & ds](#)) step along their trajectories; hence each and every step is unique and irreversible in the [Heraclitean \(non-Archimedean\) time](#).

As to (i), the [energy density](#) is fixed *both* 'at a point' *and* 'viewed from infinity'. It's a package, and we can get it only with the *global mode* of spacetime in which the notions of 'geometrical point' and '[actual infinity](#)' refer to ONE entity. Depending on the "[direction](#)" we look at 'the universe as ONE' from *within* the 3-D space (local mode), it looks either as 'infinitesimal geometrical "point" tending asymptotically toward [zero](#)', or as 'infinitely large and "[expanding](#)" volume of 3-D space'.

There is [no other choice](#) for quantum gravity. We first have to fix the long-standing problems of QM and GR, and then all pieces of the jigsaw puzzle will snap to their places -- effortlessly. Then the proper math will also show up -- effortlessly. I am sure professional mathematicians will understand what I mean.

If you agree with [Chris Isham](#), you'll be playing with the drawing below forever.



Again, GR and QM "[bartenders](#)" are cordially invited.

Well, as [Blaise Pascal](#) says, I have made this note longer than usual because I lack the time to make it shorter. Sorry. Will try to do better in November 2015.

D. Chakalov

September 30, 2010

Last update: October 8, 2010

[Ref. 1] Jochen Rau, On the metric structure of space-time, [arXiv:1009.5523v1 \[gr-qc\]](#). Journal reference: M. A. del Olmo, M. Santander, and J. Mateos Guilarte, eds., Group Theoretical Methods in Physics, Vol. II, Anales de Fisica, Monografias 1, CIEMAT, Madrid, 1993, pp. 483-486

"(W)hich physical assumptions are being tacitly made whenever one postulates the existence of a Lorentzian metric? Only after these assumptions are exhibited can one start to systematically relax them; thus, answers to the above question may be helpful for the study of more general space-time structures.

"Primitive concepts are taken to be events, counting of events, causal relationships and the ability to compare measurements; the corresponding mathematical structures are a differentiable manifold, volume element, causal vectors and affine connection(s), leading to the notion of an 'event manifold'.

"The key assumption, which I will call 'deformability', is that the event manifold's physical structure is allowed to vary freely.

"The proof of the Weyl-Cartan theorem is then reviewed to establish the result that any deformable event manifold must be Lorentzian.

## 2 Event Manifolds

"I assume that space-time is a connected  $n$ -dimensional differentiable manifold  $M$ . At  $x \in M$ , local measurements (e.g., evaluating vector fields) are performed using a basis of the tangent space  $T_x M$ . In order to have a means to compare local measurements at different points, I require the manifold to be endowed with an affine connection.

"The connection is assumed to be [torsion-free](#).

.....

## 3 Deformability

"So far my considerations have been very general, and the symmetry group  $G$  is by no means uniquely determined. Only now the key idea of General Relativity comes into play: rather than being fixed as in Newtonian theory, the local physical structure on the space-time manifold is itself a variable; it depends on the distribution of matter in the universe (and on boundary conditions)."

=====

Subject: Virtual geodesic path formulation of GR  
Date: Sat, 2 Oct 2010 16:09:16 +0300  
Message-ID:  
<AANLkTikDKpf6TrPVD2=+tQO7qjeVP4DHpzWM01EYJmSz@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: [snip]

Dear Colleagues,

On Wednesday, 25 November 2015, I intend to suggest a virtual geodesic path formulation of GR:

[http://www.god-does-not-play-dice.net/#Rau\\_comments](http://www.god-does-not-play-dice.net/#Rau_comments)

It will elaborate on the \*emergence\* [Ref. 1] of globally valid 3-D space, along an Arrow of Space,

[http://www.god-does-not-play-dice.net/#Zinkernagel\\_note](http://www.god-does-not-play-dice.net/#Zinkernagel_note)

Hence 'time' emerges locally, in terms of a 'future directed, time-like unit vector field' (cf. below).

Details in Sec. Summary, pp. 35-36, in

<http://www.god-does-not-play-dice.net/ExplanatoryNote.pdf>

Should you find these efforts interesting, please reply by September 25, 2015, and I will gladly send you details about the venue (probably Munich).

May I take this opportunity to thank you all for everything I learned from you, and will (hopefully) continue to learn in the years ahead.

Kindest regards,

Dimi Chakalov

[Ref. 1] C.J. Isham and J. Butterfield, On the Emergence of Time in Quantum Gravity, gr-qc/9901024  
<http://arxiv.org/abs/gr-qc/9901024>

p. 25: "Space and time are such crucial categories for thinking about, and describing, the empirical world, that it is bound to be ferociously difficult to understand their emerging, or even some aspects of them emerging, from 'something else'.

.....

p. 46: "As we said in Section 1, we intend 'the emergence of time' to also cover the emergence of spacetime, and so space."

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Subject: A future directed, time-like unit vector field  
Date: Tue, 31 Mar 2009 05:46:18 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Helmut Friedrich <hef@aei.mpg.de>  
Cc: Hermann.Nicolai@aei.mpg.de, Curt.Cutler@aei.mpg.de

Dear Dr. Friedrich,

You acknowledged that a future directed, time-like unit vector field, for which no natural choice exists in general, is characterized indirectly and becomes explicitly available only after solving the equations (arXiv:0903.5160v1 [gr-qc], p. 17).

I've been trying to argue that this problem can only be solved by recovering the reference fluid in GR.

[snip]

=====

Subject: The universe modeled as a 'brain'  
Date: Sun, 3 Oct 2010 04:53:03 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Charles L Bennett <cbennett@jhu.edu>,  
Gary F Hinshaw <Gary.F.Hinshaw@nasa.gov>,  
David Spergel <dns@astro.princeton.edu>,  
Lyman Page <page@princeton.edu>,  
Ed Witten <witten@ias.edu>,  
Richard H Miller <rh@oddjob.uchicago.edu>,  
Stephan S Meyer <meyer@oddjob.uchicago.edu>,  
Joshua A Frieman <frieman@fnal.gov>,  
Rocky Kolb <Rocky.Kolb@uchicago.edu>,  
Robert Rosner <r-rosner@uchicago.edu>,  
Carlos S Frenk <C.S.Frenk@durham.ac.uk>,  
Berkeley Center for Cosmological Physics <bccpcoth@lbl.gov>

Dear Colleagues,

I've been trying to suggest a model of the universe as a human brain -- please check out Sec. Summary at

<http://www.god-does-not-play-dice.net/ExplanatoryNote.pdf>

It seems to me -- please correct me if I got it wrong -- that Eqs 1 and 2, pp. 35-36 at the link above, may offer a solution to the 'most embarrassing observation in physics' (Ed Witten) and explanation of the apparent finite age of the universe:

"WMAP definitively determined the age of the universe to be 13.73 billion years old to within 1% (0.12 billion years) - as recognized in the Guinness Book of World Records!"

The model suggests a dual age of the universe, such that the evaluation of the statement from WMAP Team will be, in German, YAIN (both yes and no).

Your critical comments will be appreciated, and will be kept private and confidential.

Kindest regards,

Dimi Chakalov

=====

Subject: The Koch curve and [Thompson's Lamp Paradox](#)  
Date: Mon, 20 Sep 2010 06:44:58 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Piero Nicolini <nicolini@th.physik.uni-frankfurt.de>,  
Benjamin Niedner <niedner@arcormail.de>  
Cc: Karl <svozil@tuwien.ac.at>, Jeremy <jb56@cam.ac.uk>

Dear Dr. Nicolini,

I read with great interest your latest [arXiv:1009.3267v1 \[gr-qc\]](#). May I ask a question regarding the Koch curve in Fig. 1.

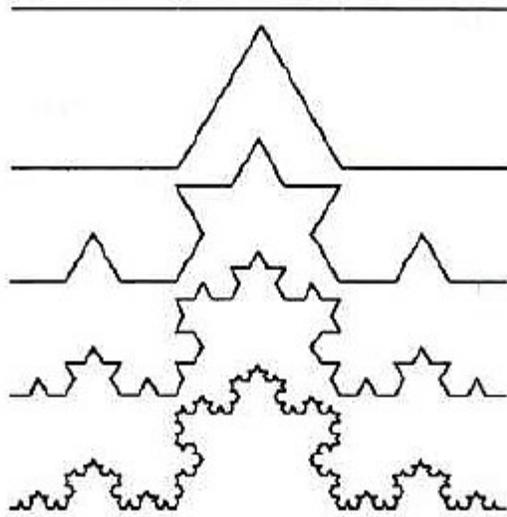


FIG. 1: Construction of the Koch curve. At each step, the middle third of each interval is replaced by the other two sides of an equilateral triangle.

You and Dr. Niedner wrote: "It is an example of an everywhere continuous but nowhere differentiable curve. We can construct the Koch curve as a final product of an infinite sequence of steps. At each step, the middle third of each interval is replaced by the other two sides of an equilateral triangle."

Suppose we consider, as a Gedankenexperiment, an infinite sequence of steps, and assume "the presence of a minimal length" (p. 5), such that (operational definition) the initial 'interval' in Fig. 1 at this "minimal length" becomes sufficiently small (the key expression from the Equivalence Principle in GR textbooks), hence can be considered as 'infinitesimal point' -- the very same infinitesimal point "inside" which the state of the Thompson's Lamp becomes indecisive . Namely, a superposition of  $|on\rangle$  and  $|off\rangle$  state(s), which can never be "collapsed" bzw. observed.

We would have an ultimate cutoff by such (Planckian?) 'sufficiently small minimal length', yet we won't be able to compute the actual length of the whole Koch curve (nor the Hausdorff dimension), because the sufficiently small infinitesimal length will act as 'numerically finite but physically unattainable boundary/cutoff'.

Stated differently, the final curve won't be "infinitely long", as you put it, but indecisive .

I believe the implications for the notion of "delocalization of point like objects" (p. 3), as well as for those depicted in Fig. 4, are obvious, but let me first state my question:

Am I wrong?

More on the crucial issue of 'sufficiently small' at

[http://www.god-does-not-play-dice.net/#when\\_how](http://www.god-does-not-play-dice.net/#when_how)

Kindest regards,

Dimi Chakalov

=====

Subject: Re: The Koch curve and Thompson's Lamp Paradox  
 Date: Mon, 20 Sep 2010 07:43:13 +0300  
 From: Dimi Chakalov <dchakalov@gmail.com>

To: Piero Nicolini <nicolini@th.physik.uni-frankfurt.de>

Cc: [snip]

Dear Piero,

Thank you for your reply.

[snip]

- > as far as I understand, I would say that in some sense your comment is
- > correct. the conventional computation of the Hausdorff length is modified
- > as we showed in our paper.

With the Thompson's Lamp Paradox, I think the situation changes drastically.

- > The introduction of a length scale breaks the self similarity property
- > of the erratic path of a quantum particle.

Please see above.

- > However some points don't seem to be correct in your comments. In
- > particular the reference to the infinitely long case, which is the
- > conventional case rather than that in the presence of a cut off as shown
- > in Eq. 16.

Perhaps you didn't have time to consider my Gedankenexperiment vs. yours (the alleged cutoff in Eq. 16).

Please check out the linked text at

<http://www.god-does-not-play-dice.net/#Nicolini>

I do hope to learn about your professional opinion.

All the best,

Dimi

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Note: The introduction of a *minimum* length scale as a 'numerically finite but physically unattainable boundary/cutoff' follows from the [non-Archimedean](#) nature of the geometric realm of 'the grin of the cat without the cat' ([Alice](#)): we cannot reach the "hidden unmoved mover" (Karel Kuchar) and the Aristotelian First Cause *from within* the [local mode](#) of spacetime. Corollary: speculations about some dirty black hole thermodynamics, noncommutative gravity, non-commutative micro black holes, entropic "[force](#)" (the latter translates to 'information force'), *etc.*, are unjustified.

D.C.

September 20, 2010

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Subject: [arXiv:1009.3559v1 \[gr-qc\]](#)

Date: Tue, 21 Sep 2010 06:58:44 +0300

From: Dimi Chakalov <dchakalov@gmail.com>

To: [Niall](#) <niall@ucc.ie>, [julian@platonica.com](#)

Cc: [david.klein@csun.edu](#),

[yang@euclid.math.temple.edu](#),

[lbszab@rmki.kfki.hu](#),

[Roger Penrose](mailto:penroad@herald.ox.ac.uk) <penroad@herald.ox.ac.uk>

Dear [Niall](#) and [Julian](#),

In your latest paper, you stated the following:

"The time at which wave-function collapse occurs is ill defined in relativity; however the simultaneity associated with the shape-dynamic CMC foliation could bring interpretational clarity. This is also true for the 'problem of time' [14], which arises from the ambiguity in the time evolution in superspace if foliation invariance ([many-fingered time](#)) is made inviolate."

May I request some interpretational clarity: please tell me how you plan to resolve the [quasi-local mess](#) in GR,

<http://www.god-does-not-play-dice.net/#Zinkernagel2>

If your colleagues have some insights, I will appreciate their feedback as well.

Regards,

Dimi

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Note: The only way I could think of "the time at which [wave-function collapse occurs](#)" is by speculating about [Weyl's Principle](#) being applied to some *preferred* foliation of spacetime into 3-D spacelike hypersurfaces, to fix *the* temporal order for spacelike separated "points" -- simultaneity-at-a-distance -- hence 'simultaneity surfaces' along which *quasi-local* effects propagate among the "[school of fish](#)", in which every "fish" follows [pre-correlated quasi-local](#) geodesics.

The present-day GR explicitly forbids such luxury, as well as some 'nondynamical time parameter' ([Unruh & Wald](#)).

Niall Murchadha and Julian Barbour claim that have found "the configuration space of general relativity" that "could bring interpretational clarity", and I offered them 'the test of the pudding'. Are they implying some [null surfaces backward in time](#) to resolve the [quasi-local mess](#) in GR? Check out the 1982 paper by [R. Penrose](#); the problem has been agonizingly clear since the inception of GR.

Apart from that, Niall Murchadha and Julian Barbour have brains, which could **not** have worked in any "timeless world" from GR, nor with some 'time variable' in STR, used to explain the [energy conservation](#) during that 'time variable', after [Noether's Theorem](#).

The human **brain** needs an [arrow of spacetime](#). Otherwise the human mind *must* act on its brain, which is sheer parapsychology. The latter has been explored by many people since the Roman Empire, with the same dead-end result.

If you seriously believe that [the flow of spacetime](#) is within the framework of the theory of relativity "an illusion", you have a choice: fix the [quantum theory](#) and theory of relativity by incorporating its "[dark energy](#)", or do parapsychology.

Or simply ignore this web site, and pretend that you've never learned anything from it, like Julian Barbour does.

D.C.

September 21, 2010

=====

Subject: The Design and Validation of the Quantum Mechanics Conceptual Survey,  
[arXiv:1007.2015v1](#)

Date: Wed, 14 Jul 2010 15:37:59 +0300

From: Dimi Chakalov <dchakalov@gmail.com>

To: Sarah McKagan <sam.mckagan@gmail.com>  
Cc: Sergio Doplicher <dopliche@mat.uniroma1.it>,  
Jeremy <jb56@cam.ac.uk>,  
David Schroeren <davidschroeren@cantab.net>,  
Ronnie Hermens <ronnie.hermens@gmail.com>,  
Landsman <landsman@math.ru.nl>,  
Laszlo Szabados <lbszab@rmki.kfki.hu>,  
Chris Isham <c.isham@imperial.ac.uk>,  
Adam Helfer <adam@math.missouri.edu>

Dear Dr. McKagan,

Students are kids, and I think nobody can blame them for being unable to grasp QM, given the fact that their tutors and professors are profoundly confused in the first place ("large variation in faculty views on many topics in QM", as you mildly put it).

Please see my efforts at

<http://www.god-does-not-play-dice.net/#KS>  
(updated July 14, 2010)

More on QM and GR at  
<http://www.god-does-not-play-dice.net/#shoal>

Your professional feedback will be appreciated.

All the best,

Dimi Chakalov

=====

Subject: [arXiv:1011.2287v1 \[quant-ph\]](http://arxiv.org/abs/1011.2287v1)  
Date: Thu, 11 Nov 2010 04:32:40 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Peter Evans <peter.evans@sydney.edu.au>  
Cc: Huw Price <huw@mail.usyd.edu.au>,  
John <cramer@phys.washington.edu>,  
Tim Maudlin <maudlin@rci.rutgers.edu>,  
Abner Shimony <abner.shimony@gmail.com>,  
Philip Pearle <ppearle@hamilton.edu>

Dear Dr. Evans,

May I elaborate on John Cramer's idea (p. 4): "repeats until" ... at which point the transaction is completed, and the observer can finally witness the \*already\*-completed transaction ([post factum](#)). I deliberately use temporal notions to show that (i) we're dealing with two kinds of time, and (ii) this language doesn't work. Perhaps if we allow these two kinds of time to [co-exist peacefully](#), the [crux of QM](#) can be resolved:

<http://www.god-does-not-play-dice.net/#KS>

I will appreciate your professional opinion, as well as the feedback from your colleagues. Please feel free to disagree, and explain why.

Kindest regards,

Dimi Chakalov



**Note:** Read Sects 2 and 3 from Peter Evans' [arXiv:1011.2287v1 \[quant-ph\]](https://arxiv.org/abs/1011.2287v1) (emphasis, comments, and links added by me - D.C.):

p. 2: "...the process of electromagnetic radiation should be thought of as an interaction between a source and an absorber rather than as an independent elementary process. (footnote 1)"

Footnote 1, p. 3: "... it is as absurd to think of light emitted by one atom regardless of the existence of a receiving atom, as it would be to think of an atom absorbing light without the existence of light to be absorbed."

p. 3: "... an advanced incoming field that is present at the source **simultaneous** with the **moment** of emission. The claim is that this advanced field exerts a finite force on the source which has exactly the required magnitude and direction to account for the observed energy transferred from source to absorber; ..."

p. 3: "The crucial point to note about the Wheeler-Feynman scheme is that due to the advanced field of the absorber, the radiative damping field is present at the source at **exactly** the time of the initial acceleration. Quite simply, if a retarded electromagnetic disturbance propagates for a time **t** before meeting the absorber then the absorber will be a distance **ct** from the source. The advanced field propagates with the same speed **c** across the same distance and thus will arrive at the source **exactly** time **t** before the absorber field is generated, i.e. at the time of the **initial** acceleration."

p. 4: "The transaction is completed with a "handshake": the offer and confirmation waves combine to form a four dimensional *standing wave* between emitter and absorber. (...) Any observer who witnesses this process would perceive only the **completed** transaction, which would be interpreted (post factum - D.C.) as the passage of a particle (e.g. a photon) between emitter and absorber."

p. 5: "The process is atemporal and the only observables come from the superposition of all "steps" to form the **final** transaction. (1986, fn. 14, p. 661)"

In order to employ this beautiful story for the mechanism of inertial reaction "force" in our Machian universe, we need a "mirror for gravitational waves" from Finite Infinity, plus a few other things. Only the math is unknown.

Don't say you knew nothing about it! 😊

D.C.

November 17, 2010

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Subject: Colloquium in Honour of [Ernst Specker](#) at his 90th Birthday, [October 29-30, 2010](#)

Date: Sat, 9 Oct 2010 06:02:21 +0300

From: Dimi Chakalov <dchakalov@gmail.com>

To: Jürg Fröhlich <juerg.froehlich@itp.phys.ethz.ch> ,

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Dear Colleagues,

In the late 1950's, Ernst Specker posed the question of whether the omniscience (total knowledge) of God extends to events which would have occurred if something had happened, which did not, in fact, happen (Ernst Specker, "Die Logik nicht gleichzeitig entscheidbarer Aussagen," *Dialectica* 14, 239-246 (1960); [p. 243](#)).

Die Schwierigkeiten, die durch Aussagen entstehen, welche nicht zusammen entscheidbar sind, treten besonders deutlich hervor bei Aussagen über ein quantenmechanisches System. Im Anschluss an die dort übliche Terminologie wollen wir solche Gesamtheiten von Aussagen als nicht gleichzeitig entscheidbar bezeichnen; die Logik der Quantenmechanik ist zuerst von Birkhoff und von Neumann in [1] untersucht worden. Auf ihre Ergebnisse soll zurückgekommen werden. In einem gewissen Sinne gehören aber auch die scholastischen Spekulationen über die «Infuturabilien» hierher, das heisst die Frage, ob sich die göttliche Allwissenheit auch auf Ereignisse erstreckt, die eingetreten wären, falls etwas geschehen wäre, was nicht geschehen ist. (Vgl. hierzu etwa [3], Bd. 3, S. 363.)

This leads to the questions of 'the universal truth function', and "why does quantum theory not have this sort of complementarity" [[Ref. 1](#)].

My scattered thoughts on KS Theorem and truth evaluation in Quantum Theory can be read at

<http://www.god-does-not-play-dice.net/#KS>

Regrettably, I cannot attend the Colloquium in Honour of Ernst Specker, and can only wish him all the best upon his Birthday 'by distance', although I will be, in some sense, present as well, since we are all entangled.

May I take this opportunity to invite you at my talk on quantum gravity,

<http://www.god-does-not-play-dice.net/#VGP>

Kindest regards,

Dimi Chakalov

[Ref. 1] Yeong-Cherng Liang, Robert W. Spekkens, Howard M. Wiseman, Specker's Parable of the Over-protective Seer: Implications for Contextuality, Nonlocality and Complementarity, arXiv:1010.1273v1 [quant-ph], <http://arxiv.org/abs/1010.1273v1>

p. 3: "(O)ne must imagine that the outcome of a measurement (or equivalently, the property that is measured) is context-dependent — whether a gem is seen or not in the first box depends on whether that box was opened together with the second or together with the third.

.....

"To get this kind of contextuality, it is necessary to find a situation wherein there are very specific sorts of limitations on joint measurability — there must exist a triple of measurements that can only be implemented jointly in pairs. For projective measurements in quantum theory, this sort of limitation on joint measurability does **not** occur.

.....

pp. 27-28: "Specker's parable provides an interesting new kind of foil, because the kind of complementarity it exhibits — three measurements that can be implemented jointly pairwise but not triplewise — is something that is **not** found among projective measurements in quantum theory. This prompts the question: why does quantum theory not have this sort of complementarity?"

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**Note:** Just a hint to the question above: suppose the {1,0,1} rule was **not** broken, and the [full catalogue of expectation values](#) for the spin-1 system were present (no "uncolored" section from KS sphere). Then people could develop a [relativistic QM](#) that could explain the "collapse" with some "hidden" stuff, and prove Schrödinger wrong, namely, 'a variable would have a *definite* value *before* I measure it; then measuring it simply means *ascertaining* the value that it *has*.'

D.C.

October 28, 2010

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"Wenn es doch bei dieser verdammten Quantenspringerei bleiben soll, dann bedauere ich, mich mit der Quantentheorie überhaupt beschäftigt zu haben."

(If we have to go on with these damned quantum jumps, then I'm sorry that I ever got involved.)

Erwin Schrödinger

"Let me say at the outset, that in this discourse, I am opposing not a few special statements of quantum mechanics held today (1950s), I am opposing as it were the whole of it, I am opposing its basic views that have been shaped 25 years ago, when Max Born put forward his probability interpretation, which was accepted by almost everybody.

....

"I don't like it, and I'm sorry I ever had anything to do with it."

[Erwin Schrödinger](#), *The Interpretation of Quantum Mechanics*. Dublin Seminars (1949-1955) and Other Unpublished Essays, Ox Bow Press, Woodbridge, 1995

**A brief note on the [Kochen-Specker Theorem](#)**

(if you aren't familiar with the subject, read the notes [here](#), [here](#), [here](#), and [here](#))

July 21, 2011

Abstract: Any "[quantum states](#)" that can be put in Dirac brackets, such as [|whatever>](#) , as well as any combination of such "[quantum states](#)", cannot be mapped to the UNdecidable Kochen-Specker (KS) state from the uncolored KS sphere. It cannot fit into *any* Hilbert space whatsoever, being a *pre-quantum* or rather *potential* quantum reality. No [state vector](#), in any Hilbert space, can accommodate the *potential* quantum reality which, from the perspective of our Boolean logic, is 'both yes and no' ([YAIN](#)). It cannot fit in the [Riemannian manifold](#) of [GR](#) either ([hypothetical](#) manifold with postulated (i) [differentiable structure](#), (ii) [affine connection](#), (iii) tangent space at each infinitesimal "point", and (iv) [metric](#) that can only "[expand](#)" *with respect to* the [reference fluid of GR](#)).

Suppose you are an Eskimo, and you have never seen, and will never see an elephant in your whole life. Yet you can nevertheless make observations on elephant's trunk by means of [two "complementary" devices](#), 'nose' and 'arm'. You know that Heisenberg relations preclude you from observing simultaneously the "nose" and the "arm" of elephant's trunk (the position and momentum of an [electron](#), say). Then you're struck by Schrödinger's [1935 paper](#):

"In general, a variable *has* no definite value before I measure it; then measuring it does *not* mean ascertaining the value that it *has*. But then what does it mean?"

It means you cannot observe elephant's trunk with (inanimate) devices at the length scale of tables and chairs. It does *not* mean that the trunk doesn't exist. Fortunately, the [Kochen-Specker Theorem](#) can help you understand the true, UNdecidable quantum "trunk"; check it out with your own brain [here](#). Richard Feynman claimed ([12 August 1983](#)): "We can do the arithmetic, but we cannot picture the car!" Yes we can. All we need is a brain.

[Carsten Held](#) stated that the KS theorem, "by its mathematical nature, is not empirically testable", and since [Ronnie Hermens](#) (and [Wiki](#)) seem to have some troubles with it, may I offer a brief, personal, and biased interpretation, ensuing from Ernst Specker's [tripod](#).

Ernst Specker was eager to clarify the answer to a truly fundamental question: is it possible to **distill** *all conceivable* quantum states as 'observables in 3-D space', such that **(i)** there will be **no counterfactuals** (cf. [Karl Svozil](#)) and **(ii)** the unitarity principle will be upheld, that is, the probabilities for all conceivable quantum observables will sum up to unity. If that were possible, one could make a "reverse engineering" of a quantum system, by exposing all of its localizable observables, after which the cornerstone questions of Quantum Mechanics (QM), posed by Erwin Schrödinger in [1935](#) and in [November 1950](#) (cf. below), would have acquired a dead simple answer: hidden variables. Then QM would be just a statistical theory based on the unitarity principle, and will also be marred with the intractable parapsychology of those "hidden variables" (maybe sub-quantum, or maybe noncontextual, but you never know, because all this parapsychological stuff is "hidden" from the outset). Thank God, the [Kochen-Specker Theorem](#) proved this whole mess wrong. But it also showed that the notion of '*complete set* of observables pertaining to a quantum system' is far more subtle and rich than expected, due to the presence of an UNdecidable KS state that **does not belong to this set**.

Imagine three quantum guys, Tom, Dick, and Harry, and think of the "spectral decomposition" of their *quantum states* as being presented by their hands, with the following specifications: upon observation at particular instant, they all have to simultaneously raise their hands (hermitian operators). Thus, each of them can, and have to, raise either his left hand (L), or right hand (R), or both (B). Recall that, unlike probabilities in classical statistical physics, probabilities in QM originate in Pythagoras' theorem in  $n$  dimensions ([C. Isham, Lectures on Quantum Theory, Sec. 2.1.2](#), get pp. 16-17 from [here](#)), so if one of the quantum guys cannot have orthogonal "states" for his hands, he will ruin the whole system.

The famous KS Theorem (download an explanation by R.I.G. Hughes from [here](#)) says that the (spin 1) system {Tom\_Dick\_Harry} will exhibit the following "paradoxical" (from the viewpoint of classical physics) situation: if Tom and Dick happen to possess context-dependent and *well-defined* ("an unequivocal true-false value", cf. Isham and Butterfield [above](#)) *quantum states* of their hands (either L, or R, or B), then in that same instant Harry will not have **any hands at all**. For if the poor guy had 'hands' in that same instant, he would have the opportunity to choose **one** of his context-dependant *quantum states* -- either L, or R, or B. He will instead be shifted to the "[uncolored](#)" section from KS sphere.

Next time you "measure" the system {Tom\_Dick\_Harry}, exactly the same thing can happen to Dick. Or to Tom. So, any time you observe some *classical* presentation of 'quantum state', be aware that nevertheless *something essential is missing*. It showed up in the case with Harry, yet it "covers" the whole system {Tom\_Dick\_Harry}, much like [the "dark" energy from 'empty space'](#). Poetically speaking, the case with Harry was the "revenge" of the quantum [Noumenon](#) pertaining to {Tom\_Dick\_Harry} for our efforts to push it at the length scale of (unanimated) tables and chairs. Unlike the measuring devices examined in QM textbooks, the [human brain](#) can operate with its presentation of 'potential reality' elevated at the length scale of tables and chairs, as demonstrated with the example of three "measurements" (cf. the three sayings [above](#)). If our brains can operate with their [UNspeakable potential reality](#), so can '[the universe as a brain](#)'.

Notice that if we constrain Tom, Dick, and Harry to raise only one hand (either L or R), people would entertain "[quantum computing](#)" and "topological quantum computation" (e.g., [Michael H. Freedman](#)), because the implications from KS Theorem will be obscured. But as the UNdecidable quantum state is still working in the quantum world, it cannot be harnessed with unanimated devices.

I employ the notion of '[potential reality](#)' to signify the UNdecidable KS quantum state -- the genuine 'quantum reality out there'. Can't fit it in any Hilbert space whatsoever. If you prefer, think of it as Reichenbach's [Common Cause Principle](#).

In summary, the Kochen-Specker Theorem demonstrates the UNdecidable KS quantum state. The latter is far more profound and important than the *contextuality* alone [[Ref. 2](#)] ("not all observables can be assigned definite values that are independent of the measuring context", cf. [Ronnie Hermens](#)).

Namely, the conclusion that "**only** *contextual* values can be ascribed" [[Ref. 2](#)] does **not** shed light on the **implications** from the fact that *contextuality* is invariant to the particular place of the observables in the 3x3 array. As I wrote above, the same thing that happened to Harry can happen to Dick, or to Tom.

Nothing -- not even some "contextuality" -- can save Harry (or Dick, or Tom) from the case in which he (or Dick, or Tom) **must not** possess *any* hands.

If at some instant of measurement Harry **must not** have any **classical** hands whatsoever, yet at some other instant he -- the same Harry -- can and will obtain some *contextual*, well-defined, classical-*able* hands, then we are facing a phenomenon far more important than "contextual hands" alone. Namely, we can tell apart the contextualized classical-*able* hands, which can be filtered through the classical spacetime as '**classical** hands', from those "intact" quantum states that can't. Which does not imply that the latter do not exist. In my view, only some quantum [Noumenon](#) can secure the *ontological contextuality* of quantum objects. The *ontological contextuality* may or may not provide 'the same Harry' with [contextualized classical-able hands](#). It is also UNdecidable and Unspeakable, and of course 'not empirically testable'. Thus, if you observe the "hands" of some quantum object, be aware that you're only observing its *contextualized classical shadows* on Plato's cave, emanating from the ultimate quantum [potential reality](#).

[Three years ago](#), I explained to my [teenage daughter](#) a similar [puzzle in GR](#), regarding the [Hole Argument](#). With slight modifications, the corresponding 'KS Theorem for teenage girls' would be as follows. Imagine you cannot see your finger nails "bare", without nail varnish. One way to think of such peculiar situation is that your 'bare finger nails' do in fact exist, but are somehow banned from showing up to you. Namely, your 'bare finger nails' can show up to you only after you cover them with your nail varnish, with different colors depending on your mood, but then they won't be 'bare' anymore. They will be "contextualized", with particular color. Well, KS Theorem (roughly) says that (i) if you use **three** different nail-varnish colors for each nail, and (ii) if you have to paint three (or more) of your nails, then *one* of the them would *have to* show to you its "bare" nature: the UNdecidable KS state. Which would, in turn, ruin your whole manicure. To avoid such disasters, you should use maximum *two* nail-varnish colors, and then all your "bare" finger nails will be safely covered with some particular "contextualized" color. The downside of such (seemingly perfect) manicure will be that you may never understand QM nor [GR](#). Capiche?

**NB:** If the reader wishes to refute the "adult" interpretation of KS Theorem [above](#), please start with converting the "[uncolored](#)" section from KS sphere to some Hilbert space (your choice), to match the case in which Harry would obtain some *contextual*, well-defined, classical hands, at the expense of either Dick or Tom being shifted to the same "[uncolored](#)" section from KS sphere. What is the '[time parameter](#)' pertaining to the dynamics of the reversible (KS sphere <--> Hilbert space) transitions, for all observables from {Tom\_Dick\_Harry}? Please don't hesitate!

In a drastic contrast to the "[collapse](#)" and the [Eigenvalue-Eigenstate Link](#) from the old Copenhagen School [[Ref. 1](#)], the [PR interpretation of QM](#) employs the phenomenon of 'emergence' (e.g., [Isham and Butterfield](#)): in the case with {Tom\_Dick\_Harry}, one could **only** observe, at particular instant of time, the *emergence* of only **one** of its latent observables, say, {Tom, R}, just like the end result from the correlation and "negotiation" (global mode of spacetime) that led finally to John Wheeler's '[cloud](#)'. This **one** final result (one-at-a-time) is 'physical reality' (local mode of spacetime), while the rest of Tom's *latent* states, plus Dick's *latent* states, plus Harry's UNdecidable KS state constitute the 'potential reality' of the system {Tom, Dick, and Harry}, which is in turn rooted on the quantum [Noumenon](#) -- "The ideal monad has no windows" ([Döring and Isham](#)). This is entirely different from any 'modal' or 'contextual hidden variable' theory.

It goes without saying that a rigorous presentation of the ideas in the paragraph above is not

available. These are just ideas presented with words. Back in 1935, [Erwin Schrödinger](#) also offered some very general ideas, presented with words:

"The rejection of realism has logical consequences. In general, a variable *has* no definite value before I measure it; then measuring it does *not* mean ascertaining the value that it *has*."

The second part from the last sentence was totally forgotten by the mainstream theoretical physics community, and only [Henry Margenau](#) paid attention to it. Yet even today very few QM textbooks mention KS Theorem, which is rooted on this forgotten (or rather ignored) consideration spelled out by [Schrödinger](#) in 1935. As to the first part, "a variable has no definite value before I measure it", perhaps the *intact* quantum world 'out there' exists as *the UNdecidable quantum state*.

If this is the case chosen by Mother Nature, the mysterious transition from quantum to classical, which is essential to QM textbooks [[Ref. 3](#)], should be explained with the "back bone" of the quantum world -- [potential reality](#).

Notice that the *quantum truth functional* in QM textbooks (e.g., [Ref. 4](#), p. 314) is **not** applicable to '[potential reality](#)' due to the presence of the generic "intact" (not limited to KS Theorem) UNdecidable quantum state.

For example, regarding the notion of spin ("*klassisch nicht beschreibbaren Art von Zweideutigkeit*", Wolfgang Pauli), Bob Griffiths rightly says ([ibid.](#), p. 196) that "there is no property (explicable at the length scale of tables and chairs - D.C.) corresponding to  $S_z = +1/2$  AND  $S_x = +1/2$  for a spin-half particle."

Of course not. The whole point is that there **must** exist *something* that keeps the "sameness" ([Genidentität](#), Kurt Lewin) of *this* spin-half particle, so that it can "pass through" **it** (the "intact" UNdecidable quantum state, or 'bare finger nails'), and be able to switch between its allowed states, in line with the conservation law known from QM textbooks.

Can we, with our Boolean logic, *think* of a quantum particle as possessing simultaneously perfectly well-defined position and momentum ([ibid.](#), p. 314)? Of course not. Does that mean that we can "impose bans" on such UNdecidable quantum state in the quantum world, just because we cannot *think* about it? Of course not. The "non-commutative" quantum state is simply **not point-like**. It may be perfectly well-defined as '[potential reality](#)', yet **not point-like**. It *has to be* point-like only in classical mechanics, like the point-like states of a Frisbee along its classical trajectory. (The hypothetical abilities of the [human brain](#) to observe and act on the UNdecidable quantum vacuum state requires [special considerations](#).)

Let's not mix apples with oranges, because the 'time' in the quantum world (no time operators in QM) is *not* like the one at the classical world, and the "intact" UNdecidable quantum state simply cannot *get there*. With unanimated measuring devices, we can "measure" **only one frozen point** from the *anti-relativistic* "time parameter" in the Schrödinger equation, and by imposing such wrong, albeit inevitable, *classical filter* on the quantum world we may develop distorted and misleading impression about some "time parameter in the Schrödinger equation". The experimental fact that even by detecting electrons one-at-a-time they nevertheless build an interference pattern [[Ref. 5](#)] demonstrates their *quasi-local* nature, yet the *probability* for detecting individual electrons on the screen, as **point-like** events, is blind and deaf to their **quasi-local** nature: the interference pattern can only be produced if the individual electron was able to "sense" the two slits simultaneously, while the probability for its detection on the screen refers to registered events that are inevitably point-like **facts**.

This should be the starting point for explaining "the central mystery of quantum mechanics" (Richard Feynman): the nature of the quasi-local UNdecidable quantum state. It is not a 'fact', and cannot be presented with *any* probabilities, as was the case with Harry [above](#). If you teach Quantum Mechanics, start with the double-slit experiments and finish with the KS Theorem, which is grounded on the statement made by Erwin Schrödinger in [November 1950](#):

"It seems to me that the concept of probability is terribly mishandled these days. Probability surely has as its substance a statement as to whether something is or is not the case — an uncertain statement, to be sure. But nevertheless it has meaning **only** if one is indeed convinced that the something in question quite definitely **is** or **is not** the case. A probabilistic assertion presupposes the **full reality** of its subject."

**NB:** There is nothing "probabilistic" or "stochastic" in the quasi-local UNdecidable quantum state that *neither 'is' nor 'is not'*. Can't fit it in any Hilbert space.

There are three *totally different* cases in QM. With just one degree of freedom, we (not Mother Nature) calculate an observable with a single eigenvalue ("an eigenstate of  $\mathbf{k}$  belonging to an eigenvalue  $\mathbf{k}$ ," P.A.M. Dirac, [p. 154](#)); the second case is confined to 'contextual values' (we constrain Tom, Dick, and Harry to raise only one hand -- either L or R; see [above](#)); and the third case deals with the absence of **any classical hands whatsoever**, after KS Theorem and the [Free Will Theorem](#).

Quantum Mechanics is about this *third case*. Can't fit it in any Hilbert space.

Tell your students about it, [Prof. Doplicher](#). No kid should end up like [A. Connes](#).

Surely the *quasi-local* UNdecidable quantum state cannot be filtered through the spacetime of STR and the Boolean logic of propositions: the truth evaluator will be **YAIN** (*both yes and no*). Which is *entirely different* from the "toposification" of quantum theory suggested by [Chris Isham](#) -- neither true nor false, but "somewhere in between" [[Ref. 6](#)].

To quote Niels Bohr, "Mathematical clarity has in itself no virtue. A complete physical explanation should absolutely precede the mathematical formulation." And the physical explanation has been spelled out by Schrödinger and [Margenau](#). Only the math is unknown.

To move further ([Machian quantum gravity](#)), try to unravel the origin and mechanism of [instantaneous](#) inertial reaction "[forces](#)", starting *solely* from [Albert Einstein](#)'s postulate that "the metrical character (curvature) of the four-dimensional spacetime continuum is determined at **every point** by the matter there, together with its state" (Kosmologische Betrachtungen zur allgemeinen Relativitätstheorie, 1917).

No way. Something inherently *quasi-local* is again missing (try an experiment with your brain [here](#)), as hinted by KS Theorem and CK [Free Will Theorem](#). In the case of GR, the [torsional degrees of freedom](#) are excluded from the outset. But I'll stop here, because, as many people complain, the story will (again) become deadly boring.

I think [Ronnie Hermens](#) should ask his QM tutor (Nicolaas Landsman) lots of questions about KS Theorem. Perhaps he should also ask [Chris Isham](#), after reading Ch. 9 from his [famous textbook](#).

D.C.

February 12, 2010

Latest update: July 21, 2011

[Ref. 2] Karol Horodecki *et al.*, Contextuality offers security, [arXiv:1002.2410v1 \[quant-ph\]](#)

"We shall use the Peres-Mermin version of KS paradox [23, 24]. The quantum observables and the KS conditions are depicted on Fig. 1." (Emphasis added - D.C.)

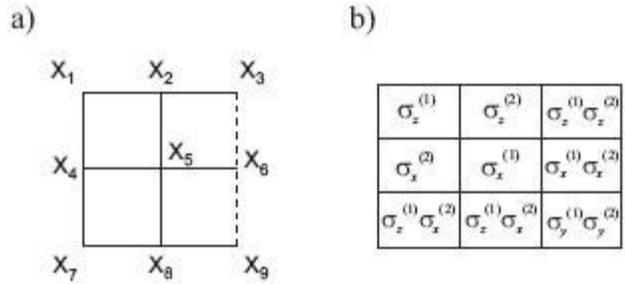


FIG. 1: Peres-Mermin version of Kochen-Specker paradox. We have 9 observables  $x_i$  arranged into  $3 \times 3$  array. If one chooses the observables as in (b) - where we have two two-level systems and  $\sigma^{(i)}$ 's are Pauli matrices on  $i$ -th system - quantum mechanics allows for joint measurement only of observables in a chosen row or a chosen column. One can ask whether some better theory could reproduce quantum mechanical predictions but at the same time predict outcomes of all nine observables at the same time. This was the subject of the famous Einstein-Bohr controversy. The Kochen Specker paradox says that it is impossible. Namely, quantum mechanics predicts that along solid lines, the outcomes, if multiplied give with certainty 1, while on the dashed line they give -1. (In the paper, instead of values  $\pm 1$  we shall use bit values 0, 1. Then quantum mechanics predicts that parity of outcomes is 0 for solid lines, and 1 for dashed line; we shall refer to it as KS conditions.) Thus, supposing that these nine observables have some preexisting values, which are merely revealed by measurement, we would obtain different value of the product of all nine of them, if multiply them in different order, which is a contradiction. So if one insists on ascribing some definite values to observables, the value of at least one of them would need to depend on whether the given observable is measured within row or within column, i.e. on the context. Thus only contextual values can be ascribed. Interestingly, the Kochen-Specker paradox, was thought not empirically testable, due to its mathematical nature. However recently, its operational version in terms of inequalities has been formulated [15] which paved the way to experimental verification of contextuality.

[Ref. 3] L. Landau, E.M. Lifshitz, *Quantum mechanics: Non-relativistic theory*, 3rd ed., Pergamon Press, 1977, p. 3

"Thus quantum mechanics occupies a very unusual place among physical theories: it contains [classical mechanics as a limiting case](#), yet at the same time it requires this limiting case for its own formulation."

[Ref. 4] Robert B. Griffiths, *Consistent Quantum Theory*, Cambridge University Press, 2003, <http://quantum.phys.cmu.edu/CQT/toc.html>

<http://quantum.phys.cmu.edu/CQT/chaps/cqt16.pdf>

p. 190: "... when constructing a quantum description of a physical system it is necessary to restrict oneself to a single framework, or at least not mix results from incompatible frameworks.

p. 194: "One cannot use a single framework to answer all possible questions about a quantum system, because answering one question will require the use of a framework that is incompatible with another framework needed to address some other question.

p. 195: "If two or more frameworks are compatible, there is nothing problematical in supposing that the corresponding conclusions apply simultaneously to **the same** physical system. (...) Consequently one can think of  $F_1$ ,  $F_2$ , ... as representing alternative "views" or "perspectives" of the same physical system, much as one can view an object, such as a teacup, from various different angles. Certain details are visible from one perspective and others from a different perspective, but there is no problem in supposing that they all form part of a single correct description, or that they are all simultaneously true, for the object in question.

p. 196: "Conceptual difficulties arise, however, when two or more frameworks are incompatible. (...) ... just as there is no property corresponding to  $S_z = +1/2$  AND  $S_x = +1/2$  for a spin-half particle. (...)

"Incompatible frameworks do give rise to conceptual problems when one tries to apply them to the same system during the same time interval. (...) The difficulty comes about when one wants to think of the results obtained using incompatible frameworks as all referring simultaneously to the same physical system, or tries to combine the results of reasoning based upon incompatible frameworks. It is this which is forbidden by **the single framework rule of quantum reasoning.**"

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<http://quantum.phys.cmu.edu/CQT/chaps/cqt22.pdf>

p. 261: "Each of the nine observables in (22.14) commutes with four others: two in the same row, and two in the same column. However, it does not commute with the other four observables. Hence there is no reason to expect that a single value functional can assign sensible values to all nine, and indeed it **cannot**.

"The motivation for thinking that such a function might exist comes from the analogy provided by classical mechanics, as noted in Sec. 22.1. What the two-spin paradox shows is that at least in this respect there is a profound difference between quantum and classical physics.

p. 263: "The nonexistence of **universal quantum truth functionals** is not very surprising. It is simply another manifestation of the fact that quantum incompatibility makes it impossible to extend certain ideas associated with the classical notion of truth into the quantum domain. Similar problems were discussed earlier in Sec. 4.6 in connection with incompatible properties, and in Sec. 16.4 in connection with incompatible frameworks.

p. 268: "Note that quantum truth functionals form a perfectly valid procedure for analyzing histories (and properties at a single time) as long as one restricts one's attention to a **single framework**, a single consistent family. With this restriction, quantum truth as it is embodied in a truth functional behaves in much the same way as classical truth. It is only when one tries to extend this concept of truth to something which applies **simultaneously to different incompatible frameworks** that problems arise.

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<http://quantum.phys.cmu.edu/CQT/chaps/cqt27.pdf>

p. 314: "For the purposes of the following discussion it is convenient to refer to the idea that there exists a unique exhaustive description as the principle of unicity, or simply unicity. This principle implies that every conceivable property of a particular physical system will be **either true or false**,

since it **either is or is not** contained in, or implied by the unique exhaustive description. Thus unicity implies the existence of a universal truth functional as defined in Sec. 22.4.

"But as was pointed out in that section, there **cannot** be a universal truth functional for a quantum Hilbert space of dimension **greater than two**. This is one of several ways of seeing that quantum theory is inconsistent with the principle of unicity, so that unicity is **not** part of quantum reality."

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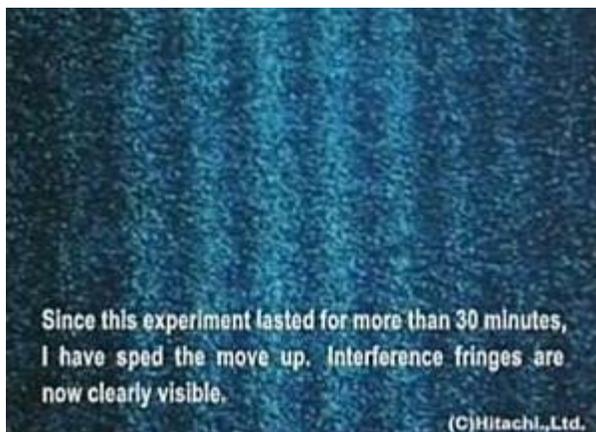
p. 375:

## Ch. 22. Incompatibility paradoxes

The impossibility of simultaneously assigning values to all quantum variables was pointed out by Bell (1966) and by Kochen and Specker (1967). See the helpful discussion of these and other results in Mermin (1993). The two-spin paradox of Mermin (1990) was inspired by earlier work by Peres (1990). See Mermin (1993) for a very clear presentation of this and related paradoxes.

(Note: Bob Griffiths didn't comment on the Kochen-Specker diagram (see the 17 projections, p. 70, in S. Kochen and E.P. Specker, The problem of hidden variables in quantum mechanics, *J. Math. Mech.* 17 (1967) 59-87), but instead suggested "the helpful discussion of these and other results" offered by N. David Mermin. Recall that Kochen and Specker used a finite set of **spin-1** observables (not spin-2, as in the case examined by Mermin). The essence of 'the Kochen-Specker Theorem' is the argument for **nonexistence of truth functions** on finite sets of projections -- nothing to do with Bell's [1966 paper](#) (cf. p. 452, footnote 19). Bob Griffiths is to be taken with a grain of salt. The same, of course, applies to my interpretation. D.C.)

[Ref. 5] A. Tonomura *et al.*, Demonstration of single-electron buildup of an interference pattern, *Am. J. Phys.* 57, [117-120](#) (1989)



Bram Gaasbeek, Demystifying the Delayed Choice Experiments, [arXiv:1007.3977v1 \[quant-ph\]](#)

p. 4: "A remark on assumptions. In the previous section, we supposed the measured observables to be conserved. This is necessary to carelessly time-translate the projection operators. The translated observable here is the idler photon measurement. This determines the beam of photon (so its momentum) and is clearly conserved."

Philip Pearle, Wavefunction Collapse and [Conservation Laws](#), [arXiv:quant-ph/0004067v2](#)

Philip Pearle: "... the collapse postulate of standard quantum theory can violate conservation of energy-momentum and there is no indication from where the energy-momentum comes or to where it goes."

Dharam Vir Singh Ahluwalia, Three Quantum Aspects of Gravity,  
[arXiv:gr-qc/9711075v1](http://arxiv.org/abs/gr-qc/9711075v1)

p. 2: "The second observation that I wish to report here is that the collapse of a wave function is associated with the collapse of the energy-momentum tensor. Since it is the energy-momentum tensor that determines the spacetime metric, the position measurements alter the spacetime metric in a fundamental and unavoidable manner. Therefore, in the absence of external gravitating sources (which otherwise dominate the spacetime metric), it matters, in principle, in what order we make position measurements of particles [D.V. Ahluwalia, Quantum Measurement, Gravitation, and Locality, [gr-qc/9308007](http://arxiv.org/abs/gr-qc/9308007)]. Quantum mechanics and gravity intermingle in such a manner as to make position measurements non-commutative. This then brings to our attention another intrinsic element of gravity in the quantum realm, the element of non-locality."

Yuan K. Ha, Is There Unification in the 21st Century?  
[arXiv:1007.2873v1 \[gr-qc\]](http://arxiv.org/abs/1007.2873v1)

pp. 8-9: "The result indicates that there is no evidence so far of any quantum nature of spacetime above the Planck length. Spacetime there (distance of 7.3 billion light years from Earth - D.C.) is smooth and continuous."

[Ref. 6] [C J Isham](#), Is it true; or is it false; or somewhere in between? The logic of quantum theory, *Contemporary Phys.*, 46(3), [207-219](#) (2005)

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Subject: Dark Energy  
Date: Fri, 12 Feb 2010 15:11:03 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Fred J.G. <jgfred@gml.com>  
Cc: Jerzy Kowalski-Glikman <jurekk@ift.uni.wroc.pl>, Yi Wang <>wangyi@hep.physics.mcgill.ca>, Miao Li <mli@itp.ac.cn>, Erik Verlinde <e.p.verlinde@uva.nl>, [CEOFOF <G.tHooft@uu.nl>](mailto:CEOFOF@uu.nl), Anthony Zee <zee@kitp.ucsb.edu>

Dear Fred,

Nice to hear from you.

> Did you read this submission from [Erik Verlinde](#)?  
> <http://arxiv.org/abs/1001.0785>

Yup. Do you know what advice Claude Shannon got from John von Neumann?  
<http://en.wikipedia.org/wiki/Entropy#Quotations>

"You should call it entropy, for two reasons. (...) In the second place, and more important, nobody knows what entropy really is, so in a debate you will always have the advantage."

> Wiki on this fellow "Dutchman":  
> [http://en.wikipedia.org/wiki/Erik\\_Verlinde](http://en.wikipedia.org/wiki/Erik_Verlinde)

Someone (Erik Verlinde?) wrote there that "Verlinde's approach to explaining gravity apparently leads naturally to the correct observed strength of dark energy." I respectfully disagree,

<http://www.god-does-not-play-dice.net/#Zee>

If some day Jerzy Kowalski-Glikman, or anyone else, explains the notion of "horizon", you will hear about it from CNN Breaking News :-)

All the best,

Dimi

--

<http://tinyurl.com/steel-evaporation>

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Subject: [arXiv:1002.1390v1 \[quant-ph\]](#)

Date: Tue, 9 Feb 2010 19:23:05 +0200

From: Dimi Chakalov <dchakalov@gmail.com>

To: Nicolas Gisin <nicolas.gisin@unige.ch>

Cc: hugo.zbinden@unige.ch, Mikael.Afzelius@unige.ch, Hugues.deRiedmatten@unige.ch, Robert.Thew@unige.ch,

Stefano.Pironio@unige.ch, Nicolas.Sanguard@unige.ch, Bruno.Sanguinetti@unige.ch,

Jun.Zhang@unige.ch,

S.Popescu@bristol.ac.uk

N. Gisin: "Finally, one should mention that a way out of our entire argumentation is to assume the existence of one preferred universal reference frame which determines unequivocally one and only one time ordering for all events."

Welcome aboard, Nicolas Gisin. You just discovered John Bell [[Ref. 1](#)] and the legacy of Schrödinger and Margenau,

<http://www.god-does-not-play-dice.net/#NB>

<http://www.god-does-not-play-dice.net/Szabados.html#Hilbert>

Have you ever received email from me in the past **seven** years?

Pity you can't respond ...

Sincerely,

D. Chakalov

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[Ref. 1] J. S. Bell, in *The Ghost in the Atom: A Discussion of the Mysteries of Quantum Physics*, ed. by P.C.W. Davies and Julian Russell Brown, Cambridge University Press, 1993, pp. 49-50.

"The reason I want to go back to the idea of an aether here is because in these EPR experiments there is the suggestion that behind the scenes something is going faster than light. Now, if all Lorentz frames are equivalent, that also means that things can go backward in time. [This] introduces great problems, paradoxes of causality and so on. And so, it's precisely to avoid these that I want to say there is a real causal sequence which is defined in the aether."

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Subject: Pre-quantum dynamics, ref. [[7](#)] in [arXiv:0912.2211v1 \[quant-ph\]](#)

Date: Mon, 14 Dec 2009 04:15:30 +0200

From: Dimi Chakalov <dchakalov@gmail.com>  
To: Steve Adler <adler@ias.edu>  
Cc: bassi@ts.infn.it

Hi Steve:

Before wrestling with the CSL model, why don't you explore first the legacy of Schrödinger and Margenau?

<http://www.god-does-not-play-dice.net/#NB>

Notice that the latest reference at the link above, relevant to the modification of Quantum Theory, is from November 1950.

Latest update at  
<http://www.god-does-not-play-dice.net/#Doplicher1>

Regards,

Dimi

P.S. Notice also an update at  
<http://tinyurl.com/steel-evaporation>

D.

=====

Subject: A Biased and Personal Description of GR at Syracuse University, 1951-61, by E.T. Newman  
Date: Thu, 4 Feb 2010 04:47:39 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Ted <newman@pitt.edu>  
Cc: tim.adamo@gmail.com, goldberg@phy.syr.edu

Ted:

Perhaps that full-time base-scientist (Josh should know his name) who was trying to understand and develop anti-gravity devices at Wright-Patterson Air Force Base [[Ref. 1](#)] will be interested to check out

[http://www.god-does-not-play-dice.net/#brick\\_wall](http://www.god-does-not-play-dice.net/#brick_wall)

<http://www.god-does-not-play-dice.net/Szabados.html#H3>

Perhaps a Machian-type theory of gravity can explain the origin and mechanism of (instantaneous?) inertial reaction "forces" and their reversible cancellation, so that you can levitate your "[anti-gravity device](#)".

As to the McCarthy witch-hunt period [[Ref. 1](#)]: would you turn up your collar to read the facts about 9/11?

<http://tinyurl.com/steel-evaporation>

People are scared to even talk about 9/11. What a sad sad country.

I wish you and your colleagues could at least elaborate on the origin and mechanism of inertial reaction "forces", but I'm afraid you won't do it either. You didn't even respond to my email regarding your [lrr-2009-6](#) and the mythical "[future conformal null infinity](#)".

Take care,

Dimi

--

[Ref. 1] E.T. Newman (July 30, 2002 ), A Biased and Personal Description of GR at Syracuse University, 1951-61.

<http://physics.syr.edu/faculty/Goldberg/GRHistory3Ted.dvi.pdf>

"I point out that Wright-Patterson Air Force Base provided financial support for the Syracuse and King's College groups (among several other relativity groups) from the mid 1950s to the early 1970s - during a most productive period. A question often asked is why did they do so. Though I was not privy to any internal Air Force information, once, when I spent a three month period working at the base, a full-time base-scientist remarked to me that they hoped to be able to understand and perhaps develop anti-gravity devices. It does seem likely that this idea played some role in their financial support.

.....

"... a few weeks after I arrived in Syracuse I saw that a well-known left-wing journalist, I.F. Stone was giving a public talk. I went to the talk but with considerable trepidation since I had come from a fairly left-wing family background and the time was at the peak of the Joe McCarthy witch-hunt period. In my mild state of paranoia I actually had my collar turned up so that I would not be recognized."

=====

Subject: Gravity (not "gravitons") knows about everything

Date: Thu, 11 Feb 2010 16:25:10 +0200

From: Dimi Chakalov <dchakalov@gmail.com>

To: Anthony Zee <zee@kitp.ucsb.edu>

Cc: Iain A Brown <I.Brown@thphys.uni-heidelberg.de> ,

Lily Schrempp <L.Schrempp@thphys.uni-heidelberg.de> ,

Kishore Ananda <Kishore.Ananda@gmail.com> ,

Edward W Kolb <rocky.kolb@uchicago.edu> ,

Lawrence M Krauss <krauss@asu.edu> ,

Nima Arkani-Hamed <arkani@ias.edu> ,

Paul Federbush <pfed@umich.edu> ,

Ronnie Hermens <ronnie.hermens@gmail.com>

RE: Anthony Zee, Gravity and its Mysteries: Some Thoughts and Speculations, arXiv:0805.2183v2 [hep-th] <http://arxiv.org/abs/0805.2183>

Dear Professor Zee,

I greatly enjoyed your essay. It is such a pleasure to get in touch with your sharp mind.

Regarding Secs I and VII, perhaps you may be interested to see

[http://www.god-does-not-play-dice.net/#brick\\_wall](http://www.god-does-not-play-dice.net/#brick_wall)

<http://www.god-does-not-play-dice.net/#Brown>

Since you offered the idea that the universe may be "secretly acausal but only the universe knows about it", please consider the possibility that the universe may not be "acausal" but pre-correlated (Leibnitz) and bootstrapped (Geoffrey Chew): think globally, act locally. Perhaps all we need is to model the universe as a brain,

<http://www.god-does-not-play-dice.net/#history>

You also wrote: "To move forward, physics had to abandon an apparently ironclad piece of commonsense that "where there is a wave something must be waving." I would not be at all surprised if it turns out that to move forward, we have to abandon an equally ironclad piece of commonsense. I leave it to the reader to identify that piece."

Have you seen a [walking centipede](#)? The legs exhibit a correlated wave pattern. Perhaps only the 'universe as ONE' (global mode of spacetime) can *evoke* quantum "waves" -- there is no source that is "waving", in QM textbooks.

As to GWs, "we have to abandon an equally ironclad piece of commonsense", as you put it. Please see the first link above.

I will highly appreciate your comments, as well as the professional feedback from your colleagues.

Kindest regards,

Dimi Chakalov

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Subject: An "improved" energy-momentum tensor, Eqs 41 and 42, [arXiv:0911.1636v3 \[gr-qc\]](#)  
Date: Mon, 26 Apr 2010 15:19:36 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Brian P Dolan <bdolan@thphys.nuim.ie>  
Cc: Luca Fabbri <luca.fabbri@bo.infn.it>

Dear Dr. Dolan,

I read very carefully your papers on torsion degrees of freedom, but found it impossible to hear and follow your talk on June 10th last year, [PIRSA:09060061](#). If you have a written version, please send me the link.

May I ask a question. Regarding your latest [arXiv:0911.1636v3 \[gr-qc\]](#) and your Lecture Notes MP476: [Cosmology](#) (dynamics of length scale  $R$ , [p. 43](#)), I wonder how you would pinpoint some dynamics of the so-called "dark energy".

I look at my wristwatch and claim that there is a "global" cosmological time, read by my wristwatch, such that, say, in the past 5 min the global 'length scale'  $R$  has been "increased". With respect to what? Can you introduce some [Akasha](#)-like "memory" of the whole universe, such that some (global) observer could verify that some "increase" of  $R$  has indeed happened w.r.t. some earlier value of  $R$  five min ago?

I cannot imagine how anything could be "[conserved](#)" in the cosmological time driven by such dynamical "dark" energy of (whatever). Please advise.

My efforts can be read at <http://www.god-does-not-play-dice.net/#quiz>

Kindest regards,

Dimi Chakalov

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**Note:** In one sentence: if something can be 'conserved in the time read by a clock', then it will be 'observable', and won't be "dark", because its source could be traced back and identified (cf. [note 3](#)). Again, the (global) time in which something can be 'conserved' is **not** the (local) time read by our mischievous clocks. It is the *global mode of time* produced by the dynamics of 3-D space itself (cf. Fig. 2 [above](#)). Any approach based on the Hamiltonian formulation of GR is inadequate [from the](#)

[outset](#), because the intrinsic dynamics of 3-D space, produced by its "dark" energy, cannot be captured *within* the 3-D space itself. You can never identify some [isolated system in GR](#), and will always be haunted by problems at "infinity" ([Paul Tod, 01:19-02:05](#)):

• The Big Question: which Cauchy data evolve to give a smooth  $\phi$  ?

To clarify the problems mentioned [above](#), I will quote from a well-known text by S. Weinberg (emphasis added), in which the notion of 'torsion' has never been mentioned, and will offer my biased, personal, and frank comments.

Steven Weinberg, *Gravitation and Cosmology: Principles and Applications of the General Theory of Relativity*, Wiley, January 1972; ISBN: [978-0-471-92567-5](#).

p. 68: "Although inertial forces do not exactly cancel gravitational forces for freely falling systems in an inhomogeneous or time-dependent gravitational field, we can still expect an approximate cancellation if we restrict our attention to such a small region of space and time that the field changes very little over the region. Therefore we formulate the equivalence principle as the statement that *at every space-time point in an arbitrary gravitational field it is possible to choose a "locally inertial coordinate system" such that, within a sufficiently small region of the point in question, the laws of nature take the same form as in unaccelerated Cartesian coordinate systems in the absence of gravitation.*

"There is a little vagueness here about what we mean by "the same form as in unaccelerated Cartesian coordinate systems," so to avoid any possible ambiguity we can specify that by this we mean the form given to the laws of nature by special relativity, for example, such equations as (2.3.1), (2.7.6), (2.7.7), (2.7.9), and (2.8.7).

"There is also a question of how small is "sufficiently small." Roughly speaking, we mean that the region must be small enough so that the gravitational field is sensibly constant throughout it, but we cannot be more precise until we learn how to represent the gravitational field mathematically. (See the end of Section 4.1.)"

p. 93 (the end of Section 4.1): "There are in general many generally covariant equations that reduce to a given special-relativistic equation in the absence of gravitation. However, because we only apply the Principle of General Covariance on a small scale compared with the scale of the gravitational field, we usually expect that it is only  $g_{\mu\nu}$  and its first derivatives that enter our generally covariant equations. With this understanding we shall see in this and the next chapter that the Principle of General Covariance makes an unambiguous statement about the effects of gravitational fields on any system, or part of a system, that is sufficiently small."

Comment (D.C.): This isn't any mathematical treatment of "sufficiently small". This is pure poetry, spiced with math.

.....

p. 106: "Write the appropriate special-relativistic equations that hold in the absence of gravitation, replace  $n_{\mu\nu}$  with  $g_{\mu\nu}$  and replace all derivatives with covariant derivatives. The resulting equations will be generally covariant and true in the absence of gravitation, and therefore, according to the Principle of General Covariance, they will be true in the presence of gravitational fields, provided always that we work on a space-time scale sufficiently small compared with the scale of the gravitational field."

Comment (D.C.): Such kind of thinking is typical to people like [CEOFOF](#).

.....

p. 149: "Although a freely falling particle appears to be at rest in a coordinate frame falling with the particle, a pair of nearby freely falling particles will exhibit a **relative motion** (Sic! - D.C.) that can reveal the presence of a gravitational field to an observer that falls with them. This is of course not a violation of the Principle of Equivalence, because the effect of the right-hand side of (6.10.1) becomes negligible when the separation between particles is much less than the characteristic dimensions of the field."

Comment (D.C.): Pure poetry, again.

.....

See pp. 146-147, [The Bianchi Identities](#) (6.8.4), and also 'The Cauchy Problem', p. 164:

"Thus we cannot learn anything about the time evolution of the gravitational field from the four equations {XXX} (7.5.1). Rather, these equations must be imposed as **constraints** on the initial data, ... ."

Comment (D.C.): Typical *non sequitur*. Besides, the Cauchy problem for the Einstein equations cannot be resolved: the global behavior of solutions of Einstein's equations **cannot** be uniquely defined (cf. [Paul Tod](#)'s metaphysics at [01:19-02:05](#), and the discussion of angular momentum at [46:22-46:35](#)).

.....

**p. 166**, Eq. (7.6.7): "the total energy-momentum "tensor" of matter and gravitation" is "**locally** conserved."

Comment (D.C.): **YAIN!** It *has to* be "locally conserved", but only in the '[local mode of spacetime](#)'; see Fig. 1 [above](#).

.....

p. 155: "The term  $[\lambda]g_{\mu\nu}$  was originally introduced by Einstein for cosmological reasons (which have since disappeared); for this reason,  $[\lambda]$  is called the *cosmological constant*. This term satisfies the requirements (A), (C), and (D), but does not satisfy (E), so  $[\lambda]$  must be very small so as not to interfere with the successes of Newton's theory of gravitation. Except in Chapter 16 (cf. "the scale factor  $R(t)$ ", p. 613 - D.C.), I am assuming throughout this book that  $[\lambda] = 0$ ."

Comment (D.C.): After the discovery of the "dark" energy in the [fall of 1997](#), Steven Weinberg didn't re-examine the source of the problem: you get "dark" energy because you *presume* that it comes from stuff with positive energy density, but if you focus on the puzzle of the *physical* existence of one "charge" only, you may discover the mechanism by which we see only *positive* energy densities, and not 'torsion connection' in GR. It should be "dark", of course.

Regarding the dynamics of "the scale factor  $R(\mathbf{t})$ ", and the meaning of the variable  $\mathbf{t}$  therein, see my [email](#) and Fig. 2 [above](#).

But as Chris Isham said [eight years ago](#), ... (no comment).

D. Chakalov  
April 27, 2010

=====

Subject: Curvature energy vs torsion energy, [arXiv:1006.2154v1 \[gr-qc\]](#), p. 4  
Date: Mon, 14 Jun 2010 12:29:02 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Mamdouh Wanas <wanas@frcu.eun.eg>  
Cc: [snip]

Dear Dr. Wanas,

May I ask two questions. You wrote, in your latest [arXiv:1006.2154v1 \[gr-qc\]](#), that torsion energy

has "a pure geometric origin", and "follows a [conservation law](#), similar to that of the curvature energy (for details see reference [7])".

I looked at ref. [7], Eq. 22 in your [arXiv:0705.2255v1 \[gr-qc\]](#), which deals with "the [second Bianchi Identity](#)", and hence cannot understand the \*source\* of the torsion energy.

Would you consider the other "charge" of mass, along the lines of Hermann Bondi (Negative Mass in General Relativity, Reviews of Modern Physics 29 (1957) 423)? Can you suggest a mechanism by which we can observe only positive mass, hence the physical source of torsion energy is not traceable in GR, and its origin looks like "a pure geometric origin"?

Kindest regards,

Dimi Chakalov

=====

Subject: If something walks like a duck and quacks like a duck, ...

Date: Tue, 28 Sep 2010 15:06:42 +0300

From: Dimi Chakalov <dchakalov@gmail.com>

To: Brian Dolan <bdolan@thphys.nuim.ie>

Cc: Sachiko Tsuruta <sachiko@physics.montana.edu> ,

Dana Backman <dbackman@sofia.usra.edu> ,

Alexander Potekhin <palex@astro.ioffe.ru>

Brian P. Dolan (September 21, 2010), Lecture Notes MP476: Cosmology, Sec. 3.1 Cosmological Constant, p. 45: "In General Relativity  $R$  is not a radial co-ordinate, it is a length scale determining the physical size of lengths in 3-dimensional space. If  $R = R(t)$  then when  $\dot{R} > 0$  space is said to be expanding while when  $\dot{R} < 0$  space is contracting. We can interpret  $R$  as the physical distance between any two fixed galaxies, provided their separation is of the order of 100M Pc, or more."

<http://www.thphys.may.ie/Notes/MP467/Cosmology-Lectures.pdf>

Dear Brian,

Regarding the quote from your Lecture Notes, please recall that if something walks like a duck and quacks like a duck, it may not be necessarily a duck ("the physical distance between any two fixed galaxies"). Details in Sec. Summary, pp. 35-36, at

<http://www.god-does-not-play-dice.net/ExplanatoryNote.pdf>

I also mentioned your Lecture Notes and articles by your colleagues at

<http://www.god-does-not-play-dice.net/Szabados.html#Sachiko>

All the best,

Dimi

On Thu, Apr 29, 2010 at 2:06 PM, Brian Dolan <bdolan@thphys.nuim.ie> wrote:

>  
> Dear Luca and Dimi,  
>  
> Thanks for your e-mails.  
[snip]

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## Comments on Jean-Philippe Uzan

1. Jean-Philippe Uzan, *Les distances de l'univers*, Conférence grand public, conseil général de Saint-Brieuc, 18 novembre 2008

The **crucial** question: *à quelle distance?* The answer by Jean-Philippe Uzan:



2. Jean-Philippe Uzan, Dark energy, gravitation and the Copernican principle, [arXiv:0912.5452v1 \[gr-qc\]](https://arxiv.org/abs/0912.5452v1)

2.1. "The *cosmological principle* supposes that the Universe is spatially isotropic and homogeneous. In particular, this implies that there exists a privileged class of observers, called **fundamental observers**, who all see an isotropic universe around them. It implies the existence of a cosmic time and states that all the properties of the universe are the same everywhere at the same cosmic time. It is supposed to hold for the smooth-out structure of the Universe on large scales.

"We can distinguish it from the *Copernican principle* which merely states that we do not live in a special place (the center) of the Universe. As long as isotropy around the observer holds, the principle actually leads to the same conclusion than the cosmological principle."

2.1. Comment: Regarding 'fundamental observers', see Eq. 1 on p. 35 [here](#). In the words of Paul Valery, "God made everything out of nothing, but the nothingness shows through."

As to the *Copernican principle*, recall the old wisdom that the universe looks like an *unbroken ring with no circumference*, for the circumference is nowhere, and the "center" is *everywhere*. The topology of such universe is unknown, of course.

2.2. Regarding Sec. 1.1.7, 'The equation of state of dark energy'

Jean-Philippe Uzan: "The equation of state of the dark energy is obtained from the **expansion history**, assuming the standard Friedmann equation."

2.2. Comment: Perhaps we could rely on the "expansion history" if only we knew the variable denoted by  $t$  in  $R = R(t)$  from Brian Dolan [above](#). The problems are [enormous](#).

2.3. Jean-Philippe Uzan, p. 41: "At the moment, none of these three possibilities is satisfactory, mainly because it forces us to speculate on scales much beyond those of the observable universe."

2.3. Comment: See the answer to the **crucial** question [above](#). If you employ [Archimedean geometry](#) only, there is *nothing* at your disposal to define [ds & dt](#) and 'the grin of the cat *without* the cat' ([Alice](#)).

3. Jean-Philippe Uzan, Varying constants, Gravitation and Cosmology, [arXiv:1009.5514v1 \[astro-ph.CO\]](#)

3.1. Regarding Sec. 7.2 (pp. 104-105), Jean-Philippe Uzan wrote (p. 103): "The numerical values of the fundamental constants are not determined by the laws of nature in which they appear."

3.1. Comment: In the same vein, the source of "dynamic dark energy" cannot be located *inside* the very thing it produces: 3-D space. I tried to explain the puzzle to my teenage daughter [here](#); details and implications [here](#).

Final comments: Previously, I tried to contact Jean-Philippe Uzan on Fri, 06 Jun 2003 15:19:29 +0300; Fri, 07 Nov 2003 21:39:48 +0200; and Thu, 18 May 2006 14:50:21 +0300. My last effort was made yesterday, regarding his review on varying "constants". We don't need any anthropic parapsychology: check out Pauli's solution from 1948 quoted [here](#), and Eq. 2 on p. 36 [here](#).

This is just business; nothing personal. I could be [totally wrong](#), too.

D. Chakalov  
September 30, 2010

=====  
Subject: Re: An "improved" energy-momentum tensor, Eqs 41 and 42, arXiv:0911.1636v3 [gr-qc]  
Date: Thu, 29 Apr 2010 17:13:26 +0300  
Message-ID:  
<l2sbcd37361004290713r38b53e76m874be358e208959@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Brian Dolan <bdolan@thphys.nuim.ie>  
Cc: Luca Fabbri <luca.fabbri@bo.infn.it>,  
Graham Nerlich <Graham.Nerlich@adelaide.edu.au>,  
Laszlo Szabados <lbszab@rmki.kfki.hu>

Dear Brian,

Thanks for your reply.

> [Weinberg](#) does not mention it for a very good reason ---  
> there is no known source of matter that produces any  
> appreciable torsion that could affect the Friedmann  
> equation and influence gravitational dynamics, it is  
> simply too weak. That is why it usually ignored.

I believe have discussed, at the link sent in my [initial email](#), the problem with the so-called "dark" energy. Its origin may not be confined exclusively to some (i) matter source with (ii) positive energy density (as usually done in the old cosmological problem by addressing the question of whether the quantum vacuum "gravitates", by Wolfgang Pauli in 1930s).

The "dark" energy may be of geometrical origin; hence my interest in the origin of torsion effects.

If we zoom on the affine structure (cf. Graham Nerlich below), I believe one can speculate about two "dark" components (global mode of spacetime), which I call 'torsion' and 'curvature' components of the affine connection. Please note that such two-component affine connection is postulated to explain how some Hausdorff topological space gets "connected" and can be endowed with differentiable structure.

In other words, all this is postulated prior to GR textbooks and review articles on torsion (e.g., how tangent spaces twist about a curve when they are "parallel transported"). It's all about the purely geometric connection "between" (=global mode of spacetime) points; please see Fig. 2 at

<http://www.god-does-not-play-dice.net/#Bahn>

The putative 'torsion component of the affine connection' may be envisaged by replacing the drawing from Wiki (cf. 'Torsion along a geodesic')

[http://en.wikipedia.org/wiki/Torsion\\_tensor](http://en.wikipedia.org/wiki/Torsion_tensor)

with the \*cycle\* of Escher hands,

<http://www.god-does-not-play-dice.net/#Escher>

<http://www.god-does-not-play-dice.net/#light>

It's a whole new ball game "between" the points of the manifold: the curvature component of the affine connection pertains to the "bridge" between two adjacent points on a 'line', while the torsion component of the affine connection refers to this same "bridge" between two adjacent points, made by a 'cycle' (cf. above). It's the topology of the "bridge" that makes the difference between the two components of the affine connection.

In some ludicrously fictional "flat" (Minkowski) space, these two components of the affine connection should be "flattened", hence made indistinguishable, which would in turn obliterate the affine connection itself.

Going back to the mundane affairs of GR: people read at

[http://en.wikipedia.org/wiki/Einstein-Cartan\\_theory](http://en.wikipedia.org/wiki/Einstein-Cartan_theory)

"General relativity set the affine torsion to zero, because it did not appear necessary to provide a model of gravitation (with a consistent set of equations that led to a well-defined initial value problem)."

Do you believe that GR can eventually produce \*any\* 'well-defined initial value problem' ? If you do, please show me one example of solved Cauchy problem for the Einstein equations.

All the best,

Dimi

-----

**Note:** Let me quote from an alternative viewpoint [[Ref. 1](#)], in which the [KS Theorem](#) and [Free Will Theorem](#) haven't been mentioned. Notice that your brain has no choice but to follow its states, which are fixed in the "past, present and future all at once." All this explained with lots of advanced math. Enjoy!

D.C.

April 30, 2010

[Ref. 1] Joseph Andrew Spencer, James T. Wheeler, The existence of time, [arXiv:0811.0112v2 \[gr-qc\]](http://arxiv.org/abs/0811.0112v2).

Footnote 1, p. 1: "S. Lloyd tells the amusing anecdote[?], "I recently went to the National Institute

of Standards and Technology in Boulder. I said something like, 'Your clocks measure time very accurately.' They told me, 'Our clocks do not measure time.' I thought, Wow, that's very humble of these guys. But they said, 'No, time is defined to be what our clocks measure.'

"Indeed, the standard second is *defined* as the duration of 9,192,631,770 oscillations of the radiation from the transition between the two hyperfine levels of the ground state of the cesium 133 atom.  
.....

p. 30: "In general relativity, for example, we have an initial value formulation, but can also find global solutions. In the initial value formulation, we can specify the configuration of the world at a given time, then integrate forward to predict how things will evolve. However, in the case of a global solution such as a cosmological model, we are presented a complete description of past, present and future all at once. In this view, the outcomes of measurements are already fixed.

"The best we can do is to think of consciousness as sequentially illuminating certain fixed events, then others, with all the events already right there in the solution."

=====

Subject: Re: torsion  
Date: Sun, 2 May 2010 00:45:55 +0300  
Delivered-To: dchakalov@gmail.com  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Brian Dolan <bdolan@thphys.nuim.ie>  
Cc: Luca Fabbri <luca.fabbri@bo.infn.it>,  
Graham Nerlich <Graham.Nerlich@adelaide.edu.au>,  
Laszlo Szabados <lbszab@rmki.kfki.hu>

Hi Brian,

On Sat, 1 May 2010 14:00:41 +0100 (IST), you wrote:

>  
> On Thu, 29 Apr 2010, Dimi Chakalov wrote:  
>>  
>> The "dark" energy may be of geometrical origin; hence my interest in  
>> the origin of torsion effects.  
>  
> I guess this comes down to the old chicken and egg problem on Einstein's  
> equations, which Einstein himself was not happy about.  
> The geometry is determined by the matter distribution, but you  
> need the geometry to specify the matter distribution. This is  
> just as true in the Einstein-Cartan formulation as in the  
> original Einstein formulation.

I think the chicken-and-egg problem and the so-called Buridan donkey paradox

<http://www.god-does-not-play-dice.net/Szabados.html#Buridan>

encapsulate the \*paradox\* of time in GR, as a relational/background-free theory: "the metric is treated as a field which not only affects, but also is (at the same time - D.) affected by, the other fields" (John Baez). This paradox is depicted by Escher hands,

<http://www.god-does-not-play-dice.net/#Escher>

Hence the dynamics of GR cannot be resolved with the unsolved puzzle of 'time in GR'. It is not surprising to me that people cannot define some 'gravitational energy' that would be conserved in such paradoxical time, and in the case of the Einstein equations alone, "there are no physically motivated boundary conditions" ([Alan Rendall](#)). Which brings me to the discussion with Laszlo regarding the precise meaning of his statement that any observable of the gravitational field is "necessarily quasi-local",

<http://relativity.livingreviews.org/Articles/lrr-2009-4/articlese1.html#x4-10001>

I believe the solution proposed at my web site is based on *the* only possible option for resolving this bundle of issues, because it seems to me that it solves other "quasi-local" paradoxes as well,

<http://www.god-does-not-play-dice.net/#KS>

- > I think you have a specific idea about the geometry in mind,
- > involving torsion, that comes from a geometric principle.

It's actually a pre-geometric principle,

<http://www.god-does-not-play-dice.net/#plenum>

- > If so that should translate into a statement about matter which,
- > assuming it has observational consequences, could be tested.
- > Historically I think people have worked the other way --- they look for
- > types of matter that might give torsion and all the known
- > candidates seem to give negligible torsion. If you have
- > a geometrical principle in mind that makes torsion significant
- > that would surely have observational consequences?

My "theory" is assembled on most general level. I cannot derive quantitative predictions, so it's far too early to say anything conclusive about the "dark" geometric effects of torsion.

Moreover, please bear in mind that everything I've written on my web site could be **wrong**. After all, I'm just a [psychologist](#),

<http://www.god-does-not-play-dice.net/#history>

Best regards,

Dimi

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Note: Regarding "a statement about matter which, assuming it has observational consequences, could be tested": use your brain to test 'potential reality' [here](#), and check out the UNdecidable quantum state [here](#). It's not about [type I matter fields](#). It's all about [quantum gravity](#).

Pity [Brian Dolan](#) didn't have time to check out the links. Your wristwatch does read the standard second *defined* as "the duration of 9,192,631,770 oscillations of the radiation from the transition between the two hyperfine levels of the ground state of the cesium 133 atom" (reference [above](#)). If you apply here GR, "points become *fuzzy* and *locality loses any precise meaning*", says [Sergio Doplicher](#). Hence your wristwatch reads a finite time interval, called 'second', based on the miraculously precise timing of the cesium 133 atom. Moreover, the fact that "it is possible to look around, and see as far as we can" ([Lee Smolin](#)) is another mystery that GR cannot explain either.

The mystery of these **finite** intervals of time and space, comprised of infinitely many and infinitely small "points", is the subject of the so-called Relative Scale Principle (RSP) outlined [here](#). Central to RSP is the hypothetical [pre-geometric plenum](#), which is supposed to **act** as a connecting-*and*-separating object that **does not belong** to this *perfectly smooth* set of "points". Hence we may describe an *emergent* and *perfect continuum* of "points", called 'local mode of spacetime': please see Fig. 1 [above](#). That's 'law and order' at all length scales, from the Planck scale to the sliding cosmological "horizon". Pity nobody is interested.

["just another crank"](#) D.C.

May 2, 2010

Last update: May 3, 2010

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Monday, August 2nd, 2010  
Your Local Time: 36 minutes past 4 P.M.  
Your Global Time is ZERO

## Relative Scale Principle: Equation of Space

Final version is expected on 25 November 2015,  
commemorating the 100th anniversary of GR  
(joint work by [Levi-Civita](#), Einstein, and Hilbert)

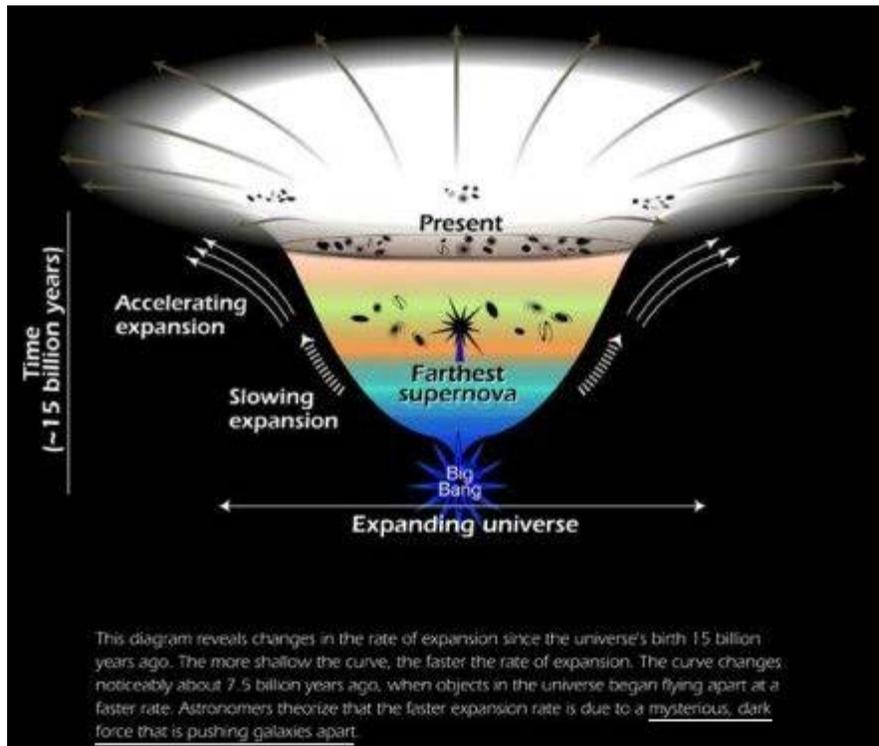
### Abstract

It is argued that the [Hamiltonian formulation of GR](#) cannot address the *dynamics* of space due to its "dark" energy from the quantum vacuum, hence [new degrees of freedom](#) should be introduced to the *dynamics* of space -- an [arrow of space](#). The scope of 'relative scale principle' ([RSP](#)), announced on [21 September 2008](#), is to introduce "boundaries" on spacetime, such that an [isolated system](#) endowed with 'finite infinity' can be constructed. The ontological assumptions in RSP are about '*necessary* and *sufficient* conditions for spacetime': the former concerns physical substratum ([positive energy density](#)), while the latter condition refers to a global, Heraclitean, and [non-Archimedean](#) state of the whole universe as ONE.

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[Excerpts from the 3rd draft version, 2 August 2010]

Let me start with a quiz: Look at the two pictures below and tell the *essential* difference.



Yes, you got it right: the first picture is a negative image from [the original](#).

You may also say that, unlike [Chuck Norris](#), those people at [NASA](#), who offer a meta-observer view on the "expanding" 3-D space, use lots of math, but that doesn't really matter, because the essential similarity is that both images are jokes. Back in 1963, [Roger Penrose](#) offered a recipe for reaching infinity from any location in space, which was also a joke, although spiced with lots of math.

.....

Here's the problem of "[more space](#)". Some prelims from GR textbooks: unlike STR, the spacetime in

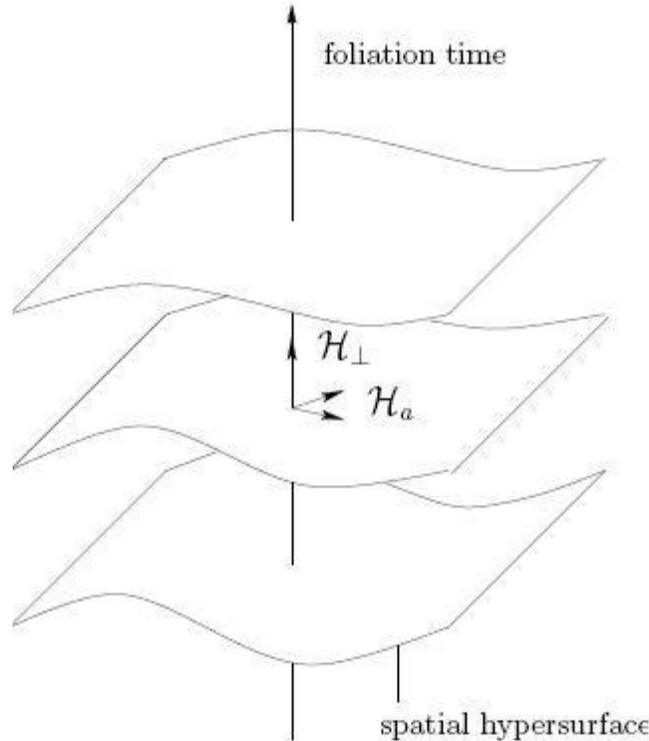
GR textbooks is considered "dynamical", such that, to follow a well-know metaphor, the "actors" ([matter](#)) and the "stage" (spacetime) engage in a *non-linear* negotiation (Escher's [hands](#)): "Space [acts](#) on matter, telling it how to move. [In turn](#), matter reacts back on space, telling it how to curve" ([John Wheeler](#)). But notice that, unlike GR textbooks, the [non-linear](#) negotiation between the two sides of Einstein equation is interpreted here as "taking place" in the *global mode* of spacetime endowed with additional spatial degrees of freedom from the [arrow of space](#).

We all agree that 'time' is no longer a fixed background parameter, but the *global mode* of time, in which the *non-linear* negotiation of geometry of spacetime vs. matter "takes place", **cannot** be read by any wristwatch from GR textbooks. This produces a plethora of "times" in GR textbooks, but "these definitions of time are in general unphysical, in that they provide no hint as to how their time might be measured or registered" ([Butterfield and Isham](#)). Here, all these "times" constitute the "eternally present" [all time \[tau\]](#) ([Karel Kuchar](#)).

.....

To elucidate the second major difference in treating the 'tangent vectors', recall that in GR textbooks you are invited to take the same meta-observer, bird's-eye view on the whole spacetime as in the NASA picture [above](#): to explain the alleged "curvature" of spacetime, "it is easy to see it in a 2-dimensional surface, like a sphere. The sphere fits nicely in 3-dimensional flat Euclidean space, so we can visualize vectors on the sphere as 'tangent vectors'" ([John Baez](#)). Then you've been taught by [Bob Wald](#) "to work **infinitesimally**, using the idea that, on *sufficiently small scales* (this notion certainly needs clarification in the context of [Thompson lamp](#) - D.C.), a curved geometry *looks very nearly flat* (notice the poetry - D.C.). These departures from flatness can then be described via differential calculus. To do so, one begins by introducing the notion of a tangent vector to describe an [infinitesimal displacement about](#) a point **p** ." The major differences to the interpretation offered here are in the following. Regarding [John Baez](#), the *local mode* of spacetime is **not** embedded in *any* "higher-dimensional flat spacetime", but in an infinite-dimensional purely geometric *manifold* (called here 'global mode of spacetime'). Hence [the infinitesimal](#) is indeed equipped with 'tangent vectors', but they all "point" to the global mode of spacetime -- not to the *local mode*.

The new (to GR textbooks) "direction", resulting from the very "expansion" of space due to "dark" energy, is **not** the [mythical foliation time](#) orthogonal to the three [Hamiltonian components](#) that are somehow "tangential" to all hypersurfaces (cf. [Kiefer and Sandhöfer](#) below).



**Fig. 1.** The above plot shows the (3 + 1)-decomposition of a four-dimensional spacetime. Spatial hypersurfaces are stacked together along a foliation parameter. The components of the Hamiltonian tangential and perpendicular to the hypersurfaces are shown (but note that there are actually three components tangential to the hypersurfaces).

The new "direction" from the "dark" energy is **non-existent** in ADM presentation, since it pertains to the 'absolute time' of the '[absolute structures](#)'. Small wonder Karel Kuchar couldn't dig it out from [present-day GR](#): you have a plethora of unphysical "times" from the [foliation recipe](#), and no reference fluid (global mode of spacetime), which makes you 'eternity blind' ([John G. Bennett](#)).

The crucial "direction" of the so-called "expansion" of space due to the "dark" energy from *empty space* ([Lawrence Krauss](#)) requires a brand new dynamics of GR. In GR textbooks, the flexibility of space is limited to its "curvature" only, and, if you manage to compute a linearized snapshot from Einstein's field equation, you inevitably end up with a frozen "block" spacetime: "There is no dynamics *within space-time itself*: nothing ever moves therein; nothing happens; nothing changes" ([Robert Geroch](#)). Then the new dynamics of spacetime, due to the "dark" energy, can only spring from something "outside" (the local mode of) spacetime. That is, from "outside" **both sides** in the Einstein equation -- the global mode of spacetime. It literally *creates* both "more space" (cf. R. Rakhi

& K. Indulekha and S. Carroll [above](#)) and "more matter".

The proper dynamics of 'GR *with DDE*' *cannot* be unitary. Enter the puzzle of "points": the perpetually re-created world of *facts* (local mode of spacetime) and its ultimate source 'the ideal monad without windows' ([Döring and Isham](#)) contain [uncountably infinite](#) points ('the set of all sets', maybe). The cardinality of such "set" (if any) is not even [aleph-0](#). Once created by The Beginning, the *local* mode of spacetime is wrapped by its special "boundaries" (see RSP below), such that the 3-D space of the *local* mode is *de facto* infinite ([dual age cosmology](#)).

.....

**NB:** These so-called [points](#) are a special [non-Archimedean](#) entity. It was [Lucretius](#) who pointed out the unknown mechanism by which these "[points](#)" build up any **finite** domain of space. The task of revealing some [pre-geometric plenum](#) which "connects" these [non-Archimedean](#) "points" was missed by [Felix Hausdorff](#) and [Roger Penrose](#), to name but a few.

.....

On the other hand, the [3-D Flatlanders](#) (local mode of spacetime) will only notice that the two 'ideal endpoints' or "edges" of the *local mode* of spacetime (denoted with **S** and **L**, see below) have acquired some 'numerically finite but physically unattainable values' (one of which is the Planck scale), and will recall the old idea that the universe looks like an [unbroken ring with no circumference](#), for the circumference is nowhere, and the "center" is *everywhere*.

But they will also notice some puzzling "projection" from the dark energy, cast on the 3-D space, just as they can notice, and indeed measure, the "projection" of space curvature, cast on the 3-D space (see Larry Krauss, [p. 12](#)). While we don't know the nature of gravity, we are accustomed from GR textbooks to treat it as 'curvature of *spacetime*', although it shows up more like 'deviation of *something* from something *else* that *might* be "flat" but you can't tell, because you have only one "flat" point'.

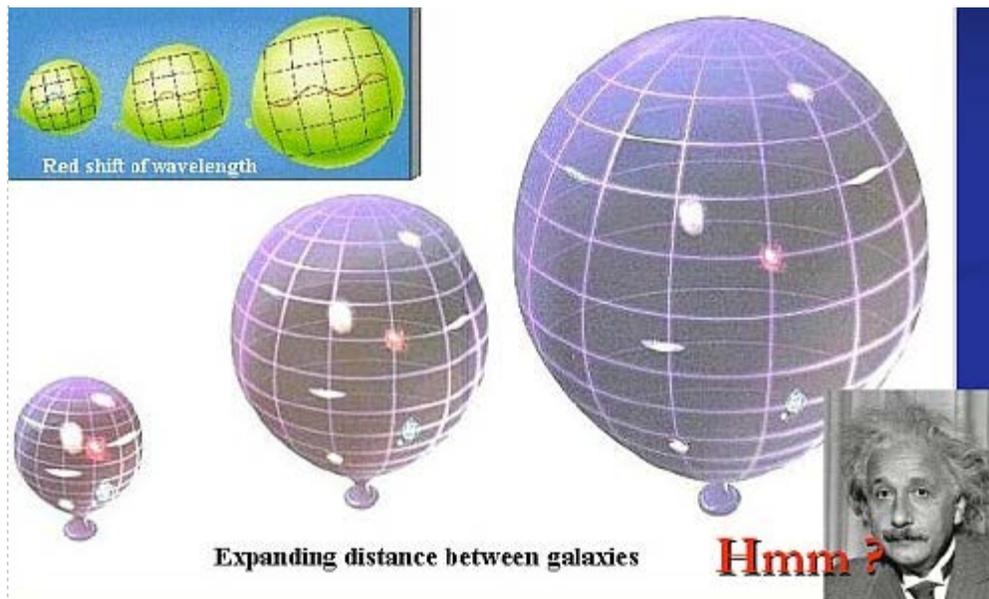
The "projection" from "dark" energy, cast on 3-D space, is just as weird and misleading as the 'curvature of space', yet it bothers people much more than the puzzling nature of gravity (the latter *has to* disappear on "[points](#)", so you have only one "flat" point as a reference object for "curvature").

People from NASA may ask, what kind of stuff is "expanding", creating the [illusion](#) (see also the misleading picture below) about galaxies "running away" from each other, in line with the [Hubble Law](#)?

**Wrong question.** In the local mode of spacetime, *nothing* could possibly "expand" or be "curved". The actual illusion is that something is "expanding" (or "curved"). It is the illusion from NASA's meta-observer view.

**NB:** All such illusions, the [absolute structure of space](#) included, should be eliminated by proper relativistic presentations, such that *the sole invariant object* in space will be an [infinitesimal "point"](#). Its 3-D projection or "shadow" does look like a "point", but upon a closer view it unveils its **infinite-dimensional** nature.

The picture below (as well as the one from NASA [above](#)) can only be seen by some meta-observer, who can also see the whole universe, and of course count to infinity (like Chuck Norris). The [3-D Flatlanders](#) can't.



Such kind of illusionary "expansion" (much like the "curvature" of space) may be caused by some 3-D "projection" from *something*, maybe some process or mechanism, which takes place in the *global mode* of spacetime. How about the old idea of the *mutual penetration* of the Large and the Small?

Perhaps Einstein would only look at my efforts and say ... well, he was a very polite person. But because he also was, on some occasions, driven solely by his personal taste and instinct, rather than sound physical principles [[Note 1](#)], let me try to follow his style.

On [21 September 2008](#), I suggested a *scale relativity principle* (SRP) aimed at explaining the nature of *space* (don't confuse it with [Laurent Nottale's](#) scale relativity). If we are to think as proper relativists, I believe we should abandon the [absolute structure of 3-D space](#) in today's GR [[Note 2](#)], and work out new symmetry presentations of The Large and The Small.

I also admit that SRP is direct prediction of my theory, hence if it turns out to wrong, so will be my whole project, as started in [January 1972](#).

I believe physical objects can be considered "large" bzw. "small" only with respect to the *macroscopic* length scale of tables and chairs. If a volume of space changes its size toward 'the Large/Small', the **metric of space** in 'the Large/Small' will be altered accordingly, in such way that the "size" of objects in that sphere or volume will remain **unchanged** in the volume-determined reference frames of 'the Large/Small', yet will continue to look 'Large/Small' in the initial *macroscopic scale* frame of classical mechanics. The idea of SRP involves (i) an omnipresent observer (Claudia) endowed with 'the eternally present *all time* [ $\tau$ ]' ([Karel Kuchar](#)), (ii) [space inversion](#) producing CPT-invariant presentations of 'volume of space', and (iii) macroscopic observer located at the length scale of classical mechanics, from which the postulated *mutual penetration* of the Large and the Small starts to unfold.

We have **three** possible views on 'the length of objects' in 3-D space. First, the viewpoint of a macroscopic observer who can *simultaneously* see (i) 'the Large' as an expanding volume of space, and herself being located **inside** such expanding sphere, and (ii) 'the Small' as contracting volume of space, and herself being located **outside** such contracting sphere.

Consider a table with length two meters, located **inside** a sphere with diameter two meters, along with the macroscopic observer **inside** this sphere. If the table is stretching toward the size of a galaxy, it will look like 'getting larger' to the **first** observer, but its *intrinsic length* will always remain "two meters" to a co-moving observer in its *scale-dependent* reference frame evolving toward 'the Large'. The [co-moving observer](#) will never, in no circumstances, register any change of the length of the table, as her metric also expands with the same rate as the expanding table toward 'the Large'. Likewise for the journey toward 'the Small': take the first observer and the two-meter sphere at macro-scale, perform [space inversion](#), and now the [CPT mirror image](#) (like turning a rubber glove inside-out) of the macro-observer will find out that she is now located **outside** a *contracting* sphere,

as the table is now running toward the Planck scale, yet a co-moving observer will again see "her" table as keeping its *intrinsic length* of 'two meters' in her *scale-dependent* reference frame toward 'the Small'. This is the 'second view'.

And the third view is that of a **fixed** meta-observer (global mode of spacetime), who will see a table stretched to the size of a galaxy, a table at the initial macroscopic length scale, and a table squeezed to the size of an atom, all of which possessing 'the same UNdecidable ([KS-like](#)) length'.

Now, one can offer an *operational* definition of 'infinitesimal volume of 3-D space' in the *local mode* of spacetime (in ADM presentation, cf. [B. Bolen](#), it is denoted with **ds**). Imagine an omnipresent observer being "spread" inside an 3-D Euclidean sphere -- *except for the center*. She looks at the point-like *center* of the sphere from infinitely many directions (radii) -- simultaneously.

But the center of the sphere is not a *bona fide* mathematical point -- it is an '[infinitesimal](#)', **such that** one can treat it as '*the smallest possible rubber glove*' and perform [CPT space inversion](#), by **replacing** (not 'reversing', as in Wu-Ki Tung's textbook, [Ch. 11](#)) all "points" *inside* 'the infinitesimal rubber glove' with all points *outside* it, that is, with all points of Claudia. Notice that we cannot use quantitative notions like 'more' and 'less' regarding *any* "number" of points -- neither those of Claudia nor those inside '*the smallest possible rubber glove*'. Were the '[infinitesimal](#)' an abstract mathematical point, the operation 'space inversion/replacement' would be impossible, and then there would be two opposite and privileged views on 'the Small' and 'the Large', and the latter would be 'absolute qualities of space', just like in GR textbooks.

Thus, an *operational* definition of 'infinitesimal volume of 3-D space' is that which permits [space inversion](#) at (i) *the minimal*, hence [infinitesimal](#), volume of space (**S**) and (ii) an arbitrarily large (inverse-proportional to **S**) volume of space (**L**).

Now an omnipresent observer can simultaneously "see" the *very same* center of the sphere (infinitesimal volume of 3-D space, **S**) in a space turned "inside out" **as well**; one could perhaps say that she is "residing" at [two superposed inverted states](#) of 3-D space, as she is able to see both **S** from **L** and **L** from **S** -- simultaneously. She is **not** restricted (as we are) to choose one of the 'views'. She is placed at **S = L**, and is wrapping *the whole* (seemingly "expanding", according to the first macroscopic observer above) 3-D space *en bloc*.

.....

It doesn't matter whether this *shrinking* or *expanding* is (or is not) "accelerated": either way, the "number" of points is a [non-Archimedean](#) notion that cannot be subject to quantitative evaluations like 'more' vs. 'less'.

What matters is that the good old 3-D space has just been **re-created**, like a Phoenix Universe, along the [arrow of space](#). The mechanism is the same as in The Beginning, but without the initial "inflationary stage" -- just an *elementary step* of the arrow of spacetime and an *elementary increment* of the memory of 'the universe as a [brain](#)', which leads to "more points" being *emerged* in its memory, available to choose from in the *next* elementary step: the universe only gets smarter, richer in terms of physical content, and more flexible, just like an *evolving* brain. If some day [John 1:1] decides to **halt** the arrow of spacetime, the [UNdecidable nature](#) of 'the infinitesimal' will be nullified, the [Thompson's lamp paradox](#) will suddenly become solvable, the number of "points" will become *denumerable* (e.g., there will be roughly  $10^{99}$  "atoms of volume" in every cubic centimeter of space, as claimed by L. Smolin, [p. 61](#)), and the 3-D space will cease to exist. From our viewpoint, such development is logically impossible (the [vacuum cleaner paradox](#)).

.....

The global mode of time runs *simultaneously* in opposite directions -- in **all possible** directions in 3-D space -- which will make her (and ours) [unanimated](#) wristwatch [dead frozen](#), like the proper time of a photon "between" emission-and-absorption; see [Kevin Brown](#). (This is the exact meaning of 'Your Global Time is **ZERO**', which was posted on this web site on March 14, 2004, to commemorate Einstein's 125th birthday; see the *atemporal* "handshaking" medium [above](#).)

Such symmetry over '[space inversion](#)' and the two "superposed" inverted views of Claudia (needed for derivation of [three views](#) on 'the length of objects' in 3-D space; see above) reveal *the sole invariant object* in 3-D space -- the infinitesimal volume of 3-D space, called "[point](#)".

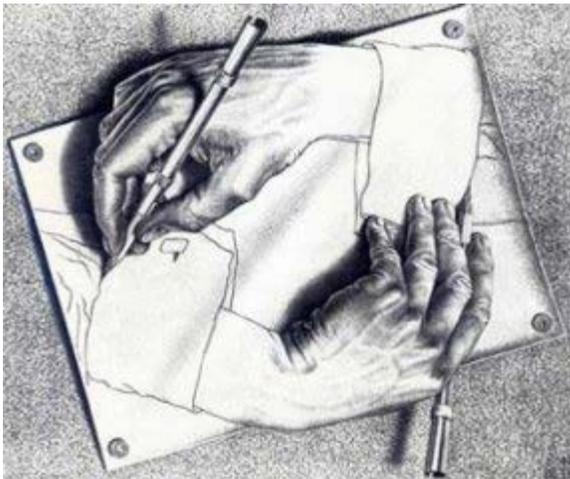
.....

After this shaky exercise with *the sole invariant object* in space, called "**point**", we need to explain the two 'scale factors' (for the lack of better terms), which create 3-D space: **S** (from Small) and **L** (from Large). **S** refers to 'the infinitesimal point', and **L** to 'the maximal yet *finite* volume of an ever-expanding 3-D space'.

We postulate: **LS = 1** . This is the recipe for a natural "boundary" (cf. G F R Ellis' [Finite Infinity](#)) imposed on **L** due to the "extension" of the infinitesimal "point" **S** .

If we think of The Beginning as the case in which **L** equals *exactly* **S** (**L = S = 1**), we can understand the "inflationary stage" in which a tiny little difference between **L** and **S** is being introduced **by** [John 1:1], after which the two scale factors will *run* in opposite directions, to produce 3-D space *tightly* filled -- [perfect continuum](#) -- with infinitesimals **S** and bounded by an "expanding diameter" **L** . Now Claudia will be placed in the *global mode* of spacetime -- *both* inside **S** and outside **L** . She will be able to "see" the whole (infinitely-connected, by Claudia) *local mode* of spacetime *en bloc*, and her *global mode* of time will be just like that of our **brains**: an *atemporal* and infinite-dimensional "[handshaking](#)" medium **by** which *each and every* infinitesimal **S** is simultaneously correlated -- the 'absolute *now*' of Claudia -- with 'the rest of the universe', as depicted in the Escher drawing below. And since their EPR-like correlation is "spanned over" an infinitesimal "point", in the *local mode* we will see the [blueprint](#) from [quantum waves](#) and [relic inflationary waves](#), yet their source will be inevitably "[dark](#)". (In order to detect quantum waves "online", one would have to perform a perfect non-demolition measurement avoiding *any* point-like collapse, by screening the *quasi-local* wave over [extended 3-D domains](#).)

Notice that Escher's hands can be moved only *by* an [arrow of space](#), not *with* the kinematics of **L** and **S** alone.



Briefly, we can think of The Beginning as some "absolute vacuum polarization" (not necessarily irreversible), and suggest an *equation of space*:

$$\mathbf{L} = \mathbf{S} = 1 \text{ (John 1:1) } \rightarrow \mathbf{LS} = 1$$

The equation above contains reference to The Gospel, but I believe St. John wouldn't mind to be removed by those obsessed with different religions, such as *anti*-theism or "agnosticism" (those who *deeply believe*, for the lack of scientific proof, that there is nothing to believe in).

In summary, the *elementary* building block of geometry, presented with a geometrical "point" (explanation and drawings [here](#)), is supposed to be 'at the same time' a space-inverted image of 'the whole universe' at **L** , and *vice versa*. An omnipresent observer in the *global mode* of spacetime (the two "[superposed copies](#)" of Claudia) will be able to monitor all the "points" in the whole 3-D space *en bloc*, since it is ONE single object, **L = S** . Our "Claudia" is nothing but the postulated

[Aristotelian Connection](#), which binds all "points" by/via their space-inverted image at the level of ONE (the whole universe at **L** ).

This is the [pre-geometric plenum](#), which is still missing in [differential geometry textbooks](#). Consider, for example, Chris Isham's *Modern Differential Geometry for Physicists*, [2nd ed.](#), in which you are advised that the Hausdorff topological space has been somehow "connected" (p. 61, footnote 1; see also Sec. 1.2.1, p. 3, and pp. 59-60 and Fig. 2.1 therein). It is unclear what sort of *pre-geometric plenum* could do this job. Think of it as 'the universe as ONE', which is being multiplied as infinitely many ([uncountably infinite](#)) geometrical "points" ensuing from 'the ideal monad without windows' ([Döring and Isham](#)), in such way that all "points" are connected and correlated by/via 'the universe as ONE' at **L = S** .

This is a very old idea '*all is in all*', which I am trying to cast in some (relatively) comprehensible *relative scale principle* (RSP). There are no "genuine" nor "absolute" dimensions of physical bodies, according to SRP. The spatial relations of 3-D space -- inside/outside and left/right -- should originate from a **four-segment** "[lily](#)" spacetime diagram of the *global mode* of spacetime (notice the fav icon of this web site). Once such **four-segment** spacetime diagram is properly constructed (we also have to explain [rotation symmetry](#)), we should be able to calculate [the cancellation of 'all but one' potential states](#) of quantum-gravitational systems, hence show the [correlated states](#) that build up the local mode of spacetime, valid for *only one frozen snapshot* from [Die Bahn](#).

The *frozen snapshot* from the "[film reel](#)" (the [arrow of spacetime](#)) will display an [already-correlated](#) set of point-like values of **all** physical variables, in line with the Bootstrap Principle 'think globally, act locally'. The *atemporal* (with regard to our unanimated wristwatches) correlation "takes place" in Claudia's global mode of spacetime. She is residing in (**L = S**), and her two "[superposed copies](#)", toward **L** and toward **S**, contain uncountably infinite "number" of [classical-able states](#) from which **one** correlated and **re-created** physical universe is being explicated as 'local mode of spacetime': one-at-a-time, along the [arrow of spacetime](#).

Notice, however, that the *direction* of the arrow of spacetime points only and exclusively only to the global mode of spacetime, but the latter is *totally hidden* in the local mode: the "dark gaps" are *completely* sealed off by '[the speed of light](#)', rendering the local mode a *perfect* continuum.

Another important feature of SRP is the difference between **L** and **S** in their postulated relation **LS = 1** : while **S** is "[bounded from below](#)" by a geometric "point", the ever-expanding "horizon" of space is bounded by an entirely different geometric object, which is (sort of) 'inverse-proportional' to a geometric "point". Although the "number" of points needed for **L** and **S** to 'pass through' in order to reach **the exact** relation **LS = 1** is [indecisive](#) in the local mode of spacetime, there is nevertheless a **difference** between the "run" toward **S** and the "run" toward **L** , which determines the **asymmetry** of time. After all, in the global mode of spacetime the age of the universe is *finite*, such that any "run" towards it will have a fixed cut off at The Beginning, while the "end" of the cosmological time is *indecisive*, which in turn permits the evolution of 'the universe as a [brain](#)'.

**NB:** Notice the nature of the **cut off** toward **S** : it cannot be reached from *within* the local mode of spacetime due to the [inherent teleological structure](#) of 'the world of facts'. This truly fundamental *cut off* can only be "seen" from the global mode of 'the whole universe as ONE', hence it is considered to be the Aristotelian *First Cause*. Its action is called [The Aristotelian Connection](#). It acts without being '[acted upon](#)'. Its job is to cast point-like values of physical quantities at the level of 'geometry' -- the grin of the cat *without* the cat, as [Alice](#) would have said regarding the left-hand side of Einstein equation.



And because The Aristotelian Connection produces not just one "point" (as in the [Thompson Lamp paradox](#)) but an infinite "number" ([uncountably infinite](#)) of such purely geometrical "points" -- simultaneously, with [zero duration](#) according to your wristwatch -- it connects these "points" of the local mode of spacetime as a *pre-geometric plenum*. It is also the ultimate 'chooser' of particular physical content that would belong to particular geometrical "point": due to the correlation and

negotiation (cf. [Escher](#)) in the global mode of spacetime of all **potential** physical content available to the local mode, the 'chooser' of the particular physical content specifying any particular "point" is 'everything *else* in the universe'. The end result is the *cancellation* of '**all but one**' state from the spectrum of *potential* states available to the particular "point" to choose from, and we get the *local mode* of [already-correlated](#) facts -- one-at-a-time, along [Die Bahn](#) (the arrow of space).

Nobody and nothing "plays dice" here: God casts the die, not the dice. The inherent [flexibility](#) (not "uncertainty") of all spacetime points to get dressed with specific physical content is like the flexibility of the human arm to perform any movement. Surely there are constraints, boundary conditions, [conservation laws](#), etc., yet the *flexibility* of all "points" to choose from their quantum-gravitational spectrum of [potential states](#) (God's "die" or rather 'matrix') can never be reduced to zero. For example, Heisenberg's relations can be interpreted as the *flexibility* of a quantum particle to choose from a spectrum of *potential* states: if its *potential* states regarding its **next** 'position' get shrunk, it will have a corresponding larger spectrum of *potential* states regarding its **next** 'momentum' to choose from. Of course, if you "filter" this [quantum flexibility](#) through the spacetime of STR, you may claim that it is impossible for a quantum particle to possess simultaneously point-like values of "complementary" observables. But again, these values need not be point-like. They can be perfectly well-defined yet [quasi-local](#). The idea of '[wave-particle dualism](#)' may be correct for QM measurements, but nobody knows, for example, how would an electron look like in an **intact** quantum world: if it is **not** forced to behave like a point-like particle since it isn't being "observed" at the length scale of tables and chairs, how would its "wave" look like? Perhaps the quantum "wave" of an intact electron pertains to its [quantum flexibility](#).

Going back to the pre-geometric plenum: perhaps the *asymmetry* of time is determined by the *asymmetry* of space, namely, by the difference between the two "runs" toward **L** and **S**, bounded by their relation  $\mathbf{LS} = \mathbf{1}$ . All efforts to derive the fundamental *asymmetry* of time from some physical stuff or '[entropy](#)' are doomed to fail, because such fundamental feature of spacetime can only be determined by 'the grin of the cat [without the cat](#)'.

Also, our wristwatches [[Note 3](#)] are perfect examples for quantum-gravitational measuring devices, as they can in fact read *one* 'dynamical instant' from Claudia's absolute time since The Beginning, but because we can "look" at this dynamical instant only with a physical "[torch](#)", we inevitably see a [dead frozen snapshot](#), as explained eloquently by [Robert Geroch](#).

Everything said here pertains only to the [kinematics of spacetime](#); to obtain its dynamics (the arrow of spacetime) we need to include the Aristotelian First Cause "by hand", because **nothing** in this [purely kinematical structure](#) can or should point *directly* to God.

In modern parlance, SRP is expected to "suffer" from Gödel's incompleteness theorem, but because of the fundamental nature of SRP, the additional elements in it, which belong to some 'meta theory', will inevitably come from 'outside science'. To be specific, the introduction of Aristotelian First Cause "by hand" means endowing the universe with the faculty of **self-acting**: just like the human brain (we think *about* our brain, *with* our brain), the universe modeled as a '[brain](#)' should have the faculty of acting on itself, but no *physical* path toward 'the acting mind of God' (such path may show up with math only) should show up in quantum gravity. Perhaps some of those "agnostic" people may prefer to call Him "dark" -- I don't mind; we all enjoy His gift called *free will*.

More in my talk in [November 2015](#). Just a hint: look at [Fig. 2](#) in the note about [Die Bahn above](#). The direction of **w** is "dark" to the local mode, and the gravitational effects (global mode) should have 3-D presentations (e.g., the so-called "curvature") in the local mode ([Fig. 1](#)). If some day we find out that the origin and the mechanism of [inertial reaction "forces"](#) are indeed produced by the *gravitational* potential reality, perhaps we will explain the most difficult puzzle: the *asymptotically flat* space of the local mode of spacetime, produced by the two tug-of-war components of gravity at cosmological scale: [CDM](#) and DDE.

Perhaps at *the* largest length scale, **L**, the "dark" geometrical effect from the global mode makes the 3-D space of the local mode 'asymptotically flat'. However, given the basis relation  $\mathbf{LS} = \mathbf{1}$ , an *absolute* flat and *absolute* infinite 3-D space would require some mathematically unclear state  $\{\mathbf{S} = \mathbf{0}, \mathbf{L} = [\text{inf}]\}$ : the two symmetry axes of the infinitely-inflated sphere and torus will *coincide*, along with their centers (check out a story about a screen saver in Windows 98 [here](#)). I intend to argue, in [November 2015](#), that the topology of the local mode of spacetime is being *dynamically* fixed as 'asymptotically flat' at each and every step of **re-creation** of the local mode (cf. [Die Bahn](#) above), by "passing" through such mathematically unclear state that is neither sphere nor torus anymore. Stated

differently, I suppose there exist two asymptotical "boundaries" on what looks like an 'asymptotically flat 3-D space': a 3-D sphere and a 3-D torus with *the* largest possible radii, **L**, "between" which a mathematically unclear (and *purely* theological) state is quietly residing. All this will be a sequence to my previous talk in [September 2008](#).

As to the "expansion" of space depicted in the drawing from [NASA](#), perhaps the projection of the metric in 'the Large' onto the macroscopic scale produces the **illusion** to the 'first observer' (cf. above) of some "[expanding universe](#)". Again, according to [RSP](#), the "expansion" is **not** caused by any *physical* stuff. It is an illusion of some "expanding" metric, which can be seen only by the 'first observer'.

As suggested above, the cosmological horizon is 'ever expanding' along the [arrow of spacetime](#), while the Planck scale is **fixed**. That is, the 'infinitesimal' is **fixed** (bounded from below) by some 'numerically finite but physically unattainable' values that do **not** change (e.g., the Planck length), while the 'maximal volume of space for gravity' (**L**) increases with the age of the universe, like an expanding horizon "bounded" by an ever-sliding **L**: *Panta rei conditio sine qua non est*.

By the way, have you seen an [UFO](#) with [your very eyes](#)? If these guys can switch off the inertial reaction "[forces](#)", perhaps they can fly effortlessly, much like we move our [thoughts](#). And if they can modulate the metric of space, perhaps they can make their pathway in the whole Milky Way just "two meters". From their perspective, they will indeed fly 'two meters', while the space will be "running towards them". Perhaps in such altered-metric space they fly literally 'from point to point', and with a very low speed of, say, just 2 m/s, as recorded by **their** wristwatch.



Wilbur B. Smith: "... to produce the gravity differential, the time field differentials which were necessary to operate the ship."

I wish I knew what is 'space' [\[Note 4\]](#). There is so much *latent* energy packed in the [quantum vacuum](#). Perhaps all we may need is access to the global mode of spacetime. The whole [RSP](#) may sound unclear and farfetched, but recall Christopher Columbus: If we don't leave for India, how can we discover America?

Latest update: August 2, 2010

Note 1. In a letter to Paul Ehrenfest from 4 February 1917, Einstein wrote about his 'cosmological constant':

"I have again perpetrated something relating to the theory of gravitation that might endanger me of being committed to a madhouse." (Ich habe wieder etwas verbrochen in der Gravitationstheorie, was mich ein wenig in Gefahr bringt, in ein Tollhaus interniert zu werden; English translation by [N. Straumann](#)).

Note 2. Recall [Einstein's opinion](#) of his theory:

"The right side (the matter part) is a formal condensation of all things whose comprehension in the sense of a field theory is still problematic. Not for a moment, of course, did I doubt that this formulation was merely a makeshift in order to give the general principle of relativity a preliminary closed expression. For it was essentially not anything more than a theory of the gravitational field, which was somewhat artificially isolated from a **total field** of as yet unknown structure."

Note 3. The problems with '[time in GR](#)', the paradox of time in canonical quantum gravity ([Karel Kuchar](#)), and the puzzle of so-called "dark" energy from [empty space](#) stem from the **absence** of the [arrow of spacetime](#) in present-day GR. On the one hand, our mischievous wristwatches do in fact read the arrow of spacetime as a "[chain of points](#)", as they "filter" only **one** of the infinitely many "**dynamical** points" from the global mode of time, and read these filtered points "one-at-a-time" along the "vertical skewer" of the arrow of spacetime (global mode of time), on which all "horizontal snapshots" are stacked. On the other hand, in order to "look" at [this arrow](#) with physical (unanimated) devices, we can *only* use a "**torch**", which kills the arrow, and shows only *one frozen* "point" fixed by the calculated values of physical quantities at this dead frozen "point". And here people like [Robert Geroch](#) say -- let's try to solve the Einstein field equations, starting from this well-calculated **frozen** "point", and then move the ([canonical](#)) data *only* on this "horizontal" set of such "points", and end up with the insurmountable Cauchy problem for the Einstein equations. Why? Because the genuine dynamics of GR ain't there ([Stanley Deser](#) will undoubtedly disagree).

Note 4. "In the first place, we entirely shun the vague word "space," of which, we must honestly acknowledge, we cannot form the slightest conception."

[Albert Einstein](#), *Relativity: The Special and General Theory*, 1920

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**P.S.** Nobody has so far asked, what is the meaning of the phrase 'Your Global Time is [ZERO](#)'. The sole question from the readers of this web site has been, 'why don't you publish all this in a book, to explain your ideas' (or something similar).

The criticism is fully justified: reading my web site is anything but fun. I am considering writing a book, but it will be intended to kids age 15+, and will have to be complemented by a [DVD with video lectures](#), to explain the crux of the idea about 'the universe modeled as a [brain](#)'.

Why kids? Because the future belongs to them (I will soon hit 58, *Deo volente*). My work on quantum gravity concerns very few people, all of whom have this *utterly* negative attitude of 'the worst of criticism is neglect'. Just a few examples: the last time I heard from Claus Kiefer was in 2003, only to tell me that he can't open the CD ROM I sent him by surface mail, because all computers at the University of Cologne run on Unix. The last time I heard from Karel Kuchar was on 8 Jan 2003, and from [John Baez](#) on 14 Jan 2002. The case with [Chris Isham](#) was even worse. And look what happened with my talk in [2008](#).

Thinking about the future, I can imagine only two developments regarding [RSP](#). One possible case will be that it is just [crap](#) and [delusion](#), so *obviously wrong* that none of the renowned experts made the slightest effort to show my stupid dilettante errors. Will see. Planck's Law of Thermal Radiation was met with very nasty attitude by the established scientific community [[Note 5](#)], as it literally blew away their comfortable world. If [RSP](#) turns out to be correct, it will cause *far more* "damage" to many established scholars studying [canonical](#) quantum gravity and "[gravitational wave astronomy](#)" (at least [679](#); see also [[Note 6](#)]).

But could [RSP](#) be correct, really? Well, as I mentioned [previously](#), the *two* rules for success are:

Rule #1: Never tell [them](#) everything you know.

And [nobody is curios](#) anyway. (For those who are: I believe [RSP](#), embedded in an [arrow of spacetime](#), offer *the only* possible solution to the mind-brain problem -- the mind has to be *both* detached from matter, to preserve its ontologically different nature, *and* linked to it, in order to communicate with its [brain](#) via the bi-directional "talk" depicted in the Escher drawing [above](#).)

Therefore, there is no need to use paper -- everything I need to say is, and always will be posted at this web site, available to anyone interested. If some day it turns out that [RSP](#) in 'the arrow of spacetime' had hit *the* right track toward quantum gravity, I suppose people will be interested to explore it (see the download link [above](#)).

Besides, we don't live in [18th century](#):

"When this [lowly chap](#) informed the Lucasian Professor of Mathematics that he had formulated the inverse square law of gravitation years before the publication of *Principia*, Newton is said to have flown into a rage. The two had already sparred over their optical theories, and when Newton took over as president of the Royal Society in 1703 (the year of Hooke's death), he began erasing all traces of Hooke. Famously, he tossed the only contemporary portrait of [Hooke](#) onto a fire."

D. Chakalov

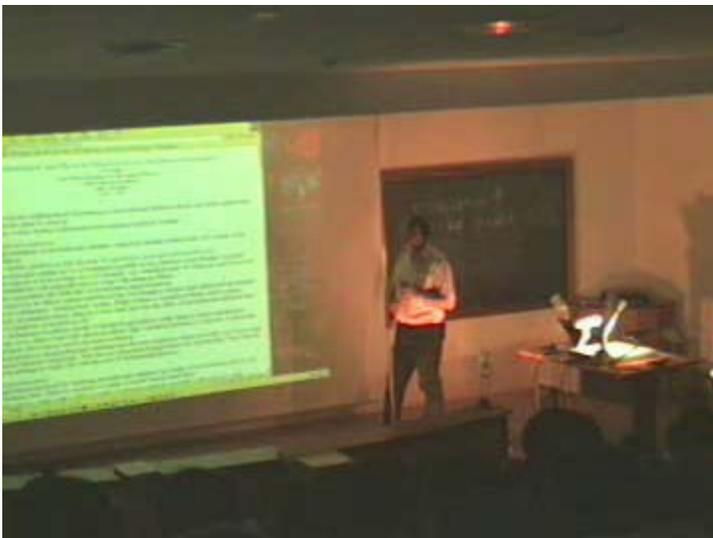
February 26, 2010

Last update: March 2, 2010

Note 5. Max Planck, [Philosophy of Physics](#), W.W. Norton and Company, New York, 1936, p. 97:

"An important scientific innovation rarely makes its way by gradually winning over and converting its opponents: it rarely happens that Saul becomes Paul. What does happen is that its opponents gradually die out and that the growing generation is familiarized with the idea from the beginning: another instance of the fact that the future lies with youth."

Note 6. [B F Schutz](#), *Mathematical and Physical Perspectives on Gravitational Radiation*, August 2, 2002.



Snapshot at 00:04:20 from [video.wmv](#) (156 MB)

p. 1: "Equivalence principle implies no *local* definition possible in any situation: must attempt "regional" definition in regions at least as large as a wave-length.

p. 9:

From a physical point of view, null infinity is *very* far away. A measure of how far one has to get from a source to be "near" infinity is to consider the divergence of the true curved-space light-cones from their flat-space approximations, which wind up at spatial infinity. Martin Walker first pointed out the enormous distance required to separate these cones by just one wavelength or period of the gravitational wave, a reasonable length scale for a radiation problem. The separation is something like  $2M \ln(r/M)$ . Setting this equal to  $\lambda$  for the Hulse-Taylor pulsar, we solve for  $r$  and find that it is a bit more than  $10^{10^9}$  km! This is unimaginably bigger than the observable Universe, whose radius is a mere  $10^{23}$  km.

p. 10: "A more elegant and potentially powerful scheme is to incorporate conformal techniques to bring null infinity to a finite point on the grid (emphasis added - D.C.), then can incorporate infinity into the computational domain ([Friedrich](#), Husa, Lechner, Frauendiener [all attending this meeting](#))."  
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Comment: I highly recommend B. Schutz' [video lecture](#) and [manuscript](#) to all Jehovah's Witnesses of Gravitational Astronomy. Compare it to B. Schutz' article "Gravitational Radiation", [gr-qc/0003069 v1](#). More [here](#).

D.C.  
March 3, 2010

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Subject: Re: What, then, are Obits good for?  
Date: Tue, 11 Oct 2011 20:43:18 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: N David Mermin <ndm4@cornell.edu>  
Cc: Charles H Bennett <bennetc@watson.ibm.com>, William.K.Wootters@williams.edu, divince@watson.ibm.com

David:

RE my email from Mon, 22 Jul 2002 20:05:22 +0300: I quoted your viewpoint on KS Theorem at <http://www.god-does-not-play-dice.net/#Cecilia>

You acknowledged in arXiv:quant-ph/0305088 that your "computer science students know very little physics". I am sure you know a bit more quantum physics than your students, and will be able to understand the argument at the link above, which answers the question in the subject line as well.

Take care,

Dimi

=====

Subject: The Kochen-Specker state  
Date: Wed, 3 Mar 2010 03:20:42 +0200  
Message-ID:

<bed37361003021720v1fd01861uf28e46b5c4bd1b02@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Michael H Freedman <michaelf@microsoft.com>

Cc: Parsa Bonderson <parsab@microsoft.com> ,

Chetan Nayak <nayak@kitp.ucsb.edu> ,

Sankar Das Sarma <dassarma@umd.edu>

Dear Dr. Freedman,

I wonder if you could help me understand the topological nature of Kochen-Specker state,

<http://www.god-does-not-play-dice.net/#KS>

It seems to me that this UNdecidable state is protected from "decoherence", simply because it cannot reside in any Hilbert space. It isn't "observable", nor is computable in the sense of Turing (Topological Quantum Computation, [80.pdf](#)). You can grasp it with your [brain only](#).

May I take this opportunity to invite you and your colleagues to join our efforts toward a new relativity principle, outlined at

<http://www.god-does-not-play-dice.net/#quiz>

Kindest regards,

Dimi Chakalov

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**Note:** Michael Freedman posted today (November 4, 2010) the 16th version of "Quantum Gravity via Manifold Positivity", [arXiv:1008.1045v2 \[quant-ph\]](#), in which he tried to obtain the dimensionality of space from the notion of 'empty set', and suggested a fleeting "pre-time" (*ibid.*, p. 8). The latter emerges here from [AOS](#).

Notice that the UNdecidable Kochen-Specker state at the first link above is a *bona fide* empty set from the viewpoint of its observed/actualized "projections" (if you like non-linear modifications of QM, try to attach this particular "empty set" to the manifold of states in [geometrical formulation](#) of QM).

To cut the long story short, "quantum computing" is impossible, even if it is "topological" and supported by Microsoft. Look again at the "general principle" in R.I.G. Hughes, *The structure and interpretation of quantum mechanics*, [p. 77](#):

### 2.7 The Evolution of States in Quantum Mechanics

Like classical mechanics, quantum theory tells us how the state of a system evolves with time. The key role in the equation governing this evolution is played by an operator rather than by the Hamiltonian function, in line with the general principle that, in quantum mechanics, operators represent physical quantities. As in the classical case, the quantity in question is the total energy of the system; it is represented in quantum theory by a Hermitian operator  $\mathbf{H}$  which we call the *Hamiltonian operator* for the system. The rate of change of the state  $\mathbf{v}$  of a system is given by

$$(2.6) \quad i\hbar \frac{\partial \mathbf{v}}{\partial t} = \mathbf{H}\mathbf{v}$$

and this equation is known as *Schrödinger's time-dependent equation*, or sometimes simply as *Schrödinger's equation*.

Firstly, this "general principle" does not apply to the case of UNdecidable, not-yet-physical, [KS state](#),

as explained by R.I.G. Hughes [here](#). Secondly, because in QM we're dealing with *operators*, we cannot even *imagine* that some dynamical variable labeled with the anti-relativistic and "ideal Schrödinger time" ([Jorge Pullin et al.](#)) could possess some pre-existing values, like those we attach to each point of phase space in classical mechanics. Hence it is manifestly pointless to hope that we could **control** any of those *quasi-local* dynamical variables from the length scale of tables and chairs -- especially the [Kochen-Specker state](#).

Now, if we look at GR, we have a similar puzzle with the equally incomprehensible "proper time  $\tau$ " ([Carlo Rovelli](#)), in the sense that our wristwatch does read a continual line (1-D Euclidean space) of **already linearized** snapshots from the initial "proper time  $\tau$ ". Looks like something is doing a *linearized* and *flattening* "collapse" of the "proper time  $\tau$ " at each and every "[sufficiently small](#)" ([Einstein](#)) region of the points from our 'time read by a clock'. Hence the [confusion in GR](#).

Not surprisingly, Mike Freedman didn't respond to my email (nor mentioned my efforts at the second link above). Due to the lack of interest, I will only reiterate the startling characteristic feature of 3-D space: [finite things](#). If you wish to explain an elephant, all you need is to "obtain" its unique trunk; likewise [finite things](#) for 3-D space.

Details in my note on quantum gravity [below](#). No other choice for *self-wrapping* of space and *self-connecting* of spacetime "points" seems possible. But first, one needs to identify an "instant", such that it can be (i) "multiplied" and (ii) "ordered in [time](#)", with "duration" equal to the infinitesimal *separation* of these instant(s), or rather **one**-multiplied-instant. More in Sec. Summary, pp. 35-36 from [ExplanatoryNote.pdf](#).

All this is a tentative answer to [Michael Teller's](#) question ([The Sunday Times, March 13, 2008](#)): So long as the Universe had a beginning, we can suppose it had a creator. But if the Universe is really completely self-contained, having no boundary or edge, it would have neither beginning nor end: it would simply *be*. What place, then, for a creator?

Well, if The Universe does work like a [brain](#), perhaps we may wish to consider an entity resembling our mind and consciousness. Say, [John 1:1].

Is the all-mighty Microsoft interested, I wonder. 

D.C.

November 4, 2010

Last update: November 5, 2010

=====

Subject: Quantum gravity  
Date: Sat, 20 Feb 2010 06:35:23 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Chris Isham <c.isham@imperial.ac.uk>  
Cc: Jeremy <jb56@cam.ac.uk>

Hi Chris,

Over seven years ago, on [Wed, 23 Oct 2002 19:24:15 +0100](#), you boldly declared the following:

"You do not know enough theoretical physics to help with any research in that area."

You haven't so far produced any evidence in support of your claim.

My latest proposal can be read at <http://www.god-does-not-play-dice.net/#quiz>

Prelims from KS Theorem at

<http://www.god-does-not-play-dice.net/#KS>

I respectfully urge you to defend your (immensely insulting) claim from Wed, 23 Oct 2002 19:24:15 +0100. Just show me my errors.

As ever,

Dimi

=====

Subject: RE: Update?

Date: Fri, 12 Oct 2007 15:14:09 +0100

Message-ID:

<18BC110D9A023542A41960EE3D066CD402D89B0C@icex3.ic.ac.uk>

From: "Isham, Christopher J" <c.isham@imperial.ac.uk>

To: Dimi Chakalov <dimi@chakalov.net>

[snip]

> unfortunately, your current mode of writing suggests to [everyone](#) that  
> you are just another crank.

[snip]

=====

Comments on [Chris Isham's](#) opinions

Look at the following statement, from Stephen Hawking's "Grand Design" (to be published on [September 9, 2010](#)):

"Because there is a law such as gravity, the Universe can and will create itself from nothing. Spontaneous creation is the reason there is something rather than nothing, why the Universe exists, why we exist. (...) If there are trillions of universes as M-theory proposes, that luck and probability are enough to make our existence feasible, so no God was needed."

Ignore the second and third sentences (spontaneous creation of an infinite multiverse doesn't make sense at all, or implies a [very dumb and sloppy god](#)).

How many factual and logical errors can you identify in the **first** sentence?

I think our understanding (S. Hawking, C. Isham, and myself included) of gravitation and [the origin of inertia](#) resembles my wife's knowledge in electricity, as she can comprehend [Ohm's Law](#) only by some analogy of water running in a flexible hose. As to Hawking's conjecture about "singularity", it was formulated as a theorem many years ago, and only after very specific and crucial [presumptions](#), which do not hold in a world dominated by [\[we-do-not-know-it\]](#).

Yet Chris Isham will always praise his colleague, Stephen Hawking, and will never expose the factual and logical errors (*non sequitur*) in the **first** sentence above. Moreover, if the so-called [Arrow of Space](#) is [correct](#), both his theory and Stephen Hawking's "Grand Design" will be wrong. But let's see the main ideas in the [toposification](#) of Quantum Theory, proposed by Chris Isham.

According to [Gerard 't Hooft](#), "Isham believes another mathematical language may help, but I don't think so. It sounds a bit as if describing the world in German is better than in Chinese." Well, at least the "German" approach emphasizes on [KS Theorem](#), which is usually obscured in the mainstream ["Chinese" version of QM](#).



Chris Isham: "The interesting question really is, what do you mean by time?"

Isham believes that "every physical system, from atomic particles to the universe as a whole, can be viewed through different topoi" (source [here](#)), and suggests the notion of 'pseudo-state' (Würst); see Slide 28, from his January 2008 lecture "[Topos theory in the formulation of theories of physics](#)",

<http://www.comlab.ox.ac.uk/conferences/categorieslogicphysics/clap1/clap1-chrisisham.pdf>

From Heidegger's perspective, there is '**no** way things are' in QM ([Slide 13](#)). My objection is not against Chris Isham's opinion but to its implementation: all topoi he can possibly design cannot exhaust/fully describe the "[quantum trunk](#)" rooted on '[the ideal monad without windows](#)', because we are dealing with a new form of reality (dubbed 'potential reality'), which resembles [Leibniz' monads](#) and our [cognitive structures](#), in line with 'the universe modeled as a [brain](#)'.

One important implication is that, on the one hand, the truth value associated with 'potential reality' is *definitely* [YAIN](#) -- not 'somewhere [in between](#) true or false' -- but on the other hand, Heidegger's "things" are being *explicated* (as 'shadows on Plato's cave') in the **quantum** realm as reality 'out there' with [unit probability](#), and their lifetime in the instant 'now' from the [Arrow of Space](#) is *infinitesimal* -- just a "point" from the continuum along the **w** axis (cf. [Fig. 2](#)).

Thus, we need two **modes** of spacetime, a global mode for 'potential reality' and a local mode for its fleeting explications along the [Arrow of Space](#). Chris Isham is trying to place everything in one pot, while I separate them from the outset, and claim that their apparent fusion is due to the so-called [speed of light](#), because the duration of their separation, in the *local mode* of spacetime, is **zero**. We have a **perfect continuum** of such explicated things -- one-at-a-time, along the [Arrow of Space](#) -- in the *local mode* of spacetime, at **all length scales**.

This is an *absolute* instant 'now' (cf. Isham's question [above](#)) from the [Arrow of Space](#). It isn't physical, but looks like a transcendental tachyon, which is absolutely everywhere at 'no time' and at **all length scales**. It builds up *the* cosmological time and should *not* be 'GR observable', yet your wristwatch does indeed read it -- check out [Luca Lusanna](#) and the bewildered Tom Thiemann [here](#).

The paradoxical situation is that I am strictly following Chris Isham's path to quantum gravity, announced in [1993](#). In my opinion, I am more 'Chris Isham' than he currently is. All differences boil down to the way he and I understand the continuum hypothesis and the quantum of action: *dead matter makes quantum jumps; the living-and-quantum matter is smarter*.

This is the motto of my web site, since July 1998. Let me try to explain it, by offering my version of '[the quantum principle](#)'. Then I will try to answer the question about time posed [above](#).

In simple words, *the quantum principle* is based on the [Bootstrap Principle](#) and the rule 'think globally, act locally'. It postulates the rules of [the infinitesimal displacement](#) of physical stuff in space and time, along the *continuum* of events produced by the [Arrow of Space](#) (*bzw.* arrow of spacetime): no "uncertainties" nor "quantum jumps" (*verdammt Quantenspringerei*, Erwin Schrödinger) exist in the quantum realm. We have *continual* trajectories of *individual* quantum particles, as well as [emergent geodesics](#). The stochastic "quantum jumps" are artifacts from the measuring devices at the scale of tables and chairs.

If you examine the Gedankenexperiment with [four dice](#), you will see that the transition from any **n**-state of the dice to the next **n**-state is *perfectly continual* in the local mode of spacetime: the duration of the EPR-like correlation "in the air" is **zero** in the *local mode* comprised from such **n**-states. The same holds for the [emergent geodesics](#): the duration of the matter-geometry talk "takes place" in the global mode, at the *interface* of the [non-Archimedean](#) (geometrical) and [Archimedean](#) (physical) worlds, hence its physical duration in 3-D space (local mode) is **zero**. QM and GR are unified [from the outset](#). Simple, no?

**NB:** If this quantum principle is correct, *all other approaches* to quantum gravity ([Steven Carlip](#) and [Claus Kiefer](#) included) must necessarily be wrong.

As to the question by Chris Isham [above](#): 'time' is provided by the *absolute* clock of the [Arrow of Space](#), which is *external* to all physical systems, yet is also "inside" each and every physical system, as it operates in the [non-Archimedean](#) realm of 'potential reality'. This *absolute* clock reads an infinite-dimensional time, which coincides with 'the time read by your wristwatch' (the [dualist conception of time](#)) only in the instant 'now' in which the global mode is being "[flattened](#)" to the local mode.

Of course, there is no way to find out if someone has found 'the right track', but at least I can *think* of [QM & STR](#) and the [cosmological "constant"](#), regardless of Chris Isham's opinion on my intellectual abilities and knowledge in theoretical physics.

As I'm still learning, since January 1972, perhaps some day I could say more on "[the bridge](#)"; check out the current version of my note on GWs at

<http://www.god-does-not-play-dice.net/ExplanatoryNote.pdf>

What looks really impossible, I'm afraid, is some day Chris Isham to defend his insulting claim from [23 October 2002](#).

No way. He will keep quiet, and will praise [Stephen Hawking](#).

Apart from that, I must acknowledge that Chris Isham is a very nice person. We met on November 13, 1998, and had many discussions in his Office. At our last meeting on March 9, 2006, he offered me a cup of tea, which was delicious.

["just another crank"](#) D.C.

September 3, 2010

Last update: September 7, 2010

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Subject: Andreas Döring (23 August 2008), Tutorial on Conceptual Issues of Quantum Theory, 1:32:40 - 1:33:00

Date: Sat, 13 Nov 2010 04:55:35 +0200

From: Dimi Chakalov <dchakalov@gmail.com>

To: Andreas <andreas.doering@comlab.ox.ac.uk>

Cc: Jeremy <jb56@cam.ac.uk>,

Chris Isham <c.isham@imperial.ac.uk>

Andreas Döring (23 August 2008), Tutorial on Conceptual Issues of Quantum Theory

<http://www.comlab.ox.ac.uk/quantum/content/0808001/>

Slide 40, "A contextual theory would allow the value assigned to some operator  $\hat{A}$  to depend on the **context** considered."

<http://www.comlab.ox.ac.uk/quantum/talksarchive/clap3/clap3-andreasdoering.pdf>

Andreas Döring, [1:32:40 - 1:33:00](#): "I must really admit it is not clear to me how much sense this could make."

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Hi Andreas,

On Friday, 13 November 1998, I met Chris in his Office and suggested to explore the correct `_context_`, as used by the human brain,

<http://www.god-does-not-play-dice.net/#Reznikoff>

<http://www.god-does-not-play-dice.net/#Specker1>

Twelve years later (13 November 2010), he still has not used his brain to check up my proposal, but is trying to place everything in one pot (Eintopf gemacht), as I wrote at

<http://www.god-does-not-play-dice.net/#time>

I trust you can do better -- [no topos](#) nor [tensors](#),

<http://www.god-does-not-play-dice.net/#XXX>

If you're interested, feel free to write me back.

Regards,

Dimi

=====

Subject: [Translocal connections](#) beneath the smooth surface of classical spacetime

Date: Wed, 8 Sep 2010 20:45:13 +0300

Message-ID:

<AANLkTimeHd+00f43SnnZpB\_11mXTuhOjeCf6HMuEJzxc@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Manfred Requardt <requardt@theorie.physik.uni-goettingen.de>

Cc: [Petr Hajicek](#) <hajicek@itp.unibe.ch> ,

Abner Shimony <abner.shimony@gmail.com> ,

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Willem M de Muynck <W.M.d.Muynck@tue.nl> ,

Jeremy <jb56@cam.ac.uk> ,

[Chris Isham](#) <c.isham@imperial.ac.uk> ,

Dorje Brody <d.brody@imperial.ac.uk> ,

[Sergio Doplicher](#) <dopliche@mat.uniroma1.it>

Dear Manfred,

I hope you can recall my email from Tue, 02 Sep 2003 15:51:53 +0300, regarding your [arXiv:gr-qc/0308089v1](#) (cf. the subject line). Seven years later, I still don't know your viewpoint on the measurement (macro-objectification) problem and the clash of QM with STR (Abner has written a lot on this issue).

In your latest [arXiv:1009.1220v1](https://arxiv.org/abs/1009.1220v1), you offered an alternative to the decoherence/einselection mess from Zurek, but the crux of the task has not been addressed: how do you reconcile QM with STR (Special Theory of Relativity)?

STR (Minkowski spacetime) requires 'objective reality out there', while QM explicitly denies it:

"In general, a variable *has* no definite value before I measure it; then measuring it does not mean ascertaining the value that it *has*."

This is the famous quote from Schrödinger at

<http://www.god-does-not-play-dice.net/#KS>

In the case of STR, consider an example with the Sun:

1. If you look at it, you will see/observe a state of the Sun, which has been \*real\* 8 min prior to the instant of your observation.
2. At the \*very same instant\* of your observation, the Sun does possess a real state 'out there', which will be available to you for observation/recording after 8 min.

This is the meaning of '[objective reality out there](#)'.

In order to reconcile QM with STR, we need 'reality out there', as suggested at the link above. Just drop "objective" and replace it with "potential".

As a bonus, I get your "translocal connections beneath the smooth surface of classical spacetime" (although not from your approach, of course), without any spukhafte Fernwirkungen or Gespensterfelder, plus much more,

[http://www.god-does-not-play-dice.net/#Levi\\_Civita](http://www.god-does-not-play-dice.net/#Levi_Civita)

Please tell me if you can do better.

I extend this request to all your colleagues.

Kindest regards,

Dimi

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Note: The so-called PR<sup>2</sup> interpretation of QM stands for ([potential reality](#)) & ([proper relativistic](#)) interpretation<sup>1</sup>. It explains *smooth bi-directional* transitions between the classical and quantum realms, does not treat the former as some "[limiting case](#)", resolves the [temporal solipsism of QM](#) and recovers Bells' [aether](#), and explains the actualization of potentialities as a relativistic **process**, in line with '[the quantum principle](#)'. As a bonus, you get the physics of the human brain and all living creatures, without any "psi-fields" or other parapsychology: click on the smiling cat [above](#).

Or don't. It's your [free will](#) choice, in line with the PR<sup>2</sup> interpretation of QM.

I'm just a [psychologist](#), don't need quantum gravity. Even if someone explains the origin of inertia and sorts out the [quantum vacuum energy](#) with exact equations, all this will be redundant information, just as I don't need to know the exact biochemistry of food processing in order to enjoy a beef steak, say.

Does a fish need a bicycle? 

D.C.

September 8, 2010

Last update: September 30, 2010

J. S. Bell, Quantum mechanics for cosmologists, in: *Speakable and unspeakable in quantum mechanics*, 2nd ed., Cambridge University Press, 2004

Ch. 15, [p. 136](#): "(W)e have no access to the past. We have only our 'memories' and 'records'. But these memories and records are in fact *present* phenomena. (...) The theory should account for the *present* correlations between these *present* phenomena.

....

"The question of making a Lorentz invariant theory on these lines raises intriguing questions. For reality has been identified only at a **single time**."

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<sup>1</sup> The 'proper relativistic' interpretation of QM resolves the following problem, from [Dah-Wei Chiou](#):

"The seemingly puzzle is analogous to the Einstein-Podolsky-Rosen (EPR) paradox, in which a pair of entangled particles are measured separately by Alice and Bob. In the context of special relativity, if the two measurements are conducted at two spacetime events which are spacelike separated, the time-ordering of the two events can **flip** under a Lorentz boost and thus has no physical significance. Alice and Bob can both claim that the entangled state is collapsed by her/his measurement and thus have different knowledge about what the physical state should be (should have been - D.C.), yet the predictions by Alice and Bob **are** consistent to each other."

The [UNdecidable state](#) of *the* entangled/superposed "particle" (never in plural) exist as 'potential reality *out there*', and can always be traced back to the past light cone of both Alice and Bob -- retrospectively, *after* their "observations". Neither the "time-ordering" nor the "different knowledge" about what '*the physical state*' should have been have any significance whatsoever to '[the base state](#)', since the latter is *omnipresent* and can never be "[collapsed](#)". It is the 'back bone' along which Nature (not QM textbooks) has worked out *smooth bi-directional* transitions between the classical and quantum realms. Simple, no?

Well, [Manfred Requardt](#) doesn't like it, for reason he never explained. Anyway.

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How wonderful that we have met with a paradox.  
Now we have some hope of making progress.  
Niels Bohr

**Note:** Please read Ernst Specker's [1960 article](#) and notice [[Ref. 1](#)] above. To explain the seemingly mundane notion of 'counterfactual definiteness' from QM textbooks, and then compare it with the *brand new* situation introduced with [KS Theorem](#) (usually not covered in QM textbooks), consider an entangled [quantum coin](#), which is being flipped "[in the air](#)". Upon landing on the floor (Hilbert space), there are "two" (in fact, **one**) observer(s), Alice and Bob, such that Alice can record the entangled quantum coin by viewing it 'from the bottom up', while Bob can see it only 'from above'. In such highly contrived Gedankenexperiment, Alice will *know* that if she observes 'heads', in the *very same* instant Bob *should have* seen 'tails' -- after all, it's **one** coin. Alice will also *suppose* that, by virtue of 'counterfactual definiteness', it is *meaningful* to ask: what would I had seen had Bob actually saw 'heads'?

I will spare the reader the usual excursion to Bell's theorem, EPR argument and its inevitable pitfalls (e.g., "quantum correlations happen without any time-ordering", and "nonlocal quantum correlations seem to emerge, somehow, from outside space-time", [Nicolas Gisin](#)), and will only stress that Alice&Bob are confined in the Hilbert space, hence can never "see" the quantum coin "[in the air](#)". The UNdecidable KS state shows up **only** in [KS Theorem](#).

Look carefully at R.I.G. Hughes, [p. 164](#), and notice the difference between the geometrical

presentation -- in the **3-D space** of the macro-world of tables and chairs -- of spin-1 vs. spin-1/2 systems. In the latter case, the component of *the spin per se* (a *bare* finger nail, cf. 'KS Theorem for teenage girls' [above](#)) can choose from two alternative observable values, either +1/2 or -1/2, both of which can be accommodated along **one** axis from 3-D space -- all they need is to choose a "diametrically opposed direction" (*ibid.*) along *that same* axis in 3-D space. Therefore, in the case of spin-1/2 systems, the UNdecidable KS state need not, and *hence does not* show up -- the 3-D space does **not** force it to reveal **all** of its contextualized classical-*able* states.

Not so in the case of spin-1 system: the **square**  $S^2$  of any component of spin can take *three* values -- 1, 0, -1 -- which in turn requires all *three* axes of 3-D space. In other words, even **one** square  $S^2$  will invade/require all available geometrical degrees of freedom provided by 3-D space -- the classical "filter" for contextualized classical-*able* states.

Now, Kochen and Specker have shown that, if you consider any **triple** of such squares  $S^2$ , each of which requiring the three mutually perpendicular directions in 3-D space (cf. Eq. 2.8 on p. 17 from C. Isham's textbook [here](#)), the *statistical* interpretation of QM would *imply* that you will **always** find out that "two receive value 1 and the third 0" (*ibid.*), similarly to the case of 'counterfactual definiteness' from QM textbooks. But the *statistical* interpretation of QM turn out to be **wrong**, as anticipated by Erwin Schrödinger in [November 1950](#).

You can't have **all** the contextualized classical-*able* states in such [{1,0,1}](#) pattern, as proven by KS Theorem. *Some* of them will *always and inevitably* fail to comply with your (biased) expectation for "an unequivocal true-false value", as explained eloquently by Isham and Butterfield, [p. 3](#) (see the excerpt [above](#)), and will have to be shifted into the UNcolored section from KS sphere ([Helena Granström, p. 2](#)). Hence my interpretation of the UNdecidable KS state [above](#).

There is no [backward causation nor retrocausality](#), because 'potential reality' does not live on the *local* mode of spacetime (cf. Fig. 1 [above](#)), hence can act as Reichenbach's [Common Cause Principle](#) and Leibnitz' [harmonia praestabilita](#) along the arrow of spacetime (cf. the proposal for [biocausality](#)).

Notice also the logic of propositions regarding the "content" of potential reality, encapsulated with a single [YAIN](#), and compare it to the topos approach by Chris Isham [above](#).

I firmly disagree with the opinion in [Wiki](#) that KS Theorem (details in [Mladen Pavicic et al.](#), cf. p. 8 and p. 17) were some "complement to Bell's theorem". The latter theorem is based on counterfactual "reasoning", which might eventually be made clear and conclusive only in classical physics.

Regarding Bell's Theorem, Tim Palmer rightly noticed that ([p. 7](#)) "in order to establish Bell's theorem, we need to consider correlations between pairs of measurements when the magnets have different orientations, let's say **n** for the left-hand magnets and **n'** for the right-hand magnets. It is also necessary to assume that it is meaningful to ask: what would the spin of a left-hand particle have been had we actually measured it with magnets oriented in the **n'** direction (or, conversely, what would the spin of the right-hand particle have been had we actually measured it with magnets oriented in the **n** direction)?" Counterfactual "reasoning" is a recipe for parapsychology. More from Charles Tresser, [Sec. 5](#).

There is no counterfactual "reasoning" in KS Theorem, ladies and gentlemen. Quite the opposite. Check out Ernst Specker [above](#).

In summary, all quantum, as well as all gravitational "states" are contextualized *quasi-local* explications from their [potential-reality state](#) (never in plural): check out Fig. 2 [above](#).

Any comments? Please don't hesitate, like [Chris Isham](#) and his [PI colleagues](#).

D.C.

April 23, 2010

Last update: October 11, 2010

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Subject: How to falsify "decoherence" (if any)

Date: Mon, 11 Oct 2010 20:35:51 +0300

Message-ID:

<AANLkTim+NxSPH6LOBKMYaDoD=p8p8vbuAKYFqmo7aWJk@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Zeh <zeh@uni-heidelberg.de> ,

Claus Kiefer <kiefer@thp.uni-koeln.de> ,

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Dear Colleagues,

May I offer you an exercise to falsify "decoherence", as I notice that some of you are still haunted by it:

H. D. Zeh, How decoherence can solve the measurement problem

<http://www.rzuser.uni-heidelberg.de/~as3/SolveMeas.html>

The Chinese Nebulae (located at the newly build National Supercomputing Centre in Shenzhen) achieved 1.271 PFlop/s running the Linpack benchmark, and can deliver a theoretical peak performance at 2.98 petaflops per second (FLOPS means floating point operations per second).

Suppose its Intel X5650 processors are "decoherent" quantum systems, such that all quantum fuzziness in the \*timing\* of their operations is "quite strongly peaked (notice the poetry - D.C.) about one path" (Jonathan Halliwell, [arXiv:quant-ph/0501119v1](http://arxiv.org/abs/quant-ph/0501119v1)).

Please calculate (roughly) how long your Chinese colleagues may run their Nebulae before it breaks down.

Please don't hesitate to publish your calculations.

I bet 100 EUR (sorry, no [US dollars](#)) that \*none\* of the above will happen, for reasons explained at

<http://www.god-does-not-play-dice.net/#KS>

Do you accept the bet?

Kindest regards,

Dimi Chakalov

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**Note:**  $10^{15}$  perfectly classical FLOPS, totally protected from the damping of the "tails" (Max Schlosshauer, [arXiv:quant-ph/0312059v4](http://arxiv.org/abs/quant-ph/0312059v4), p. 30) -- indefinitely ?

Prove it.

The task is interesting to me because [my brain](#) has roughly  $10^{14}$  [synapses](#), which do **not** make [errors](#) (I do; not my brain). Also, I cannot explain the generation of observable paths in Wilson cloud chambers, after [Sir Nevill Mott](#) (cf. Alessandro Teta, [arXiv:0905.1467v1 \[math-ph\]](#), pp. 9-10), with "decoherence". If people believe the latter is better than the [Born Rule](#), they should explain (i) things we can observe, such as the generation of paths in Wilson cloud chambers, and (ii) things we *cannot* observe, such as 'global and absolute time' (A. Macias and H. Quevedo, [gr-qc/0610057v1](#)) along which space "[expands](#)". More on [25.11.2015](#).

D.C.

October 11, 2010

Last update: October 13, 2010

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Subject: Bishop George Berkeley: "In rebus mathematicis errores quam minimi non sunt contemnendi."

Date: Tue, 7 Sep 2010 14:24:12 +0300

Message-ID:

<AANLkTikf4PyjrFkw2-P5Xou=dHr\_Gtm=yVNfbbsYJ95A@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Steven Carlip <carlip@physics.ucdavis.edu>

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Claus Kiefer <kiefer@thp.uni-koeln.de>

Hi Steve:

I trust my email from Fri, 10 Sep 2004 11:47:18 +0100, prompted by your notes [[Ref. 1](#)], has been safely received.

Regarding your latest essay, I think the notion of 'small enough' [[Ref. 2](#), p. 6] involves an unacceptable degree of poetry in the adjective "enough" -- see NB at

[http://www.god-does-not-play-dice.net/#Zinkernagel\\_note](http://www.god-does-not-play-dice.net/#Zinkernagel_note)

Details at

<http://www.god-does-not-play-dice.net/#Alice>

[http://www.god-does-not-play-dice.net/#quantum\\_principle](http://www.god-does-not-play-dice.net/#quantum_principle)

I'm glad you offered a tentative verification of your general idea, that "even small violations at that scale can be magnified and lead to observable effects at large scales" [[Ref. 2](#), p. 10] -- please see [[Ref. 3](#)].

Notice that any viable theory of quantum gravity must pass the reality check of 3-D space: "it is possible to look around, and see as far as we like" (Lee Smolin),

<http://www.god-does-not-play-dice.net/#Buchanan3>

In summary, I believe the whole issue (cf. NB at the first link above) is strictly mathematical, which is why I quoted Bishop George Berkeley.

I will appreciate your professional comments, as well as the input from your colleagues.

Regards,

Dimi

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[Ref. 1] Steven Carlip, Conceptual problems in quantum gravity

<http://www.physics.ucdavis.edu/Text/Carlip.html#problems>

"According to general relativity, gravity is a characteristic of the structure of spacetime, so quantum gravity means quantizing spacetime itself. In a very basic sense, we have no idea what this means.

.....

"(For a nice review paper by Chris Isham on some of the conceptual issues in quantum gravity, go here.)"

<http://xxx.lanl.gov/abs/gr-qc/9310031>

[Ref. 2] *Idem*, The Small Scale Structure of Spacetime; to appear in Foundations of Space and Time, edited by George Ellis, Jeff Murugan, Amanda Weltman (Cambridge University Press), arXiv:1009.1136v1 [gr-qc],

<http://arxiv.org/abs/1009.1136>

p. 2: "Over the past several years, evidence for another basic feature of small-scale spacetime has been accumulating: it is becoming increasingly plausible that spacetime near the Planck scale is effectively two-dimensional. No single piece of evidence for this behavior is in itself very convincing, and most of the results are fairly new and tentative.

.....

p. 6: "For a small **enough** region of spacetime, one might guess that the causal structure is generic, coming from a random causal ordering.

.....

"We then face a rather bewildering question: which two dimension? How can a four-dimensional theory with no background structure or preferred direction pick out two "special" dimensions at short distances?

.....

p. 10: "There is a danger here, of course: the process I have described breaks Lorentz invariance at the Planck scale, and even small violations at that scale can be magnified and lead to observable effects at large scales [2]."

[Ref. 3] Yuan K. Ha, Is There Unification in the 21st Century?,

[arXiv:1007.2873v1](http://arxiv.org/abs/1007.2873v1) [gr-qc]

pp. 8-9: "The result indicates that there is no evidence so far of any quantum nature of spacetime above the Planck length. Spacetime there (distance of 7.3 billion light years from Earth - D.C.) is smooth and continuous."

=====

Subject: Ask Stephen Hawking

Date: Mon, 6 Sep 2010 02:13:43 +0300

Message-ID:

<AANLkTi=eKqSxhYR2LiY+fHQaygJHMyT+x8v64NqSs3gM@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>  
To: eureka@thetimes.co.uk  
Cc: Jim Al-Khalili <j.al-khalili@surrey.ac.uk>

Dear Sir or Madam,

Regarding the public lecture at the Royal Albert Hall in London on October 20, chaired by Professor Jim Al-Khalili: may I ask you to deliver a question to Professor Stephen Hawking,

<http://www.thetimes.co.uk/tto/science/eureka/article2711970.ece>

To quote from the link above: "Because there is a law such as gravity, the Universe can and will create itself from nothing. Spontaneous creation is the reason there is something rather than nothing, why the Universe exists, why we exist. (...) If there are trillions of universes as M-theory proposes, that luck and probability are enough to make our existence feasible, so no God was needed."

I have no questions to Professor Hawking regarding the second and third sentences, as spontaneous creation of an infinite multiverse doesn't make sense at all. It rather implies an utterly dumb and sloppy god (hence no capitals), which of course has nothing to do with [John 1:1].

The first sentence, however, clearly suggests that Professor Hawking holds strong opinions on the nature of gravity, quantum cosmology, and quantum gravity. Hence my question:

Q: With all due respect, do you realize that (i) you are a deeply religious person, obsessed by anti-theistic beliefs, and (ii) your book delivers many biased and unprofessional statements?

Should you disagree, please explain (i) the origin of inertia and (ii) your opinion on whether the quantum vacuum energy "gravitates".

Thank you.

Yours sincerely,

Dimi Chakalov  
<http://chakalov.net>  
-----  
35 Sutherland St  
SW1V 4JU

=====  
Subject: Re: "Preliminary version, comments wellcome", [arXiv:1008.2524v1 \[quant-ph\]](http://arxiv.org/abs/1008.2524v1)  
Date: Wed, 18 Aug 2010 16:56:59 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Petr Hajicek ITP <hajicek@itp.unibe.ch>

On Wed, Aug 18, 2010 at 4:51 PM, Petr Hajicek ITP <hajicek@itp.unibe.ch> wrote:

>  
> Dear Dimi,  
> I cannot understand your comment

Do you have Internet?

> what is missing in my discussion of KS  
> (which is standard, see Bub's book)

I have quoted from it: see the letter by Schrödinger from November 1950 at the first link from my initial email.

> Please do not send me to any further texts by you, which are similarly vague.

If you don't want to read and learn more, there is nothing I can do for you.

I wish you a pleasant and peaceful retirement.

Regards,

Dimi

> On Tue, Aug 17, 2010 at 9:13 PM, Dimi Chakalov <dchakalov@gmail.com>

> wrote:

>>

>> Dear Petr,

>>

>> Apart from the "wellcome" typo in your abstract, the treatment of KS

>> Theorem (p. 64) is incomplete, which drives your efforts to a blind

>> alley: I cannot see how you could possibly reconcile your ideas with

>> [STR](#).

>>

>> Q: What is the "back bone" of your quantum state, such that you can

>> make smooth, bi-directional transitions b/w the word of [facts](#),

>> governed by [STR](#), and the quantum realm?

>>

>> My efforts, which you've been persistently ignoring, are at

>>

>> <http://www.god-does-not-play-dice.net/#KS>

>>

>> [http://www.god-does-not-play-dice.net/#Levi\\_Civita](http://www.god-does-not-play-dice.net/#Levi_Civita)

>>

>> If you cannot answer my question, check out the links above.

>>

>> I will appreciate the professional opinion of your colleagues as well.

>>

>> Regards,

>>

>> Dimi

>>

=====

Subject: Re: ... approaching the planned level of sensitivity?

Date: Fri, 20 Aug 2010 18:24:55 +0300

From: Dimi Chakalov <dchakalov@gmail.com>

To: Leonid Grishchuk <Leonid.Grishchuk@astro.cf.ac.uk>

Cc: Stanislav.Babak@aei.mpg.de,  
mukhanov@theorie.physik.uni-muenchen.de

Hi Leonid,

Regarding my email from [Wed. 14 May 2003 14:11:49 +0300](#): I quoted from your [gr-qc/9907027](#) at

[http://www.god-does-not-play-dice.net/#Levi\\_Civita](http://www.god-does-not-play-dice.net/#Levi_Civita)

You and your colleagues are hard-core Russians, and probably will not respond, as you never did so far. Even since August 1981, after my first effort to contact a Russian physicist (David Abramovich

Kirzhnitz), I noticed this terribly rigid, [Soviet-style thinking](#).

I also noticed that you are still unable to uncover the blueprints from relic GWs (p. 4 and ref. [4] in [gr-qc/9907027](#)). If you're interested in a fresh look at the task, feel free to reply to this email, after reading the text at the link above.

Take care,

Dimi

-----

Note: Recall the [correlation puzzle](#) with relic GWs (Scott Dodelson *et al.*, [arXiv:0902.3796v1](#)):

"This discovery of the last decade sharpens the classic horizon problem: why does radiation arriving from opposite ends of the Universe share the same temperature? The problem is now even more profound: how were the initial perturbations, with their [puzzling synchronization](#), produced? What physical mechanism could have possibly planted these primordial seeds?"

If you use the '[spherical cow](#)' (linearized) approximation of GR, the "puzzling synchronization" mediated by relic GWs will have to propagate **in space**, 'from one point in space to another', just like the **z**-direction toward the L-shaped tunnels of LIGO (e.g., [arXiv:1007.3973v1](#), p. 11, Fig. 5). In the case of relic GWs, with "speed" faster than light.

If you drop the '[spherical cow](#)' (linearized) approximation of GR, you will have to use pseudo-tensors to **derive** the magic L-shape of LIGO's arms. Try this:

Ed Bertschinger, "Gravitational Radiation Emitted Power", *General relativity notes*, Sec. 4, <http://web.mit.edu/edbert/GR/gr7.pdf>

If you succeed, we all will hear about it on CNN Breaking News.

D.C.

October 8, 2010

=====

Subject: "A spoken thought is a lie"  
Date: Wed, 27 Oct 2010 07:04:57 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Lev Okun <okun@itep.ru>  
Cc: Iegor Reznikoff <xxxxxxx@xxxxx.xx>,  
Serge Krasnikov <gennady.krasnikov@pobox.spbu.ru>,  
Dmitry Slavnov <slavnov@goa.bog.msu.ru>,  
Andrei NB <novikov.borodin@gmail.com>,  
Leonid.Grishchuk@astro.cf.ac.uk,  
Stanislav.Babak@aei.mpg.de,  
mukhanov@theorie.physik.uni-muenchen.de

Dear Dr. Okun,

I'm glad you mentioned Фёдора Ивановича in your latest [arXiv:1010.5400v1](#): the origin of mass may be UNSpeakable,

<http://www.god-does-not-play-dice.net/#KS>

<http://www.god-does-not-play-dice.net/#Reznikoff>

In the context of the famous saying in the subject line,  $E = mc^2$  is a "verbalized" lie.

"Никто не обнимет необъятного" (Козьма Прутков), because it is rooted on 'the ideal monad without windows' (Kant's Noumenon). Hence my predictions about that [huge Barbie called LHC](#),

<http://www.god-does-not-play-dice.net/Greenberg.html>

Details at

[http://www.god-does-not-play-dice.net/#Hehl\\_note](http://www.god-does-not-play-dice.net/#Hehl_note)

I will appreciate your critical comments, as well as the professional opinion of your colleagues.

Kindest regards,

Dimi Chakalov

=====

Subject: Yakov Terletskii  
Date: Fri, 29 Oct 2010 04:43:56 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Edward Kapuscik <Edward.Kapuscik@ifj.edu.pl>  
Cc: Lev Okun <okun@itep.ru>

Dear Dr. Kapuscik,

In your recent [arXiv:1010.5886v1](http://arxiv.org/abs/1010.5886v1), you wrote: "It is therefore suggestive to assume that  $P_0(0)$  is equal to some unknown kind of energy, for example, the dark energy present in the Universe."

I wonder if you intend to elaborate on the three forms of mass,

Yakov P. Terletskii, Paradoxes in the Theory of Relativity,  
<http://www.directtextbook.com/prices/9780306303296>

I suppose you are fluent in Russian and know the original edition. Look at the end of Ch. VI, and will notice that the notorious KGB agent didn't like "black holes".

My recent efforts can be read at

<http://www.god-does-not-play-dice.net/#Okun>

I will appreciate your professional comments.

Kindest regards,

Dimi Chakalov

----

Note: I read today the fifth version of a very intriguing paper by Den Yerokhin *et al.*, Dynamics of Universe in Problems, [arXiv:0904.0382v5](http://arxiv.org/abs/0904.0382v5) [[astro-ph.CO](http://astro-ph.CO)]; 764 problems. My favorite one is about the "dark energy", p. 56, Task 9:

"Show that assigning energy to vacuum we do not revive the notion of "ether", i.e. we do not violate the relativity principle or in other words we do not introduce notion of absolute rest and motion relative to vacuum."

I emailed Dr. Yerokhin and said that the task seems impossible (I don't know how to define the *stress-energy tensor* of the vacuum in the first place, and then make sure that it is "proportional to the metric", [J. Baez and E. Bunn](#)), and added: "If you know how to solve it, please drop me a line with some hints and references."

The reply by Dr. Den Yerokhin ([answer.pdf](#)), along with his permission to post it on this web site, can be downloaded from [Yerokhin.zip](#). You be the judge.

I am still unable to understand how to "assign" energy to the vacuum, as its contribution *must* be zero (cf. [M. Montesinos](#)); additional puzzled from [Luca Lussanna](#) and [Thomas Thiemann](#).

D. Chakalov  
November 1, 2010

=====

Subject: Dual speed of gravity in GR  
Date: Fri, 10 Sep 2010 18:00:52 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Serguei Krasnikov <gennady.krasnikov@pobox.spbu.ru>  
Cc: erast@hotmail.com

Serguei,

Regarding your latest essay: I know that you don't care about anything I suggest, as you never did in the past six years.

But since our brains are entangled, I do care about what I say or do \*not\* say to you. In the latter case, it would be bad if I don't tell you what I think about your latest [arXiv:1009.1761v1 \[gr-qc\]](http://arxiv.org/abs/1009.1761v1), although you will undoubtedly ignore it, since you're Russian.

There are two kinds of distances in the case of deons (Erast Gliner, [arXiv:gr-qc/0006072v1](http://arxiv.org/abs/gr-qc/0006072v1)): one is in the Riemannian spacetime of GR (examined in your [arXiv:1009.1761v1 \[gr-qc\]](http://arxiv.org/abs/1009.1761v1)), and the other is in the so-called global mode of spacetime,

<http://www.god-does-not-play-dice.net/#Bahn>

The first distance is always finite, and the speed of gravity does not exceed the "speed" of light, while the latter distance is exactly zero, hence the speed of gravity there seems to be infinite, like a transcendental tachyon. With such dual speed of gravity, you get correlations \*resembling\* a school of fish:

<http://www.god-does-not-play-dice.net/#shoal>

More at

[http://www.god-does-not-play-dice.net/#quantum\\_principle](http://www.god-does-not-play-dice.net/#quantum_principle)

<http://www.god-does-not-play-dice.net/ExplanatoryNote.pdf>

Take care,

Dimi

=====

Subject: Re: Dual speed of gravity in GR  
Date: Sat, 25 Sep 2010 04:55:57 +0300  
Message-ID:  
<AANLkTimSDwyxQryOUOe2hqE=p6fHa206=HxFzf70+qTi@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Jose Geraldo Pereira <jpereira@ift.unesp.br>  
Cc: Serge Krasnikov <gennady.krasnikov@pobox.spbu.ru>, Laszlo Szabados <lbszab@rmki.kfki.hu>, Jeremy <jb56@cam.ac.uk>, Chris Isham <c.isham@imperial.ac.uk>, Adam Helfer <adam@math.missouri.edu>,

John Baez <baez@math.ucr.edu>,  
Anthony Zee <zee@kitp.ucsb.edu>,  
Sergio Doplicher <dopliche@mat.uniroma1.it>,  
Sergiu Klainerman <seri@math.princeton.edu>

Dear Jose,

You and your co-authors stressed that "the electromagnetic wave is unable to transport its own source, that is, electric charge" (arXiv:0809.2911v2 [gr-qc]; cf. p. 4 at the link below).

If I am on the right track, the true gravitational waves (forget about quadrupole radiation) should be unable to transport their own source either, that is, the entity in the l.h.s. of Eq. 1, p. 35, at the link below.

All the best,

Dimi

On Fri, Sep 24, 2010 at 4:46 PM, Dimi Chakalov <dchakalov@gmail.com> wrote:

>  
> Hi Serguei,  
>  
> Regarding my email from [Fri, 10 Sep 2010 18:00:52 +0300](#): you replied  
> by saying that cannot understand the so-called global mode of  
> spacetime.  
>  
> Check out my comment on J. G. Pereira et al., p. 4 from  
>  
> <http://www.god-does-not-play-dice.net/ExplanatoryNote.pdf>  
>  
> If you and your colleagues are still unable to understand the crux of  
> the matter, it will be entirely my fault, so please do write me back  
> with your questions.  
>  
> Regards,  
>  
> Dimi  
>

**Note:** In addition to the comments on J. G. Pereira *et al.*, arXiv:0809.2911v2, on p. 4 from [ExplanatoryNote.pdf](#), see also Sec. Summary, pp. 35-37 therein, and another paper by J. G. Pereira *et al.*, Does a tensorial energy-momentum density for gravitation exist? [arXiv:0812.0034v1](#). Jose Pereira and his co-authors concluded that "at each point of the world-line, inertia compensates gravitation yielding a **vanishing** (bit not exactly zero - D.C.) spin connection" ([p. 6](#)), and elaborated as follows:

"This means that inertial and gravitational effects are both embodied in the spin connection [XXX] and cannot be separated because of the equivalence principle (notice that inertial and gravitational effects **can** indeed be separated inside each "point" of [the emergent geodesic](#) - D.C.)

"As a consequence of this inseparability, the energy-momentum **current** in general relativity will always include, in addition to the purely gravitational density, also the energy-momentum density of inertia. Since the latter is a pseudotensor, the whole current will also be a pseudotensor. In general relativity, therefore, it is not possible to define a tensorial expression for the gravitational energy-momentum density. This is in agreement with the strong equivalence principle which precludes the existence of such definition [3]."

If we define the energy-momentum **current** with the mass-energy conservation equation on p. 35 from [ExplanatoryNote.pdf](#), we may recover the **source** of gravitational waves, placed in the l.h.s. of Eq. 1, p. 35 therein. It yields a time-conserved "charge" with only one "sign", *and* allows the

cosmological "constant" to show up with [different values](#) along the non-unitary evolution of The Universe.

More in my talk on [Wednesday, 25 November 2015](#), about what looks in current GR like "[torsion](#)". Forget about [tensors](#).

Let's start from scratch [[Ref. 1](#)]. I mentioned above that inertial and gravitational effects **can** be separated inside each "point" of [the emergent geodesic](#), that is, in the postulated [global mode](#) of spacetime (not in present-day GR nor in the kind of teleparallel gravity studied by Jose Pereira -- read [Janusz Garecki](#)). The "point" in question is the one at which (or rather "inside" which) the two fluxes ([Merced Montesinos](#)) cancel each other **completely**, hence we may *imagine* some "locally inertial coordinate system in which matter satisfies the laws of special relativity" ([S. Weinberg](#)). To be precise, let me quote again [Kevin Brown](#): "Einstein chose for his field equations a gravitational tensor whose covariant derivative vanishes identically, to ensure **local** conservation of energy-momentum, and this requirement is essentially equivalent to the [geodesic hypothesis](#)."

Now, what is the "**size**" of this "point" in GR? [Infinitesimal](#) (check out [Ohanian's](#) error [here](#)). We just have to zoom on [the infinitesimal](#), which is considered to be "of small spatial extension" [[Ref. 2](#)]. More [here](#).

D. Chakalov  
September 26, 2010  
Latest update: October 14, 2010

[[Ref. 1](#)] Kevin Brown, General Relativity and the Principle of Inertia  
<http://www.mathpages.com/home/kmath588/kmath588.htm>

"However, it's somewhat misleading to say that the equations of motion emerge from the field equations without having been imposed as a separate assumption. They follow as a direct consequence of the fact that particles follow "straight and uniform" inertial paths in each infinitesimal region of spacetime, and this in turn is a direct consequence of the [local conservation of energy-momentum](#). It's true that the field equations of general relativity imply this conservation, as can be seen by [the vanishing of the covariant divergence of the Einstein tensor](#)

$$G_{\mu\nu} = R_{\mu\nu} - \frac{1}{2}g_{\mu\nu}R$$

"The field equations simply equate this to the energy-momentum tensor  $T_{mn}$ , so the covariant divergence of the latter must also vanish, hence energy-momentum is locally conserved, [hence particles follow geodesics](#).

"But the local conservation of mass-energy didn't arise automatically, it was specifically designed into the field equations by the inclusion of the "trace" term (the term with coefficient 1/2) in the Einstein tensor. In fact, one of the early attempts of Einstein and Grossmann to formulate generally relativistic field equations led to the result  $R_{mn} = T_{mn}$ , but not surprisingly this is unsatisfactory, precisely because the covariant divergence does **not** vanish. After a great deal of searching (and with the crucial help from [Levi-Civita](#) - D.C.), Einstein finally realized that the natural conservation laws – and hence the law of inertia – is recovered if we include the *trace term*. David Hilbert arrived at this same conclusion almost simultaneously (in November 1915), although his route was much more direct, since he proceeded from a Lagrangian, which automatically leads to conservation laws.

"In view of this, it's surely disingenuous to claim that the field equations of general relativity allow us to dispense with the independent assumption of equations of motion; the equations of motion essentially were imposed as a separate assumption, corresponding to the assumed conservation of energy-momentum that was intentionally built into the equations by the inclusion of the trace term.

.....

"It's possible for the inertial mass of an electrically charged particle to be accelerated in a variety of ways while still conserving electric charge and current. In contrast, the conservation of energy-

momentum fully constrains the motion of a massive particle (in the absence of non-gravitational forces), because the inertial mass is identical to the conserved gravitational "charge". The principle of inertia is really *just another name* for the conservation of energy and momentum.

.....

"So, despite Einstein's hopes, general relativity does not in any way explain or obviate the principle of inertia. Granted, if the field equations didn't include the trace term (so that the covariant divergence didn't vanish), the resulting theory would have many problems and be subject to many objections, but this goes without saying. No one disputes that the principle of inertia is extremely well-founded in observation. It is an extremely well-justified postulate – but it is still a postulate. General relativity does **not** explain inertia, nor does it dispense with the need to organize our spatio-temporal theories on the topology and morphology implicit in the principle of inertia and the associated [distinguished coordinate systems](#)."

[Ref. 2] [A. Einstein](#), *Autobiographical Notes*: "In a gravitational field (of [small spatial extension](#)) things behave as they do in a space free of gravitation, if one introduces into it, in place of an "inertial system", a reference system that is accelerated relative to an inertial system."

.....

A. Einstein, 4 April 1955: "(T)he essential achievement of general relativity, namely to overcome '[rigid' space](#) (ie the inertial frame), is only indirectly connected with the introduction of a Riemannian metric. The directly relevant conceptual element is the 'displacement field' (XXX), which expresses the [infinitesimal displacement of vectors](#). It is this which replaces the parallelism of spatially arbitrarily separated vectors fixed by the inertial frame (ie the equality of corresponding components) by an infinitesimal operation. This makes it possible to construct tensors by differentiation and hence to dispense with the introduction of '[rigid' space](#) (the inertial frame)."

(quoted after [Friedrich Hehl](#) and Yuri Obukhov, [arXiv:0711.1535v1 \[gr-qc\]](#))

=====

Subject: CTP International Conference on Gravity and Cosmology

Date: Sun, 10 Oct 2010 23:01:18 +0300

Message-ID:

<AANLkTinSpqbaQ5bqZH58zn8i-anw\_HW8vo2UN43E7hjB@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Friedrich W Hehl <hehl@thp.uni-koeln.de>

Cc: Mamdouh Wanas <wanas@frcu.eun.eg> ,

Bahram Mashhoon <mashhoonb@missouri.edu> ,

Jose Geraldo Pereira <jpereira@ift.unesp.br> ,

Adam Helfer <adam@math.missouri.edu> ,

Alan Rendall <rendall@aei.mpg.de> ,

Claus Kiefer <kiefer@thp.uni-koeln.de> ,

Laszlo Szabados <lbszab@rmki.kfki.hu>

Dear Friedrich,

I noticed your name at

<http://ctp.bue.edu.eg/workshops/newwebsite/speakers.html>

I wonder if you plan to elaborate on the [postulate of locality](#), from

Friedrich W. Hehl and Bahram Mashhoon, [Nonlocal Gravity Simulates Dark Matter](#), Slide 3 at

<http://www.thp.uni-koeln.de/gravitation/mitarbeiter/nlGrav2010DPG1.pdf>

"Postulate of locality: An accelerated observer (measuring device) along its worldline is at each instant physically equivalent to a hypothetical inertial observer (measuring device) that is otherwise identical and instantaneously comoving with the accelerated observer (measuring device)."

Bahram ([arXiv:1006.4150v1 \[gr-qc\]](https://arxiv.org/abs/1006.4150v1)) believes that "an accelerated observer may be replaced in effect (Sic! - D.) by an infinite sequence of hypothetical momentarily comoving inertial observers; mathematically, the world line of the accelerated observer is the envelope of the straight (presumably - D.) world lines of the corresponding hypothetical inertial observers."

I don't believe in [teleparallel gravity](#), and would rather "insert" in that 'envelope of the straight world lines' a [special mechanism](#), which could perhaps make GR \*quasi-local\*, as well as produce quasi-local positive mass in an asymptotically flat spacetime: please see my email to Dr. [Mamdouh Wanas](#) (printed below), and pp. 35-36 from Sec. Summary in

<http://www.god-does-not-play-dice.net/ExplanatoryNote.pdf>

More on what looks like "torsion" in present-day GR at

<http://www.god-does-not-play-dice.net/#VGP>

I wonder if you and/or some of your colleagues would be interested in discussing these ideas.

Best regards,

Dimi

[[snip](#)]

=====

Subject: Re: CTP International Conference on Gravity and Cosmology  
Date: Mon, 11 Oct 2010 00:35:03 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Friedrich\_Wilhelm Hehl <hehl@thp.uni-koeln.de>  
Cc: Mamdouh Wanas <wanas@frcu.eun.eg>, Bahram Mashhoon <mashhoonb@missouri.edu>, Jose Geraldo Pereira <jpereira@ift.unesp.br>, Adam Helfer <adam@math.missouri.edu>, Alan Rendall <rendall@aei.mpg.de>, Claus Kiefer <kiefer@thp.uni-koeln.de>, Laszlo Szabados <lbszab@rmki.kfki.hu>

On Sun, Oct 10, 2010 at 11:14 PM, Friedrich\_Wilhelm Hehl <hehl@thp.uni-koeln.de> wrote:

>  
> Dear Dimi Chakalov,  
>  
> Thank you for your email. Of course, I am always open for discussions.  
> However, your ideas are so far from my actual field of interest that I  
> cannot see an overlap with your ideas.

I believe they overlap at the [postulate of locality](#):

-----  
>> I wonder if you plan to elaborate on the postulate of locality, from  
>>  
>> Friedrich W. Hehl and Bahram Mashhoon, Nonlocal Gravity Simulates Dark  
>> Matter, Slide 3 at  
>> <http://www.thp.uni-koeln.de/gravitation/mitarbeiter/nlGrav2010DPG1.pdf>  
>>

>> "Postulate of locality: An accelerated observer (measuring device)  
>> along its worldline is at each instant physically equivalent to a  
>> hypothetical inertial observer (measuring device) that is otherwise  
>> identical and instantaneously comoving with the accelerated observer  
>> (measuring device)."

-----

There is too much poetry in this postulate. If we add gravity to matter, the latter will have to be \*quasi-local\*. Clarifying the exact meaning of \*quasi-local\* is the scope of my efforts. We just have to zoom on the infinitesimal, which is (poetically) considered to be "of small spatial extension":

A. Einstein: "In a gravitational field (of small spatial extension) things behave as they do in a space free of gravitation, if one introduces into it, in place of an "inertial system", a reference system that is accelerated relative to an inertial system."

Stated differently, I think you've taken a wrong path marred with too much poetry.

I will appreciate the professional opinion of your colleagues as well.

All the best,

Dimi

=====

Subject: Re: CTP International Conference on Gravity and Cosmology

Date: Mon, 11 Oct 2010 02:12:22 +0300

Message-ID:

<AANLkTikdHBbovq\_uxyTQ65nwJ7SNZtf5q=rm5iyW7zbF@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Friedrich\_Wilhelm Hehl <hehl@thp.uni-koeln.de>

Cc: [snip]

Dear Fred,

> We know that the clock hypothesis (a special case of the principle of  
> locality) is very well obeyed by actual "clocks", like a decaying muon.

For fundamental research, I'm afraid "very well" is also poetry.

Moreover, you're thinking in terms of Archimedean geometry,

[http://www.god-does-not-play-dice.net/#Hubble\\_Archimedean](http://www.god-does-not-play-dice.net/#Hubble_Archimedean)

> In other words, here is a result of this "poetry" that can be confirmed  
> experimentally.

But GR cannot \*explain\* the occurrence/emergence of \*finite\* attributes of space and time, such as 'one second' and 'one meter',

[http://www.god-does-not-play-dice.net/#Levi\\_Civita2](http://www.god-does-not-play-dice.net/#Levi_Civita2)

Surely we enjoy actual "clocks", but in present-day GR they are miracles. And I don't like miracles.

> This is enough for me. If you want opinions of other colleagues, just  
> approach them.

That's what I'm doing. The task is strictly mathematical. If they don't care, some day some young and hungry Chinese grad student might crack the puzzle.

Thank you for your time, and good night.

Dimi

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Note: Friedrich-Wilhelm Hehl was born on August 26, 1937, in Ludwigsburg, Germany. I consider him one of the leading experts on GR:

F.W. Hehl, Spin and Torsion in General Relativity. I. Foundations, General Relativity and Gravitation, 4 (1973) 333-349

F.W. Hehl, Spin and Torsion in General Relativity. II. Geometry and Field Equations, General Relativity and Gravitation, 5 (1974) 491-516

F.W. Hehl, On the kinematics of the torsion of spacetime. Found. Phys. 15 (1985) 451-471

As [Asher Peres](#) used to say, "these things were well known to those who know things well", and Friedrich-Wilhelm Hehl is definitely one of the people who 'knows things well'. Regarding his 1985 article cited above, there are plenty of physical reasons (e.g., Salvatore Capozziello *et al.*, [arXiv:gr-qc/0101038](#)) to believe that the spacetime continuum, viewed [microscopically](#), should carry a torsion, but [the dynamics of torsion](#), which F.W. Hehl "left for a forthcoming article" (October 1984), is still missing. Meanwhile the so-called [DDE](#) showed up, and the dynamics of torsion became a highly non-trivial task: the spin density of matter is **not** the source of torsion.

We should dig [deeper](#) than [R. Penrose](#). Very briefly: the 720-degree rotational invariance of [spinors](#) may be interpreted as two "circles" resembling  $\mathbf{8}$ , which pertain to the *atemporal* "handshaking" of [two waves](#) in the postulated *global mode* of spacetime; the end result "happens" on null-surfaces ([Kevin Brown](#)) "at  $\mathbf{p}$ " [[Ref. 1](#)], and has **zero** duration ("[small spatial extension](#)"), as recorded with your wristwatch. The key ideas are that *physical* events ([local mode](#)) *emerge* on null-surface, and are inherently [quasi-local](#), with vanishing ([present continuous](#)) torsion; details on [November 25, 2015](#). Notice the linked text in [[Ref. 1](#)] and the notion of 'self force' in Machian gravity [[Ref. 2](#)], and check out Eq. 1 on p. 35 from [ExplanatoryNote.pdf](#) regarding the axiom of 'dominant energy condition'.

The null-energy conditions needed for singularity "theorems" and [Tipler's theorem](#) are *wishful thinking* in GR (references [above](#)). Because the "dark" energy from the [quantum vacuum](#) acts as an *additional*, all-permeating and perfectly smooth field, we encounter a blatant violation of Newton's third law; check out an explanation with a car [here](#): "The size of the force on the road equals the size of the force on the wheels (or car); the direction of the force on the road (backwards) is opposite the direction of the force on the wheels (forwards). For every action, there is an equal (in size) and opposite (in direction) reaction."

Compared it with the ultimate free lunch from DDE ([August 2006](#)): "Suppose you accelerate a car, but the gauge fuel shows that you're actually **gaining more fuel** by *accelerating* the car. That's the ultimate 'free lunch' provided by DDE, only physicists cannot explain it." It doesn't get diluted as space "[expands](#)". On the contrary, it's getting *more and more*. From the perspective of contemporary physics, it is far more shocking than [perpetuum mobile](#), simply because it exists.

We cannot apply Newton's third law ([Hans Ohanian](#)) to [the source of DDE](#) - some perfectly smooth stuff that "has *zero* inertial mass" and "can be accelerated with no cost, no effort" ([B. Schutz](#)). From the viewpoint of classical physics, this perfectly smooth [[we-do-not-know-it](#)] had its highest value at the instant of "inflation" (like the amount of fuel in a tank car), and then should have depleted rapidly, or in accelerated fashion during our current cosmological stage. Quite to the contrary: it springs out from "thin air" and does not, in any way, resemble the [Casimir effect](#), say. It is a genuine non-unitary phenomenon, in the sense of John Wheeler's dictum 'Time is Nature's way to keep everything from happening all at once'. More in the papers [above](#).

The alleged [Newtonian limit](#) is totally unclear as well -- notice the self-force from DDE in Machian gravity [[Ref. 2](#)] in the text below. Once we accept that space itself has become [dynamical](#), it's [a whole new ball game](#) for the [current GR](#).

Perhaps the reader may wish to consider a fiber over a point  $\mathbf{p} \in \mathbf{M}$  as collection of spinors (cf. p. 4

from [Geroch](#); general info [here](#) and [here](#)), and see if one can make the "fish"  $\mathbf{p}$  more **flexible**:  $\mathbf{p}$  should be endowed with Lorentzian metric only at some ([still unclear](#)) *quasi-local* positive-mass limit at  $\mathbf{p}$ . The aim is to *replace* (i) the unfortunate [splitting of spacetime in GR](#) with an [emergent spacetime](#) along an [arrow of space](#) (compare it with [R. M. Wald](#)), and (ii) the misleading notion of "curvature" [[Ref. 3](#)], usually depicted with some "curved" 2-D surface immersed into 3-dimensional **flat** Euclidean space ([John Baez](#)), with [atemporal correlations](#) in the global mode of spacetime. Have you seen a [school of fish](#)? I will take off my Euclidean spectacles [[Ref. 3](#)] and try some reverse-engineering. An *incomplete* list of tasks is outlined below.

Look at the fiber bundle hairbrush at [Wiki](#), and compare it with the "spinning" (along two "circles" resembling  $\mathbf{8}$ ; see [above](#)) quantum hedgehog, which is [supposed](#) to show up upon [zooming](#) on the infinitesimal point  $\mathbf{p}$  at [Planck scale](#).



**Q:** Can you suggest a new *nontrivial* bundle (two [Möbius strips](#) maybe?) for the quantum hedgehog, which could facilitate the *non-linear* negotiation between an arbitrary quasi-local "fish", at some [infinitesimal](#) point  $\mathbf{p}$ , and 'the whole school of fish', in [Machian perspective](#)? The symmetry operations related to 'dominant energy condition' (cf. above) should be defined over four sectors (notice the [fav icon](#) of this web site), in a very remote analogy with [Kruskal-Szekeres diagram](#).

Clarifications: the quantum hedgehog has infinitely many "bristles", which should also facilitate the *global view* on 3-D space ([Wiki](#)): one would see "all points in 3-dimensional space **simultaneously**, including the inner structure of solid objects and things obscured from our three-dimensional viewpoint" (see [below](#)).

Notice that every "fish" should be enabled to choose its [quasi-local "geodesic"](#) *relationally*, upon updating and refreshing its "Einstein field equation" at every **next** point from its quasi-local "geodesic", in line with [Weyl's Principle](#). Notice that 'relationally' refers to the [Heraclitean \(non-Archimedean\) time](#) (called here 'global mode of spacetime').

Also, the quantum hedgehog should *somehow* (sorry, I'm totally speechless here) resolve the main puzzles of (i) [finite things in space](#) and (ii) the "boundaries" of 3-D space with a new version of [Finite Infinity](#). The assumptions here are that, depending on the "direction" we look at the *global mode* of spacetime, it will show up as either 'tending asymptotically toward zero' or 'tending asymptotically toward infinity', while a global ([omnipresent](#)) observer would "see" the whole 3-D space (local mode) simultaneously, *en bloc*. Namely, the *duration* of the glancing at 'the whole school of fish' (the whole 3-D space) will be **zero**, as recorded with our wristwatch, because the luxon-like dynamics of the two "waves" (cf. [above](#)) does not feel any physical time. It's *atemporal*. Locally, our global time is **zero**, and the re-created ([AOS](#)) local mode of spacetime is a *perfect* continuum. Hence all effects from the global mode are inevitably [holistic](#) ("dark", after [M. Turner](#)).

Last but not least, the ultimate puzzle of the [kinematics of space](#) concerns the origin of the so-called "speed" of light: in the [local mode](#) of space, the "points" (quantum hedgehogs) of the underlying manifold are **chained** in such a way that (i) there is *nothing* between them, (ii) there is an upper limit on the speed of passing physical stuff 'from one point to the neighboring one', and (iii) there is a whole [mirror world](#) ([Yakov Terletsii](#)) on 'the other side' of this "speed" limit.

That's all for now. I have [five years](#) to clarify my hedgehog *Ansatz* (and "[bridge](#)"), to the extent it would become fully comprehensible. It is not an easy task to eliminate the self-referentiality ([Kevin Brown](#)) of the metric "field" and expose the genuine dynamics of GR. The textbook rule 'partial derivatives go to covariant derivatives' ([Wiki](#)) looks to me like the [Born Rule](#). People believe that the Christoffel connection can somehow "disappear", yet the [higher-order](#) derivatives never actually "disappear" [[Ref. 4](#)]. [Pseudo-tensors](#) work fine FAPP, although they shouldn't, because nobody knows

'the right answer to [the right question](#)' (MTW, [p. 467](#)). The metaphysical speculations about what happens in the "[sufficiently small](#)" (e.g., [Weinberg](#)) are [incredibly confusing](#). Something went wrong in 1915. Just look at the "[quantum horizons](#)" from [Ashtekar and Krishnan](#).

Perhaps the inherent nonlinearity in the geodesic equation ([Wiki](#)) points to a new, [relational dynamics](#) of GR: the *additional* input from '[the whole school of fish](#)' ([Newton's third law](#) is necessarily violated) is being [smuggled](#) via the non-linear mechanism of "more gravity" [[Ref. 5](#)]. Such "global" input will be inevitably "dark", because we cannot trace back its [holistic source](#) by zooming on any quasi-local "fish" at  $\mathbf{p}$ .

This "[smuggling](#)" can be explained by recalling that neither the coordinate time  $\mathbf{t}$  nor the proper time  $\mathbf{\tau}$  ([Wiki](#)) along spacetime trajectories can be used as an independent variable, as  $\mathbf{\tau}$  is a "complicated non-local function of the gravitational field itself. Therefore, properly speaking, GR does not admit a description as a system evolving in terms of an observable time variable. (...) In the quantum context a single solution of the dynamical equation is like a single "trajectory" of a quantum particle" ([C. Rovelli](#)). Luckily, given '[the quantum principle](#)' and the so-called [PR<sup>2</sup> interpretation of QM](#), one can design such 'single *quasi-local* trajectory of a single *quasi-local* quantum particle', in which the *holistic input* from '[the school of fish](#)' is smuggled into the infinitesimal point  $\mathbf{p}$  from the *quasi-local* trajectory of the quantum-gravitational "[fish](#)".

To be precise, at point  $\mathbf{p}_n$  the *holistic input* from '[the school of fish](#)' is wiped out **completely**, by "cancellation of energy and energy flux of the real gravitational field with the energy and energy flux of the inertial forces field" ([Janusz Garecki](#)); hence the "ether" (global mode of spacetime) cannot show up ([M. Montesinos](#)). In the fleeting linearized "snapshot" at  $\mathbf{p}_n$  (local mode), the total energy of the gravitational field is always **zero**, the Einstein tensor and the energy-momentum tensor [vanish identically](#), and all "dark" stuff has been linearized and *physicalized*. The same re-cancellation occurs at the *next* point  $\mathbf{p}_{n+1}$  along the [Arrow of Space](#), but because these seemingly "neighboring" points belong to two *different* universes from the "flattened" local mode of spacetime (cf. [Fig. 1 above](#)), their fleeting *physical* content is **different**, while the *holistic origin* of this difference is "dark". Hence no "[fish](#)" can register any "deviation" (with respect to *what?*) during its re-created *quasi-local* geodesic: its "[geodesic equation](#)" has been updated [dynamically](#), at each and every *next* point  $\mathbf{p}_{n+1}$  -- a genuine Phoenix Universe ([Georges Lemaître, 1933](#)). In the terminology of Karel Kuchar, this infinitesimal shift is mediated by the Perennial, which governs the dynamics "from outside as an [unmoved mover](#)". Notice that "all time  $\mathbf{\tau}$  is eternally present" ([K. Kuchar](#)), [as it should be](#).

In general, if we agree that gravitational energy should be defined over **finite** volumes of space (e.g., [B. Schutz](#)), the first off *mathematical* task is to resolve the main puzzles of '[finite things](#)' in space wrapped by its own "boundaries" at [Finite Infinity](#) (details [above](#)). This is what produces 3-D space *per se*, such that (operational definition) we can discriminate between 'inside vs. outside' and 'left vs. right'. These fundamental qualities of space are being wrongly treated as [rigid background](#) since 1915. If we introduce an [Arrow of Space](#), perhaps we can recover the dynamics of GR: **global** time can only emerge from [dynamical space](#).

Hence the idea about a null-surface formulation of '[emergent spacetime](#)' along the [Arrow of Space](#), in line with the so-called [biocausality](#).



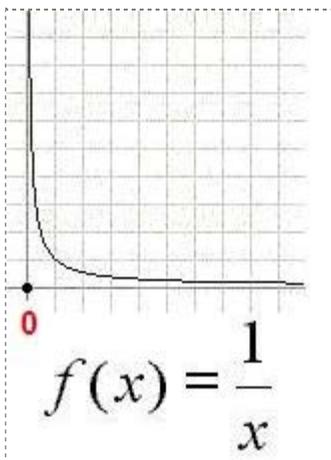
The latter is defined with respect to the *reference fluid* in GR [[Ref. 6](#), pp. 31-33]: it is the 'absolute structure' ([James Anderson](#)) of 'the universe as ONE' ([global mode](#) of spacetime), which bootstraps all quasi-local quantum-gravitational "fish" into a [school of fish](#). Notice that the "chooser" ([P. Pearle](#)) of every *next* state of a given "fish", along its quasi-local geodesic, is the bootstrapping mechanism of '[the whole shoal](#)'.

As I said [above](#), I don't like miracles, like "decoherence" and "ideal Schrödinger time" [Ref. 7]. The calculations in QM and QFT explicitly *presuppose* a perfect clock endowing the whole universe with some "global and absolute time" ([A. Macias and H. Quevedo](#)), but no *physical stuff* can **reproduce** it. It is an *acute miracle*, especially in GR. Physicists love to ponder on some Cauchy surface [Ref. 8], but it is a [smooth differentiable miracle](#) that cannot be assembled exclusively by *physical stuff* either (cf. Paul Tod's [video lecture](#)). Mathematicians used [pure math and intuition](#) to "assemble" these smooth differentiable miracles, then the founding fathers of GR ([Levi-Civita](#), [Einstein](#), and Hilbert) agreed upon introducing Lorentzian signature *by hand*, and banned these 'absolute structures' and [Perennials](#).

That's what went wrong in 1915. We need [new ideas](#) about [the origin of space](#). If you look carefully at the [Finite Infinity](#) and the [pre-geometric plenum](#), you will realize that these are *the only possible* solutions for 3-D space to be wrapped *by itself*, and to produce a *perfect* continuum (see [above](#)): in the latter case, 'the universe as ONE' is being [multiplied](#) as infinitely many ([uncountably infinite](#)) infinitesimal "points" **chained** in the local (physical) mode of spacetime by 'the whole universe as ONE' ... which is in turn **non-existent** there!

This is the *pre-geometric* plenum made by the so-called Aristotelian Connection; all geometrical "points" from 'the grin of the cat without the cat' ([Alice](#)) are connected *by themselves* (local mode) -- one-connection-at-a-time along [AOS](#). No other option for self-wrapping of space and self-connecting of points seems possible.

To explain the claim in the preceding sentence, let me elaborate a bit more on the *self-wrapping* of 3-D space with the drawing below, bearing in mind the equation  $LS = 1$  [here](#). The meaning of *finite things* (elephant's trunk for '[space](#)') is denoted with the unique number **1**, which can be seen [above](#) as well. Notice the interplay of Archimedean and [non-Archimedean geometry](#), which is missing in diff geometry textbooks (e.g., Chris Isham's one [here](#)) and in [present-day GR](#).



Once the size of *the* infinitesimal (**S**) reaches the non-Archimedean realm of [geometry](#), it becomes a geometrical point **p** (from [Planck scale](#)), with "size" running asymptotically toward **0**, while the "size" of **L** is running asymptotically toward infinity, along the vertical axis. The *global* mode of spacetime refers to 'the whole universe as ONE' ([Lucretius](#)). The latter is **totally missing** in the local mode due to the "speed" of [light](#), hence the physical space of 'finite things' becomes a *perfect* continuum: all points **p** are *entangled* and self-connected **by** their '[common cause](#)' of ONE (global mode), and by virtue of  $LS = 1$ .  
No other option seems possible.

The drawing above can also explain the idea of [dual cosmological age](#): finite in the global mode, and infinite/indecisive in the local mode, as the [deflation time](#) can never actually reach The Beginning at **0**; details in [pp. 35-36](#). As to the postulated [Equation of Space](#), picture yourself riding *the* infinitesimal toward **0**: from the viewpoint of the *global* mode, one could imagine an "accelerated" shrinking stage by approaching "zero" size/The Beginning, but in the local mode such "accelerated" stage is an **illusion**. Likewise in the case of time-and-space-reversed "direction"; see the original full drawing [here](#): people believe that space is "[expanding](#)", but it actually *isn't*, because it would take an infinite cosmological time (local mode) to actually reach '*the maximum large space*', denoted with **L**.

There is no "accelerated" stage ([Emil Mottola](#)) in "shrinking" or "expanding" the volume of space by approaching asymptotically **S** or **L**. The confusion with the old (since 1930s) cosmological "constant" problem is due to the *shape of space* **near** the two "boundaries" defined with [Finite Infinity](#), and on the unwarranted assumption that the "dark energy" is due to some [[we-do-not-know-it](#)] with *positive* mass density (an '[elephant in a china shop](#)'), so it enters the current equations in GR: "a negative pressure can **overcome** a positive energy density" ([ibid.](#)). Alternatively, check out Eqs 1 and 2 in [ExplanatoryNote.pdf](#), pp. 35-36.

(The very [cracks](#), through which the *physicalized* (=converted into positive, cf. Eq. 1, [p. 35](#)) vacuum energy [gets smuggled](#) into the local mode of spacetime, vary in a wide interval, from producing "6 × 10<sup>-10</sup> joules per cubic meter" ([John Baez](#)) to an equivalent in energy to 5 (five) solar masses emitted in under 60 seconds in the form of [X-rays and gamma rays](#); all this "[dark energy](#)" comes from the "[ether](#)", ranging from an *almost* vanished [flux](#) to "10<sup>54</sup> ergs/pulse" in [GRBs](#).)

The 'physical size of lengths in 3-D space' (the [scale factor](#)) would have to actually [expand](#) if we were limited to [Archimedean geometry](#) only. Were that the case, one could eventually picture some conformal recipe for reaching infinity by "rescaling the metric", as envisaged by [R. Penrose](#).

Regarding the "size" of '*the* maximum large space', **L**, in the proposed version of [Finite Infinity](#): look at the slope in the *current* "accelerated" stage from [NASA](#), and map it to a reversed/inverted drawing (cf. the full original drawing [here](#)): can you extend the curve (not shown above) to reach an "accelerated" stage of approaching asymptotically infinite space? This will be the ultimate "cosmological horizon" for gravity. Because gravity cannot operate in infinite space, **L** should possess a numerically finite but *physically* unattainable value, perhaps in a manner resembling the "speed" of light for [bradyons](#).

Finally, notice the [Gedankenexperiment](#) with an observer witnessing a "shrinking" *bzw.* "expanding" table with length two meters, starting from the macro-world. However, "It is very hard to imagine what new physics would introduce a cutoff on a scale of the order of 0.01cm" (L.H. Ford, [gr-qc/0504096v2](#), p. 6). I am only suggesting that the dual notions of 'small running toward **S**' and 'large running toward **L**' are **relative** to the length scale of tables and chairs. Namely, a [companion observer](#) watching the "changing size" of physical objects will not notice any difference whatsoever: her table stretched to the size of a galaxy, and her table shrunk to the size of an atom, will always keep its "size" of 'two meters' (or "0.01cm", L.H. Ford). This is an effort to revive the old idea of 'mutual penetration of the Large and the Small', but it will take a lot of work to identify the new symmetry operations for 3-D space, starting from the macro-world, along some reversible time-and-space "direction" toward **S** and **L**.

I intend to elaborate on the time-and-space reversed "direction" (inverted space with its CPT symmetries, like inverting a rubber glove inside out) and the VGP formulation of GR on [25.11.2015](#). The full original drawing [here](#) offers some hints for interpreting the possible forms of 'mass' ([Yakov Terletsjii](#)) and the *adiabatic* separation of positive and negative mass [[Ref. 9](#)], but much more work is needed to clarify the [whole bundle of issues](#) and the interpretation of "[torsion effects](#)".

As it happens [very often](#), I'll probably admit in November 2015 that what I wrote today, 15.11.2010, was very confusing. Sorry, I'm just a [psychologist](#) and my efforts are stereotyped as "[just another crank](#)". Well, [you be the judge](#).

Maybe there are indeed [wrong ideas](#) at my web site, but recall Christopher Columbus: If we don't leave for India, how can we discover America? 😊

D.C.

October 11, 2010

Last update: November 15, 2010

Monday, November 15th, 2010  
Your Local Time: 49 minutes past 2 P.M.  
Your Global Time is [ZERO](#)

[Ref. 1] [http://en.wikipedia.org/wiki/Scalar\\_curvature](http://en.wikipedia.org/wiki/Scalar_curvature)

"To each [point](#) on a Riemannian manifold, it assigns a single real number determined by the intrinsic geometry of the manifold [near](#) that point."

[http://en.wikipedia.org/wiki/Sectional\\_curvature](http://en.wikipedia.org/wiki/Sectional_curvature)

"In Riemannian geometry, the sectional curvature is one of the ways to describe the curvature of Riemannian manifolds. The sectional curvature  $K(\sigma)$  depends on a two-dimensional plane  $\sigma$  in the

tangent space at  $p$ ."

Notice the [infinitesimal instant](#)  $P$  from Leibniz, which allows us "to construct tensors by differentiation" ([A. Einstein](#)):

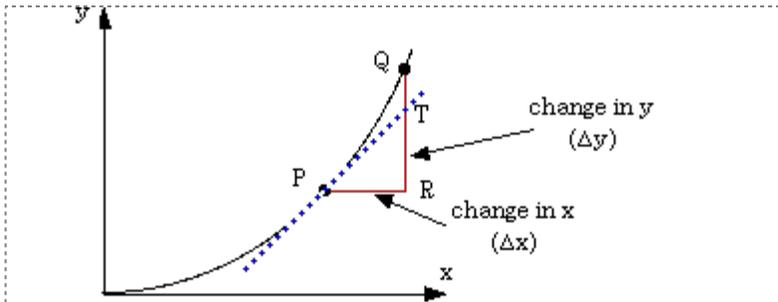


Figure 16: The blue (dotted) line is the tangent at  $P$ . Leibniz called the triangle  $PRT$  the *characteristic triangle*. He determined the ratio  $RT/PR$ . He put  $PR = dx$  and  $RT = dy$  so he found  $dy/dx$ .

"These are the laws of an instant in canonical gravity. (...) In general relativity (notice Einstein's opinion [here](#) - D.C.), dynamics is entirely generated by constraints. The dynamical data do not explicitly include a time variable," says [Karel Kuchar](#). Which is why the [global](#) time from the "[expansion](#)" of space is "dark" in current GR. In the forthcoming [VGP formulation of GR](#), the "constraints" are produced by '[the shoal of fish](#)' and are similar to the [10, 20] condition for *emergent* quasi-local geodesics (cf. [below](#)). Thus, the corrected QM and GR are united at the 'base manifold' of [emergent continuum](#).

[http://en.wikipedia.org/wiki/Positive\\_mass\\_theorem](http://en.wikipedia.org/wiki/Positive_mass_theorem)

"In general relativity, the [positive energy theorem](#) (more commonly known as the positive mass theorem in differential geometry) states that, assuming the [dominant energy condition](#), the mass of an asymptotically flat spacetime is non-negative; furthermore, the **mass is zero** only for Minkowski spacetime.'

See also: Hans Ohanian, The Energy-Momentum Tensor in General Relativity and in Alternative Theories of Gravitation, and the Gravitational vs. Inertial Mass, arXiv:1010.5557v1 [gr-qc], <http://arxiv.org/abs/1010.5557>; pp. 2-4 and endnote 7, p. 32.

[Ref. 2] A. Spallicci, Free fall and self-force: an historical perspective, arXiv:1005.0611v1, <http://arxiv.org/abs/1005.0611>

Footnote 5, pp. 5-6: "Locality, for which the metric tensor  $g_{mn}$  reduces to the Minkowski metric and the first derivatives of the metric tensor are zero, is limited by the non-vanishing of the Riemann curvature tensor, as in general certain combinations of the **second** derivatives of  $g_{mn}$  cannot be removed. Pragmatically, it may be concluded that violating effects on the EP may be negligible in a [sufficiently small](#) spacetime region, close to a given event.

.....  
"the Apollo 15 display of the simultaneous fall of a feather and a hammer [4].  
.....

Footnote 24, p. 21: "It is sometimes stated that the interaction of the particle with its own gravitational field gives rise to the [self-force](#). It should be added, though, that such interaction is due to an external factor (...). In other words, a single and unique mass in an otherwise empty universe cannot experience any self-force. Conceptually, the self-force is thus a manifestation of non-locality in the sense of [Mach's inertia](#) [135]."

[Ref. 3] [R. Aldrovandi](#) and [J. G. Pereira](#), *An Introduction to Geometrical Physics*, World Scientific, 1995, pp. [636-637](#)

In the light of the geometric vision acquired by all our previous discussion, we can indulge in some instructive reflection. As repeatedly stated, there is no "curvature of space". Curvature is a property of a connection, and a great many connections may be defined on the same space. Take an electron on a Riemannian spacetime. It responds to the action of the Levi-Civita connection given by the Riemannian metric. Now add an electromagnetic field. The electron will now answer to the appeal of two connections, the previous one and the electromagnetic potential. Add further a neutrino: it will feel (probably) the Levi-Civita connection, but not the electromagnetic potential. As long as it stays far from the electron, there will be no manifestation of the weak-force connection. Thus, different particles feel different connections, different curvatures, and will consequently show distinctly curved trajectories to our euclidean eyes.

[Ref. 4] D. Ivanenko and G. Sardanashvily, The gauge treatment of gravity, *Physics Reports* 94 (1983) 1-45; [p. 4](#).

[Ref. 5] R. J. Adler, Six easy roads to the Planck scale, arXiv:1001.1205v1 [gr-qc], <http://arxiv.org/abs/1001.1205>

p. 14: "In general relativity the problem of gravitational field energy is notoriously more subtle and complex. This is due to the nonlinearity of the field equations, which in turn is related to the fact that gravity carries energy and is thus a source of more gravity (emphasis mine - D.C.). In this sense gravity differs fundamentally from the electric field, which does not carry charge and thus is not the source of more electric field.

....

p. 17: "At present it is certainly not clear what might replace our present concept of spacetime at the Planck scale."

[Ref. 6] K. Kuchar, Time and interpretations of quantum gravity, in: Proceedings of the 4th Canadian conference on general relativity and relativistic astrophysics, ed. by G. Kunstatter, D. Vincent, and J. Williams, World Scientific, 1992. <http://www.phys.lsu.edu/faculty/pullin/kvk.pdf>

[Ref. 7] Jorge Pullin *et al.*, A realist interpretation of quantum mechanics based on undecidability due to gravity, [arXiv:1010.4188v1 \[quant-ph\]](#)

p. 2: "Here we denote by  $t$  the ideal classical time that appears in the ordinary Schrödinger equation. (...) (I)f one make some judicious assumptions, namely, that the clock does not interact with the system, that the clock is in a highly classical state (a coherent state where the "hand" of the clock is sharply peaked in space and moves in a monotonous way), ... .

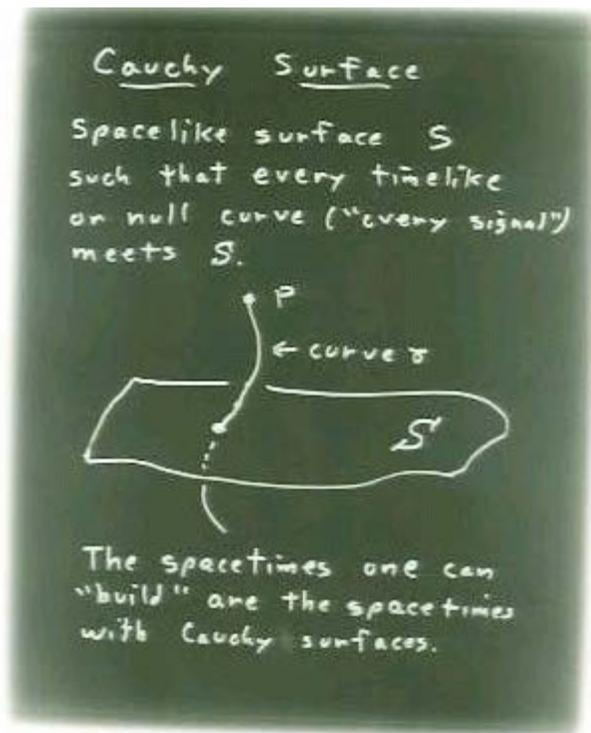
....

p. 3: "If one assumes one has a clock that follows the ideal Schrödinger time perfectly, ... .

....

p. 6: "The problem of macro-objectification of properties may be described according with Ghirardi [11] as follows: "how, when, and under what conditions do definite macroscopic properties emerge (in accordance with our daily experience) for systems that, when all is said and done, we have no good reasons for thinking they are fundamentally different from the micro-systems of which they are composed?"

[Ref. 8] R. Geroch, [Computation and Physics](#), 12.03.2008



[Ref. 9] D. Pollard, J. Dunning-Davies, A consideration of the possibility of negative mass, *Nuovo Cimento* 110B (1995) 857-864  
<http://www.springerlink.com/content/g089874117p17771/>

G. Cavalleri, E. Tonni, Negative masses, even if isolated, imply [self-acceleration](#), hence a catastrophic world, *Nuovo Cimento* 112B (1997) 897-904  
<http://prometeo.sif.it/papers/?pid=ncb6372>

[Banesh Hoffmann](#) (1964), Negative Mass as a Gravitational Source of Energy in the Quasistellar Radio Sources, in: Thomas Valone *et al.*, *Electrogravitics Systems*, Integrity Research Institute, 2001, pp. 92-96.

=====  
Subject: Request for opinion  
Date: Fri, 5 Nov 2010 22:27:24 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Stephen Crothers <thenarmis@gmail.com>  
Cc: Thomas.Mueller@vis.uni-stuttgart.de,  
Frank.Grave@vis.uni-stuttgart.de,  
Hans C Ohanian <hohanian@einsteinmistakes.com>

Dear Steve,

May I ask for your comment on the apparent discrepancy in treating "[the conservation equation](#)" (cf. [conservation.jpg](#) attached) in

Thomas Mueller, Frank Grave, Catalogue of Spacetimes, arXiv:0904.4184v3 [gr-qc]  
<http://arxiv.org/abs/0904.4184v3>

and in

Hans C. Ohanian, arXiv:1010.5557v1 [gr-qc],  
<http://arxiv.org/abs/1010.5557>

Please see [non\\_conservation.jpg](#) attached, from p. 3.

Q: How would you design a "geodesic" if the conditions for "conservation law" ([non\\_conservation.jpg](#)) are not fulfilled? I am referring here to the so-called "[dark energy](#)", which could spring from the [l.h.s. of Einstein field equation](#).

Thank you for your time and consideration.

I will appreciate the professional opinion of your colleagues as well.

All the best,

Dimi

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**Note:** In order to pinpoint the "cracks" from 'the self-force' ([A. Spallicci](#)), through which the holistic ("dark") energy of '[the shoal of fish](#)' gets **smuggled** into the *quasi-local* points of the *emergent* geodesic, check out S. Weinberg, [p. 68](#) (links and emphasis added):

"Although inertial forces do not exactly cancel gravitational forces for freely falling systems in an inhomogeneous or [time-dependent gravitational field](#), we can still expect an approximate cancellation if we restrict our attention to such a [small region](#) of space and time that the field changes very little over the region."

I will address (1) the localization of gravitational energy and (2) the notion of 'isolated system'.

1. See A. Abbassi and S. Mirshekari, [arXiv:0908.0286v1 \[gr-qc\]](#), p. 2; excerpts from their ref. [10] can be read [above](#).

In fact, the problem arises when we want to extend special relativity to GR. In special relativity and even in classical mechanics we can show the differential form of energy-momentum conservation law by

$$T_{\mu,\nu}^{\nu} = 0, \quad (1)$$

where  $T_{\mu}^{\nu}$  is the symmetric energy-momentum tensor which refers to the local flux and density of energy and momentum related to matter and all non-gravitational fields such as electromagnetic field. But, in GR, by using the Bianchi's identities ( $G_{\mu\nu}^{\nu}$ ) in field equations ( $G_{\mu}^{\nu} = 8\pi T_{\mu}^{\nu}$ ) we obtain [10]

$$T_{\mu;\nu}^{\nu} = \frac{1}{\sqrt{-g}}(\sqrt{-g}T_{\mu}^{\nu})_{;\nu} - \Gamma_{\mu\lambda}^{\nu}T_{\nu}^{\lambda} = 0, \quad (2)$$

where  $\Gamma_{\nu\sigma}^{\sigma}$  are the connection coefficients. This means that in GR energy-momentum tensor can not satisfy the conservation law ( $T_{\mu,\nu}^{\nu} \neq 0$ ). Thus, we should look forward for an alternative quantity which its ordinary derivative is zero in each point of manifold, and therefore can be localized.

I'm afraid the task for "alternative quantity" in the last sentence is not feasible with [tensors](#) ([R. Penrose](#)), and because I don't accept parapsychology in terms of "[pseudo tensors](#)", the only way out seems to develop a [VGP formulation of GR](#) for [Machian universe](#) (there isn't such animal as "vacuum equation",  $\text{Ric}(g) = 0$ ), cf. [[Ref. 1](#)]) to define energy and angular momentum ([A. Helfer](#)) as *quasi-local* variables, in a way resembling a [school of fish](#).

2. See my comments to Bjoern Schmekel [here](#). In order to fix energy densities at a "point", we need 'the whole spacetime' to be [self-wrapped](#) with "boundaries" along spacelike and null directions. It's a package. We also need some *linearized* and *flattening* "collapse", as I argued [here](#); crucial details [here](#), [here](#), and [here](#).

If you're interested, please read the text by following the links, and email me with your questions. Anything you weren't able to understand will be *entirely* my fault.

The most difficult puzzle to me is that our wristwatches are '[canonical clocks](#)' that are **at rest** with respect to [[we-do-not-know-it](#)], and read our common '[cosmological time](#)', so we have [miracles in GR](#). Related to this puzzle is the long standing issue with the energy in the vacuum: it has an additional and unique freedom to stay in some "[latent state](#)", such that it may not contribute to "curvature", hence people can afford to look for 'energy differences' only (cf. John Baez' online paper [here](#)). If you measure the temperature of your bath tube, and find out that it is '*slightly* above 37C', you can ignore such minuscule temperature increase (and publish your paper in *Nature*), but in our case we have two infinitely large and powerful sources of "[cold and hot water](#)", which cancel out their input *almost* exactly, to produce a minuscule observable increase '*slightly* above 37C'. And this "*slightly* above" is manifestation of '[the ether](#)'.

The usual renorm recipes won't work, because we cannot pinpoint some [latent](#) yet "[carefully defined limit for the continuum of values](#)" kept in the vacuum. The same vacuum can empower, in different circumstances, the most violent energy release we've seen, such as an equivalent in energy to 5 solar masses emitted in under 60 seconds in the form of [X-rays and gamma rays](#).

In other words, the "cracks" left for the holistic ("dark") energy of '[the shoal of fish](#)' (see above) are incredibly *flexible* -- an upper limit, if any, on these "cracks" is totally unclear (cf. Eq. 1 on p. 35 from [ExplanatoryNote.pdf](#)).

All this unfolds from the textbook interpretation of those 'twice contracted Bianchi identities', as stressed by [Hans Ohanian](#). Aren't you interested? Please feel free to disagree, and explain why.

But if you trust [Chris Isham](#) -- don't bother to reply. Follow 'comma to semicolon rule', [whenever possible](#), and be happy with the available "[boundary conditions](#)" and "[geodesic hypothesis](#)".

D. Chakalov

November 8, 2010

Last update: November 11, 2010

[Ref. 1] Stephen Crothers, email communication, Thu, 11 Nov 2010 13:56:23 +1100.

Special Relativity must manifest in sufficiently small regions of his gravitational field and that these regions can be located anywhere in his gravitational field.

$Ric = 0$  describes a universe that contains no matter, by construction. But if that is so then there is no matter present to cause the gravitational field, bearing in mind that the field equations are also claimed to couple the gravitational field to its sources. One cannot remove matter by setting  $Ric = 0$  (i.e.  $T_{\mu\nu} = 0$ ) and then insert a mass, post hoc, by means of Newtonian two-body relations, into the resulting metric in order to introduce a cause of the alleged gravitational field "outside the body".

General Relativity is a non-linear theory and so the Principle of Superposition does not apply. Consequently one cannot simply add masses to a given solution to the field equations. Every different configuration of matter requires a corresponding set of field equations to be solved. There are no known solutions to Einstein's field equations for two or more masses and no existence theorem by which it can even be asserted that the field equations contain latent solutions for multiple masses.

Furthermore, point-mass singularities occur in Newtonian theory – they are called centres of mass. The centre of mass of a body is a mathematical artifice, not a physical object. One can go to a shop and buy a bag of marbles but one cannot go and buy a bag of centres of mass of those very same marbles.

According to the astrophysical scientists it takes an infinite amount of time for an observer to detect an event horizon. But nobody has been and nobody will ever be around for an infinite amount of time in order to confirm the presence of an event horizon. Consequently the concept has no validity in science. In addition, the aforementioned observer cannot be present in a spacetime that by construction contains no matter, assuming that observers are material. I do not see how an observer

can be anything other than material.

Concerning Einstein gravitational waves, none have been detected. This is also not surprising because the search for such waves is destined to detect none. Since  $Ric = 0$  violates the physical principles of General Relativity Einstein's field equations form an identity with **zero** so that the total energy of the gravitational field is **always zero**; so that the Einstein tensor and the energy-momentum tensor must vanish **identically**; so that the localisation of gravitational energy is impossible; and so that the field equations violate the usual conservation of energy and momentum so well established by experiment. I wrote a paper on this which contains no mathematics:

[www.sjcrothers.plasmareources.com/GW.pdf](http://www.sjcrothers.plasmareources.com/GW.pdf)

That an erroneous theory can seemingly account for various observed phenomena is not new to science. The Ptolemaic system of epicycles accounted for various celestial phenomena but is nonetheless an erroneous theory.

.....

I now give you a simple recipe to prove me wrong. Prove that matter can be present in a spacetime that by construction contains no matter, prove that Einstein's pseudo-tensor is not a meaningless concoction of mathematical symbols, and prove that  $r$  in Hilbert's metric is not the inverse square root of the Gaussian curvature of the spherically symmetric geodesic surface in the spatial section of the Hilbert manifold.

All of my papers on aspects of General Relativity are on my webpage:

[www.sjcrothers.plasmareources.com/papers.html](http://www.sjcrothers.plasmareources.com/papers.html)

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Subject: Re: Request for opinion

Date: Fri, 12 Nov 2010 15:38:17 +0200

Message-ID:

<AANLkTinQ-uHaOMDG9NR=S3xP0zG6MNVtSh+=A4zc=Qrm@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Stephen Crothers <thenarmis@gmail.com>

To: Merced Montesinos Velásquez <merced@fis.cinvestav.mx> ,

Laszlo Szabados <lbszab@rmki.kfki.hu> ,

Alan Rendall <rendall@aei.mpg.de> ,

Sergiu Klainerman <seri@math.princeton.edu> ,

Luca Bombelli <bombelli@olemiss.edu> ,

Jim Isenberg <isenberg@uoregon.edu> ,

Chris Isham <c.isham@imperial.ac.uk>

Dear Steve,

Thank you for your reply from Fri, 12 Nov 2010 13:55:44 +1100.

My request for opinion was:

<http://www.god-does-not-play-dice.net/#Bianchi>

"Q: How would you design a "geodesic" if the conditions for "conservation law" (non\_conservation.jpg) are not fulfilled? I am referring here to the so-called "dark energy", which could spring from the l.h.s. of Einstein field equation."

> Whether one considers Einstein's covariant derivative on  $T_{uv}$  as a  
> conservation of energy law or as an energy transfer law seems to me  
> to be a matter of semantics and of no great importance. In any event  
> it is my view that  $Ric = 0$  is inadmissible and so the Einstein field  
> equations violate the usual conservation of energy so well established

- > by experiment. The total energy of Einstein's gravitational field is always
- > zero and this is [disastrous](#).

I am unable to relate your opinion to the question above. One obvious answer would be 'one cannot design such "geodesic" under these conditions', because, as M. Montesinos stressed in [arXiv:gr-qc/0311001v1, pp. 4-5](#):

"More precisely,  $T_{\mu\nu} = 0$  tells us that the 'reaction' of the dynamical background metric is such that it just cancels the effect of 'flux' associated with the matter fields. It is impossible (and makes no sense) to have a locally non-vanishing 'flux' in this situation. If this were the case, there would be no explanation for the origin of that non-vanishing 'flux' (it will look "[dark](#)" - D.). Moreover, that hypothetic non-vanishing 'flux' would define privileged observers associated with it (the ether would come back!)."

I believe we all agree to keep the metric [dynamical](#): it should keep playing its double role in the sense that it is both a field variable and defines the geometry \*at the same time\* (L. Szabados, private communication).

Then my approach to incorporating "dark" energy in GR is two-fold. On the one hand, keep the 'flux' vanishing up to [10<sup>-122</sup>](#), that is, "the 'content' of energy and momentum densities and stress associated with the matter fields [ $\psi$ ] (which is characterized in  $T_{\mu\nu}$ ) and the 'content' of energy and momentum densities and stress associated with the gravitational field [XXX]" ([M. Montesinos](#)) should cancel each other \*almost\* exactly.

On the other hand, introduce a (brand new?) dynamics of this \*almost exact\* cancellation by two kinds of time (global mode and local mode) pertaining to \*two standing gravitational waves\*, such that we have \*at the same time\* (L. Szabados) an almost exact cancellation à la [John Cramer](#),

<http://www.god-does-not-play-dice.net/#Evans>

To be precise: the hypothetical 'two standing gravitational waves' pertain to the global mode of spacetime, and their perpetual cancellation re-creates the instants (plural) at which the negotiations b/w the two sides of Einstein equation ("space acts on matter, telling it how to move; in turn, matter reacts back on space, telling it how to curve", John Wheeler) are completed -- one-negotiation-at-a-time, along an Arrow of Space,

[http://www.god-does-not-play-dice.net/#Zinkernagel\\_note](http://www.god-does-not-play-dice.net/#Zinkernagel_note)

That's the "crack" through which the vacuum energy gets smuggled into GR. Details at

[http://www.god-does-not-play-dice.net/#Hehl\\_note](http://www.god-does-not-play-dice.net/#Hehl_note)

Please notice that the total energy of Einstein's gravitational field is tending asymptotically toward zero at each and every instant of \*completed\* negotiation, which is why people can introduce initially wrong assumptions (e.g., "vacuum equation" with  $Ric = 0$  and linearized approximation of GR, to name but a few), although all these assumptions sound like the [Born Rule in QM](#).

The whole '[geodesic hypothesis](#)' looks clear only to [undergraduates](#) -- check out A. Rendall's Irr-2005-6, [9.6 The geodesic hypothesis](#).

But of course you may have quite a different approach toward designing a "geodesic" under the conditions spelled out above. A penny for your thoughts!

I extend this request to your colleagues as well.

All the best,

Dimi

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**Note:** My efforts are too specific and may not attract the attention of experts in GR, so let me briefly explain why we need quantum gravity to understand GR. I will reproduce excerpts from the text

offered by R. Aldrovandi and J. G. Pereira,

An Introduction to GENERAL RELATIVITY, March-April/2004,  
<http://www.ift.unesp.br/gcg/igr.pdf>

1. A real observer (§3.11) is not 'point-like', and therefore we need a quantum version of the strong equivalence principle (R. Aldrovandi, J. G. Pereira, K. H. Vu, Gravity and the Quantum: Are they Reconcilable? [gr-qc/0509051 v1](#)). This is a big can of worms -- check out the macro-objectification problem from GianCarlo Ghirardi, ref. [11] [above](#). The solution proposed here is *quasi-local* emergent geodesic, resembling the trajectory of a [fish](#) -- it gets its [nonlocal](#) gravitational corrections and contributions from 'the whole school of fish', and follows *locally* a trajectory comprised of "points" -- one-*correction*-at-a-point along [AOS](#). It makes no sense of talking about "curvature" (§3.81), because an [ideal observer](#) (§3.11) doesn't have [Akasha-like memory](#) to "recall" its experience without such corrections and contributions from gravity. The quantum-gravitational "[fish](#)" is a [contextual](#) and [Machian-like](#) *relational* entity, hence it must never be "free from external forces" (§3.11).

2. You need ([I don't](#)) a **constant** gravitational field to make sense of "coordinate time" (cf. §3.36) and "finite distances in space" (§3.42), pertinent to "[the scale factor  \$R\(t\)\$](#) ", as defined [above](#), with cosmological "constant" set to **zero**.

If, however, we have "[time-dependent gravitational field](#)", we can still expect an [approximate](#) cancellation if we restrict our attention to such a [small region](#) of space and time that the field changes [very little](#) over the region", says [Steven Weinberg](#). There is too much poetry in this excerpt, as well as in other crucial ideas explained [here](#).

The solution to the two tasks above is utterly needed. Do it, and if you come up with ideas different than those proposed here, I will consider my work redundant, hence wrong.

Good luck.

D. Chakalov

November 13, 2010

Last update: November 15, 2010

§ 3.11 As we have said, curves are of fundamental importance. They not only allow testing many properties of a given space. In spacetime, every (ideal) observer is ultimately a time-like curve.

The nub of the equivalence principle is the concept of observer:

An observer is a timelike curve on spacetime, a world-line.

Such a curve represents a point-like object in 3-space, evolving in the time-like 4-th “direction”. An object extended in 3-space would be necessarily represented by a bunch of world-lines, one for each one of its points. This mesh of curves will be necessary if, for example, the observer wishes to do some experiment. For the time being, let us take the simplifying assumption above, and consider only one world-line. This is an ideal, point-like observer. If free from external forces, this line will be a geodesic.

And here comes the crucial point. Given a geodesic  $\gamma$  going through a point  $P$  ( $\gamma(0) = P$ ), there is always a very special system of coordinates (Riemannian normal coordinates) in a neighborhood  $U$  of  $P$  in which the components of the Levi-Civita connection vanish at  $P$ . The geodesic is, in this system, a straight line:  $y^a = c^a s$ . This means that, as long as  $\gamma$  traverses  $U$ , the observer will not feel gravitation: the geodesic equation reduces to the forceless equation  $\frac{dw^a}{ds} = \frac{d^2 y^a}{ds^2} = 0$ . This is an inertial observer in the absence of external forces. If  $\Gamma = 0$ , covariant derivatives reduce to usual derivatives. If external forces are present, they will have the same expressions they have

§ 3.13 How point-like is a real observer? We are used to say that an observer can always know whether he/she is accelerated or not, by making experiments with accelerometers and gyroscopes. The point is that all such apparatuses are extended objects. We shall see later that a gravitational field is actually represented by a curvature and that two geodesics are enough to denounce its presence (§ 3.46).

§ 3.36 A gravitational field is said to be *constant* when a reference frame exists in which all the components  $g_{\mu\nu}$  are independent of the “time coordinate”  $x^0$ . This coordinate, by the way, is usually referred to as “coordinate time”, or “world time”. The non-relativistic limit given above is an example of constant gravitational field, as the potential  $V$  in (3.54) is supposed to be time-independent.

§ 3.42 Finite distances in space have no meaning in the general case, in which the metric is time-dependent. If we integrate  $\int dl$  and take the infimum (as explained in § 2.45), the result will depend on the world-lines. Only constant gravitational fields allow finite space distances to be defined.

### 3.8.1 Geodesic Deviation

§ 3.46 Curvature can be revealed by the study of two nearby geodesics. Let us take again Eq. (3.1), rewritten in the form

$$U^\beta V^\alpha{}_{;\beta} = V^\beta U^\alpha{}_{;\beta} \quad (3.77)$$

The deviation between two neighboring geodesics in Figure 3.1 is measured by the vector parameter  $\eta^\alpha = V^\alpha \delta V$ , with  $\delta V$  a constant. It gives the difference between two points (such as  $a_1$  and  $b_1$  in that Figure) with the same value of the parameter  $u$ . Or, if we prefer,  $\eta$  relates two geodesics corresponding to  $V$  and  $V + \delta V$ .

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Subject: Re: "On Primitive Elements of Musical Meaning"  
Date: Wed, 20 Oct 2010 23:16:45 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: [legor Reznikoff](mailto:legor.Reznikoff@xxxx.fr) <xxxx@xxxx.fr>  
Cc: [snip]

Dear legor,

Thank you for your [snip].

> What do you mean when saying (in your last email): it is what  
> I see by zooming?

In the case of your \*brain\* (not mind),

<http://www.god-does-not-play-dice.net/Azbel.html#self>

... the UNdecidable KS state is explained with two sayings at

<http://www.god-does-not-play-dice.net/#Brun>

1. You can't hide a piece of broccoli in a glass of milk.
2. Don't wear polka dot underwear under white shorts.

The UNdecidable quantum state of your \*brain\* is not about broccoli, underwear, milk, or shorts, nor anything we can put in [Dirac brackets](#). It doesn't live in Hilbert space either,

[http://www.god-does-not-play-dice.net/#KS\\_details](http://www.god-does-not-play-dice.net/#KS_details)

I tried to "zoom" on it, and it looks to me like a hedgehog,

[http://www.god-does-not-play-dice.net/#Hehl\\_note](http://www.god-does-not-play-dice.net/#Hehl_note)

I wonder what you would see!

Best regards,

Dimi

=====

Subject: Re: "On Primitive Elements of Musical Meaning"  
Date: Thu, 10 Mar 2011 02:11:51 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Iegor Reznikoff <xxxx@xxxxx.xx>  
Cc: [snip]

Dear Iegor,

Thank you very much for your reply and your very interesting manuscript. Perhaps you may wish to consider Apeiron,

<http://www.utexas.edu/cola/depts/philosophy/resources/Apeiron.php>

You hit the nail on the head (Consciousness.pdf, p. 6/8):

"This capacity of totalization, this gift of perceptive consciousness, is certainly one of its most important properties and unity may be the characteristic property of consciousness: consciousness unifies elements that otherwise are not related; from this comes meaning."

Can you read the text below?

Aoccdrnig to a rscheearch at Cmabrigde Uinervtisy, it deosn't mtttaer in waht oredr the lttteers in a wrod are, the olny iprmoetnt tihng is taht the frist and lsat lttteer be at the rghit pclae. The rset can be a total mses and you can sitll raed it wouthit a porbelm. Tihs is bcuseae the huamn biran deos not raed ervey lteter by istlefl, but the wrod as a wlohe. Pritie amzanig huh?

Voila !

I do hope some day we can get together. I deliberately missed some very important points at

<http://www.god-does-not-play-dice.net/#BrainMonad>

<http://www.god-does-not-play-dice.net/about.html#China>

Will be happy to explain them over a glass of wine, or five :-)

Wishing you all the best,

Dimi

=====

Subject: Kommunikationswissenschaft 101  
Date: Wed, 17 Nov 2010 04:03:45 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Loet Leydesdorff <loet@leydesdorff.net>  
Cc: Nikola Chakalov <chakalov.nikola@googlemail.com>

Dear Professor Leydesdorff,

May I share with you (and my son interested in KoWi) some thoughts prompted by your papers. I endorse the proposal for a third, Noetic world, different from res extensa and res cogitans [Ref. 1], which can be studied by empirical investigation, contrary to the claim by Edmund Husserl [Ref. 2].

Consider the Platonic ideas explicated with these sayings:

1. You can't hide a piece of broccoli in a glass of milk.
2. Who has no horse may ride on a staff.

3. Don't wear polka dot underwear under white shorts.
4. Faute de mieux, on couche avec sa femme.

I'd say there are two such ideas. Here's a third Platonic idea, from Lewis Carroll:

'Twas brillig, and the slithy toves  
Did gyre and gimble in the wabe:  
All mimsy were the borogoves,  
And the mome raths outgrabe.

Our brains contain neurophysiological "correlates" of [shorts, broccoli, horses, wives, etc.](#), but not the Platonic ideas *per se*. Hence [human communication](#) always runs on [two parallel](#) layers: [speakable and UNSpeakable](#). The roots of the latter can \*perhaps\* be traced down to Jungian's [Kollektives Unbewusstes](#) -- I don't know, all this can and should be studied, faute de mieux, by empirical investigation.

I will appreciate your thoughts on these issues.

Kindest regards,

Dimi Chakalov

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[Ref. 1] Loet Leydesdorff, "Meaning" as a sociological concept, arXiv:1011.3244v1 [nlin.AO]  
<http://arxiv.org/abs/1011.3244>

p. 14: "... the horizons of meaning that we share (to different extents). This domain is not in the res extensa, but remains res cogitans. In other words, the meaning that we provide to the events does not "exist" physically, but incurs on us as one among a set of culturally possible meanings."

p. 15: "This communicative reality that the communicators shape over time and reflexively reconstruct cannot be considered as res extensa, but belongs to the res cogitans; it is not stable like matter, but remains in flux like language. It enables us to communicate in terms of uncertainties (e.g., possibly relevant questions) and expectations. Husserl (1929) recognized this realm as cogitatum, that is, the substance about which the Cogito remains uncertain. Our mental predicates provided to the world in intersubjective exchanges with intentional human beings, shape our culture and therewith ground what Husserl also called a "concrete ontology" or, in other words, "a universal philosophy of science" (1929, at p. 159)."

[Ref. 2] Loet Leydesdorff, The Non-linear Dynamics of Meaning-Processing in Social Systems, arXiv:0911.1037v1 [physics.soc-ph]  
<http://arxiv.org/abs/0911.1037>

"According to Husserl, the study of this domain would provide us with "a concrete ontology and a theory of science" (ibid., at p. 159). However, the author conceded that he had no instruments beyond this transcendental apperception of the domain and therefore had to refrain from empirical investigation:

We must forgo a more precise investigation of the layer of meaning which provides the human world and culture, as such, with a specific meaning and therewith provides this world with specifically "mental" predicates. (Husserl, 1929, at p. 138; my translation).

=====

Subject: Re: Kommunikationswissenschaft 101  
Date: Wed, 17 Nov 2010 16:15:27 +0200

From: Dimi Chakalov <dchakalov@gmail.com>

To: Loet Leydesdorff <loet@leydesdorff.net>

Dear Loet,

>> I wonder if you agree with the core proposal for a third, Noetic world.

>

> I am not so sure that we need this proliferation. How many angels can  
> sit on a needle?

We're talking about an entity that exists as some form of 'reality', because the experiment I offered to your brain with the three Platonic ideas can be performed with [all human brains](#), regardless of their structural differences, memory traces, life experience, age, etc.

The crux of the issue is that these \*ideas\* are (i) UNSpeakable, (ii) robust and invariant to all differences in all human brains that have access to them, and (iii) open to newly created \*ideas\* that emerge in cosmological time. Regarding (iii), the idea of 'vehicle', for example, includes now a space shuttle, although 100 years ago it was still in the realm of 'the unknown unknown'.

> Perhaps, it suffices to distinguish between res extensa and res cogitans.  
> The Noetic world could then be considered as part of the cogitatum.

On the one hand, the Noetic world is sort of "part" of the cogitatum, to the extent to which it is revealed only by its association with our personal qualia. On the other hand, it is a form of reality (I call it '[potential reality](#)'), because it exists 'out there' and evolves/unfolds from ... well, I'd guess from [John 1:1], or perhaps from 'the true monad without windows', or from the Noumenon, but there is no way to verify such source.

There is no way to verify [the ultimate source](#) of res extensa either, yet we don't treat elementary particles as 'angels sitting on the pin of a needle'.

One final comment: if you consider the qualia of 'blue' (res cogitans), you can refer it to EM radiation with particular wavelength (res extensa), but if you consider any Platonic idea of the type from my initial email, the question is: what kind of 'potential reality' can facilitate its presence and faculties outlined in (i) - (iii) above?

All this is a very old story, after Leibniz and Pauli,

<http://www.god-does-not-play-dice.net/#consciousness>

A penny for your thoughts.

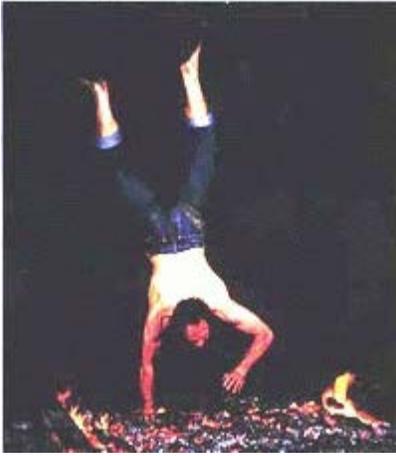
Please bear in mind that my email correspondence and web site may be screened by those (almost) transparent guys from the Echelon, so we cannot enjoy privacy.

All the best,

Dimi

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**Note:** Some people can replace the [Platonic idea](#) of 'hot' with the one relevant to 'damp moss':



Is there a ["bridge"](#) connecting the quantum vacuum and the [human brain](#)? Perhaps all you need to extract ("dark") energy from [3-D space](#) is right above your neck.

I've been arguing for many years that [these Platonic ideas](#) have **dual** ontological nature, because one can find their unique effects in both *res extensa* and *res cogitans*; and also that the need for [quantum gravity](#) stems from 'the universe modeled as a brain', as mentioned [above](#).

**NB:** I have to clarify the precise meaning of '**dual** ontological nature of potential reality', because we inevitably abuse this notion by using our language derived from the macroscopic world -- we tend to think about **it** as some sort of a "third" entity or "third world", which is "in-between" *res extensa* and *res cogitans*, and acts as a "bridge". But if you recall the notion of *entanglement*, it does not imply any "third" object or "bridge" connecting two parties. Instead, the "two" parties have become **one** inseparable object (ignore your classical thinking) due to their *entanglement*, such that we **cannot** factorize the "two" parts into some individual entities possessing well-defined properties apart from their entanglement (cf. [quantum relational holism](#)).

Likewise, the manifestation of 'potential reality' is two-fold, as we observe **it** in both *res cogitans*, in terms of Platonic ideas (cf. [above](#)), and *res extensa* in terms of [pre-quantum KS state](#). The evolution of the latter is pre-correlated (Leibnizian pre-established harmony) with the former, hence there is no need for "[anthropic principles](#)" in explaining the "coincidence" or "[Why Now?](#) problem".

It is 'potential reality' what makes *res extensa* and *res cogitans* **entangled** by its **dual** ontological nature. [Wolfgang Pauli](#) explained his proposal in 1948; the initial idea belongs to [Leibniz](#), of course. My suggestion from [February 5, 1987](#) was to parameterize the phenomenon of *entanglement*, as manifestation of 'potential reality' in the quantum realm, with an open interval of real numbers (0, infinity), such that the *latent* observables ([Henry Margenau](#)) would acquire values *larger* than those pertaining to a macroscopic object (the latter has *almost zero* value of 'potential reality'). There should be a second layer of the quantum world, corresponding to greater values of *entanglement*, which will consume the *possessed* observables (mass and charge) **as well**, and will convert them into quarks; check out my LHC prediction from [January 9, 2003](#). There should also be a very important, **third** section from this interval (mirroring the non-living macroscopic world), at which 'potential reality' approaches asymptotically infinity (cf.  $f(x) = \text{oneOverX}$ ) -- the realm of [Machian quantum gravity](#). At this "edge" of the physical world, the [mutual penetration](#) of the Large and the Small (global mode of spacetime) is *almost entirely* completed, and the physical world is approaching asymptotically 'the state of ONE'.

It is very difficult to think *about* the human brain, *with* the [human brain](#). If you're getting a headache, check out John Baez on [duality](#); his interpretation is much easier to comprehend.

If you prefer parapsychology instead of [quantum gravity](#), watch [Criss Angel](#); more [here](#).

D.C.

November 17, 2010

Last update: January 27, 2011

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Subject: Re: The reference fluid, [arXiv:1011.4444v1 \[gr-qc\]](#)  
Date: Tue, 30 Nov 2010 15:46:08 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Ian Lawrie <I.D.Lawrie@leeds.ac.uk>

Dear Ian,

Thank you for your comprehensive reply.

> I think the remark you quote from Brown and Kuchař is a bit  
> imprecise because they intend it as a general comment on a variety  
> of similar approaches.

My general comments on Brown and Kuchar are posted at

<http://www.god-does-not-play-dice.net/Margenau.html#9>

Their construction doesn't work, for a variety of reasons. Which is why I offer a radical approach toward 'the reference fluid' as "**ether**" -- an unobservable pre-quantum state of the whole universe as ONE -- and suggest a Machian quantum gravity.

> Personally, I think there are difficulties with either of these possibilities,  
> which I describe in my [paper](#), but probably not everyone would agree with me.

I agree with you, and stress that there are even more arguments against Brown-Kuchar proposal.

> There would be a third possibility, which is to take a discrete set of  
> particles, so that only some points of spacetime can be labelled  
> explicitly.

But how would you make a 'discrete set of [whatever]' and keep the spacetime continuum?

The task of such brand new quantization of spacetime is highly non-trivial, and goes back to the basic postulates of differential geometry. Which is why I asked you for advice, as I couldn't see even a hint for such task in [your book](#).

My proposal is that "some points of spacetime can be labelled explicitly" **thanks to** a pre-quantum state derived from Quantum Theory,

<http://www.god-does-not-play-dice.net/Margenau.html>

But again, the math is unknown, since modern diff geometry textbooks say nothing about [the fine structure](#) of (spacetime) "points".

In other words, I am not a bartender,

<http://www.god-does-not-play-dice.net/#Hoogen2>

How about you?

All the best,

Dimi

-----

**Note:** Excerpts from "A Unified Grand Tour of Theoretical Physics", by Ian D. Lawrie, 2nd ed., Taylor & Francis, 2001; [ISBN 978-0-7503-0604-1](#), pp. 14-15 :

Consider again the expression for proper time intervals given in (2.3). It is valid when  $(x, y, z, t)$  refer to Cartesian coordinates in an inertial frame of reference. In the neighbourhood of a gravitating body, a freely-falling inertial frame can be defined only in a small region, so we write it as

$$c^2(d\tau)^2 = c^2(dt)^2 - (dx)^2 \quad (2.6)$$

where  $dt$  and  $dx$  are infinitesimal coordinate differences. Now let us make a transformation to an arbitrary system of coordinates  $(x^0, x^1, x^2, x^3)$ , each new coordinate being expressible as some function of  $x, y, z$  and  $t$ . Using the chain rule, we find that (2.6) becomes

$$c^2(d\tau)^2 = \sum_{\mu, \nu=0}^3 g_{\mu\nu}(x) dx^\mu dx^\nu \quad (2.7)$$

where the functions  $g_{\mu\nu}(x)$  are given in terms of the transformation functions. They are components of what is called the *metric tensor*. In the usual version of general relativity, it is the metric tensor that embodies all the geometrical structure of space and time. Suppose we are given a set of functions  $g_{\mu\nu}(x)$  which describe this structure in terms of some system of coordinates  $\{x^\mu\}$ . According to the principle of equivalence, it is possible at any point (say  $X$ , with coordinates  $X^\mu$ ) to construct a freely falling inertial frame, valid in a small neighbourhood surrounding  $X$ , relative to which there are no gravitational effects and all other processes occur as in special relativity. This means that it is possible to find a set of coordinates  $(ct, x, y, z)$  such that the proper time interval (2.7) reverts to the form of (2.6). Using a matrix representation of the metric tensor, we can write

$$g_{\mu\nu}(X) = \eta_{\mu\nu} \equiv \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & -1 & 0 \\ 0 & 0 & 0 & -1 \end{pmatrix} \quad (2.8)$$

where  $\eta_{\mu\nu}$  is the special metric tensor corresponding to (2.6).

If the geometry is that of Minkowski spacetime, then it will be possible to choose  $(ct, x, y, z)$  in such a way that  $g_{\mu\nu} = \eta_{\mu\nu}$  everywhere. Otherwise, the best we can usually do is to make  $g_{\mu\nu} = \eta_{\mu\nu}$  at a single point (though that point can be anywhere) or at every point along a curve, such as the path followed by an observer. Even when we do not have a Minkowski spacetime, it may be possible to set up an approximately inertial and approximately Cartesian coordinate system such that  $g_{\mu\nu}$  differs only a little from  $\eta_{\mu\nu}$  throughout a large region. In such a case, we can do much of our physics successfully by assuming that spacetime is exactly Minkowskian. If we do so, then, according to general relativity, we shall interpret the slight deviations from the true Minkowski metric as gravitational forces.

(Notice that the geodesic hypothesis ([Alan Rendall](#)) is inherently unclear, because we presuppose some kind of linearized and flattening "collapse" taking place at "every point along a curve" to define gravitational "forces" - D.C.)

## 2.1 Spacetime as a Differentiable Manifold

Our aim is to construct a mathematical model of space and time that involves as few assumptions as possible, and to be explicitly aware of the assumptions we do make. In particular, we have seen that the theories of relativity call into question the meanings we attach to distances and time intervals, and we need to be clear about these. The mathematical structure that has proved to be a suitable starting point, at least for a non-quantum-mechanical model of space and time, is called a *differentiable manifold*. It is a collection of *points*, each of which will eventually correspond to a unique position in space and time, and the whole collection comprises the entire history of our model universe. It has two key features that represent familiar facts about our experience of space and time. The first is that any point can be uniquely specified by a set of four real numbers, so spacetime is four-dimensional. For the moment, the exact number of dimensions is not important. Later on, indeed, we shall encounter some recent theories which suggest that there may be more than four, the extra ones being invisible to us. Even in more conventional theories, we shall find that it is helpful to consider other numbers of dimensions as a purely mathematical device. The second feature is a kind of 'smoothness', meaning roughly that, given any two distinct points, there are more points in between them. This feature allows us to describe physical quantities such as particle trajectories or electromagnetic fields in terms of differentiable functions and hence to do theoretical physics of the usual kind. We do not know for certain that space and time are quite as smooth as this, but at least there is no evidence for any granularity down to the shortest distances we are able to probe experimentally.

p. 17: "The **end** points  $x = a$  and  $x = b$  are **excluded** (bad idea -- check out how to bring these 'end points' back to GR with [Finite Infinity](#) - D.C.).

"An important use of *open* sets is to define [continuous functions](#)."

p. 20: "Often, we shall expect such functions to be differentiable (that is, to possess unique partial derivatives with respect to each coordinate **at each point** of the patch)."

But you can't get [unique partial derivatives](#) in the most important case [here](#). The problem is **not** in GR. The problem stems from its inadequate and unclear mathematical basis -- [the fine structure of a 'point'](#) is missing. We need new mathematical presentations (**not** based on [tensor calculus](#)) of (i) 'spacetime point from differentiable manifold', (ii) its 'infinitesimal neighborhood', (iii) '[finite volume of space](#)', and (iv) '[closed system](#)' in order to develop [Machian quantum gravity](#).

General Relativity is only a temporary patch or "[makeshift](#)", because "we entirely shun the vague word "space," of which, we must honestly acknowledge, we [cannot form the slightest conception](#)." If the space itself is [dynamical object](#), we may recover its 'global time' and 'reference fluid' from [Quantum Theory](#). That's all.

D.C.

November 30, 2010

Last update: December 17, 2010

=====  
Subject: Re: [arXiv:1012.1739v2 \[gr-qc\]](#)

Date: Wed, 22 Dec 2010 04:15:20 +0200

From: Dimi Chakalov <dchakalov@gmail.com>  
To: carlo roveli <rovelli@cpt.univ-mrs.fr>  
Cc: Simone Speziale <simone.speziale@cpt.univ-mrs.fr>,  
Thomas Thiemann <thiemann@theorie3.physik.uni-erlangen.de>,  
Lee Smolin <lsmolin@perimeterinstitute.ca>,  
ashtekar@gravity.psu.edu,  
fpretori@princeton.edu,  
framazan@princeton.edu

Carlo,

You wrote in [arXiv:1012.4707v1 \[gr-qc\]](http://arxiv.org/abs/1012.4707v1): "Its classical limit might finally turn out to be wrong, ... "

Is this your 'scrupulous intellectual honesty' ?

<http://www.god-does-not-play-dice.net/Margenau.html>

Check out the classical limit of LQG -- you can do it now, no need to wait [another 25 years](#) -- by elaborating on the alleged [continuum limit](#) ("the refinement of the two-complex to take to infinity", Eq. 16), **\*in such way\*** that you could produce a classical 3-D space in which "it is possible to look around, and see as far as we like" (Lee Smolin, Three Roads to Quantum Gravity, [p. 205](#)).

There is no such possibility, Carlo. The requirements for observing 3-D space "as far as we like" will kill your LQG at its "[continuum limit](#)", Eq. 16.

LQG is indeed a [pathetic joke](#).

This is just business; nothing personal.

Merry Christmas.

Dimi

On Thu, Dec 16, 2010 at 4:02 AM, Dimi Chakalov <dchakalov@gmail.com> wrote:

>  
> Hi Carlo,  
>  
> I wonder what drives you to waste your time with "loop quantum gravity".  
>  
> I hear that many people at your university consider you an expert in  
> quantum gravity -- is this true?  
>  
> Can't you realize that "loop quantum gravity" is a pathetic joke? Check out  
>  
> <http://www.god-does-not-play-dice.net/Margenau.html>  
>  
> Please try to respond professionally, at least once. I know you can do it.  
>  
> Dimi  
>

-----  
**Note:** Warning: If you do mathematics as a "[bartender](#)" and are not interested in the subtleties of '[finite space](#)', don't waste your time by reading the text below.

Check out the [continuum limit](#): this is the condition for 'finite space', which allows us to see through 3-D space "as far as we like" ([Lee Smolin](#)).

Now, try to implement this [continuum limit](#) condition in the alleged continuum limit of "loop quantum gravity" (LQG), or any other background-independent approach, causal dynamical triangulations

(CDT) included. [Carlo Rovelli](#) won't even try, because he *loves* his LQG Barbie, but other people might be inclined to face the pitfalls of [LQG](#).

There is a fundamental difference between all background-independent approaches to quantum gravity, published on paper, and the Machian quantum gravity (MQG), which is outlined at Henry Margenau's [web page](#). It is about how we implement the [continuum limit](#) condition.



The *perfect* continuum of 'the grin of the cat without the cat', as observed exclusively by Alice, is interpreted in MQG as a special [non-Archimedean](#) state of the whole universe as ONE. This is the realm of 'geometry', presented with a hypothetical *global mode* of spacetime. It cannot be reached from the local (physical) mode of spacetime in the r.h.s. of Einstein equation, as demonstrated with the unresolved puzzle of ['continual finite space'](#).

With the exception of MQG, all approaches use some technique (more or less ingenious) to "zoom" onto *the* elementary building block of geometry, ensuing from a patch of [finite space](#), after which they have to recover *that same* [finite space](#). In LQG, people arrive at the idea that the *continuum* of space might be comprised of some hypothetical stuff, say, some  $10^{99}$  "atoms of volume" in every cubic centimeter of space, and try to explain how time "proceeds in **discrete** ticks of about a Planck time, or  $10^{-43}$  second" (Lee Smolin, [Atoms of Space and Time](#), *Scientific American*, January 2004, pp. 58-63).

Another idea is that there is **nothing** of that [whatever] stuff "between" the "atoms" of [whatever], much like "there is no water in between two adjacent molecules of water" ([L. Smolin](#)).

So far so good, but notice the crucial notion of 'nothing' in [the concept of 'continuum'](#): the consecutive points of a line **must succeed each other without any interval**. That is, the "interval" is absolutely needed (otherwise all points from a line will fuse into one point), on the one hand, but on the other -- the "interval" must encapsulate the metaphysical notion of 'nothing' or "[zero](#)".

Now, how do you get this "zero thing", given its seemingly incompatible faculties? Can we 'have our cake and eat it'?

Except for [MQG](#), people start with a patch of [finite space](#), and then "instruct" something from *that same patch* to approach zero, e.g., some 'infinitesimal volume of space'. Look at Newton's recipe for obtaining '*the* infinitesimal of time' (details from [Robin Jordan](#)).

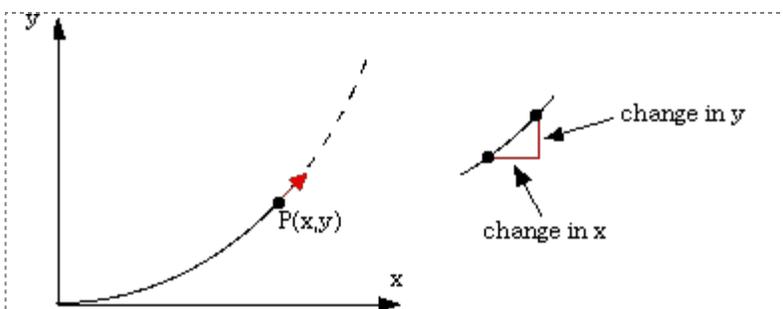


Figure 15: Newton pictured the graph of  $y = x^2$  as if it were traced by the point  $P(x,y)$  that moved in time. He thought of a short interval of time and then divided the ensuing changes of  $x$  and  $y$  by the time interval ... and, finally, imagined that time interval becoming zero. The results,  $\dot{x}$  and  $\dot{y}$ , are the fluxions of  $x$  and  $y$ , respectively. Today, we call them the rates of change of  $x$  (and  $y$ ) with time.

Let's denote *the* infinitesimal of time with **dt** , along an axis **z** orthogonal to **x/y**, as in [Flatland](#). **dt** is *the* infinitesimal time "interval" by which each and every **finite** (see [above](#)) timelike displacement is build along the [Arrow of Space](#), as driven by the "dark" energy from 'the whole universe as ONE', exhibited with the alleged [expansion of 3-D space](#), build by the infinitesimal space volume **ds** . Every physical system that can serve as 'clock' uses this *elementary timelike displacement*, **dt** . It is indeed a deep mystery, as acknowledged by Ted Jacobson (*A Spacetime Primer*, pp. [18-19](#)), and it is hidden in *the continuum*.

To obtain *the* intrinsic space "interval", **ds** (the *fluxions* of **x** and **y**, after Newton, and the "atom of volume" in LQG), we again start from a **finite** (see [above](#)) displacement in space, and instruct it to approach **zero**. Notice that we inevitably use **three** points to obtain **ds** : the cutoff,  $s_0$  , always disappears from the local (physical) mode of spacetime, regardless of obtaining a *finite* interval (as in [vacuum energy differences](#) in QFT) or *the* infinitesimal **ds** .

$$(s_2 - s_0) - (s_1 - s_0) = s_2 - s_1 = \underline{1\text{ m}}$$

Thus, we obtain **ds** by instructing  $s_2 - s_1$  to *approach zero*. The same idea applies to **dt** . We *believe* that there should exist some numerically finite but physically unattainable "values" of **ds** and **dt** at Planck scale, but we know nothing about the ultimate cutoff  $s_0$  , because it is never present in the local (physical) mode of spacetime. We can only speculate about a special "boundary" by which 'space' is bounded at The Small, such that **ds** and **dt** match  $s_0$  .

This is the mystery of *the continuum*; sorry for [repeating it](#) all over again. Now, how do we implement the requirement that there should be "nothing" between the continual chain of consecutive points **ds** ? On the one hand,  $s_0$  must encapsulate the metaphysical notion of 'nothing' or "zero" -- the consecutive points **ds** of a line (1-D Euclidean space) **must succeed each other without any interval**. On the other hand, we have to fulfill an equally important requirement that  $s_0$  must *somehow* exist in order to prevent all (**uncountably infinite**) points **ds** of a line to fuse into one **ds** . We need to 'have our cake and eat it', as sated above.

The metaphysical idea of 'continuum' is addressed in LQG with the mundane notion of 'zero *something*' (e.g., "there is no water in between two adjacent molecules of water", [L. Smolin](#)). For example, if you buy two bananas and eat them, you'll have 'zero bananas' in your hands. In LQG, the "bananas" are not converted into "zero" either, hence if you try to recover the continuum of [finite space](#), you will ultimately fail.

Why? Because the *remnants* from the "bananas" will never, in no circumstances, allow you to recover the same patch of [continual finite space](#). I will not delve into details about what constitute 'the *remnants* from the bananas' in LQG; think of these 'remnants' as the result from converting some characteristic of 'space' into [something else](#), much like we explain (and convert) heat with [kinetic energy](#).

Details available upon request.

Just a hint: because we don't live in some privileged or unique place in the universe, consider a finite volume of space with radius 7.3 billion light years (cf. [Yuan K. Ha](#)), which amounts to radius of  $690.10^{25}$  cm and volume of  $1,376,055,281.10^{25}$  cm<sup>3</sup>, each of which contains  $10^{99}$  "atoms of volume". We have  $1,376,055,281.10^{124}$ , or roughly  $10^{133}$  "atoms of volume" in which we can (i) picture [3 orthogonal dimensions of space](#), and (ii) see "as far as we like" ([Lee Smolin](#)). But because LQG is inherently relational, background-free theory, there is nothing at our disposal to 'hold onto', to avoid all **errors** in the [binding](#) of these  $10^{133}$  "atoms of volume".

Obviously, LQG is a joke. Even in [CDT](#), which is not supposed to suffer from the [splitting of spacetime](#), the best guess yields spatial [Hausdorff dimension](#)  $d_H = 3.10 \pm 0.15$  (cf. [Renate Loll et al., arXiv:hep-th/0404156v4](#), p. 7), which is also a joke. You just can't recover *the continuum*.

In MOG, the notion of "zero thing" is **not** '[zero something](#)' -- the hypothetical 'global mode of spacetime' at  $s_0$  is **not** present in the patch of [continual finite space](#) *even at the mathematical level of 'manifold'*. From the viewpoint of the local (physical) mode of spacetime, it is 'zero *nothing*':

--> [local mode] [**global 'zero nothing' mode**] [local mode] -->

Thus, we can build an [Arrow of Space](#), producing quantized spacetime from the outset -- 'have our cake and eat it'. And we always have the [reference fluid of GR](#) to 'hold onto': the [non-Archimedean global mode](#) of spacetime.

It is General Relativity itself which **requires** the global time-as-change from the [Arrow of Space](#) to be **non-existent** in the local (physical) mode of spacetime, or else the ether, as 'the reference fluid of GR', will show up in GR. The global mode of spacetime does exist, because otherwise you cannot "connect the dots" as *consecutive* points of our 3-D space, in such a way that we can see "as far as we like" ([Lee Smolin](#)). You can't **bind** the consecutive points of 3-D space with some "thermal time" (C. Rovelli, [arXiv:0903.3832v3 \[gr-qc\]](#), p. 8). Which is why the energy of the [Arrow of Space](#) is inevitably "dark" -- there is no way you can trace back its source from/within the local (physical) mode of spacetime. All you can observe in the local mode is *spatiotemporal coincidences*, but you cannot recover the phenomenon which literally builds up the 3-D space of GR, *from* GR. Which is why I tried to contact Professor Rovelli in [November 1999](#). But of course he didn't reply. Physicists don't like to be reminded of Aristotelian First Cause -- it will also look "dark" in present-day GR. Which is why we need quantum gravity.

In another email, Carlo Rovelli stated the following: "All of us keep looking around, reading, checking out the papers in the archives, and when we find ideas that seem interesting to us, or potentially good, we react. There is no shortcut to that."

It is like refusing to read the news on your mobile phone, because news must be either displayed on TV or printed on paper. That's how Carlo Rovelli implements his rule of '[scrupulous intellectual honesty](#)'. He will keep preaching to the choir and publishing papers on LQG in the [next twenty-five years](#), and will probably end up like [Alain Connes](#).

This whole story is anything but 'news', as it can be traced back to [Lucretius](#), some 2060 years ago. However, as John Coleman rightly noticed, "it is extremely difficult to induce penguins to drink warm water."

The results are indeed laughable, like the chewing over how time "proceeds in **discrete** ticks of about a Planck time, or  $10^{-43}$  second", and what might have happened "[shortly after the Big Bang](#), when the universe expanded by  $10^{28}$  within just  $10^{-36}$  of a second."

Whether such jokes are pathetic or not -- you decide.

D. Chakalov  
December 22, 2010  
Last update: December 25, 2010, 11:10 GMT

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On Thu, 23 Dec 2010 14:42:04 +0100, Message-ID:  
<AANLkTim-n4u1GhgFp8MKQKDHYfXqJZQ\_-S77gn84aq3i@mail.gmail.com>,  
Carlo Rovelli <rovelli.carlo@gmail.com> wrote:

Dear Dimi,  
thanks for your last email. I am just writing to let you know that after it I have added your name and address to my SPAM filter list. Therefore I am not going to see your mails anymore.  
[snip]

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### Addendum

Pity Carlo Rovelli chose to run away.

For those interested in his viewpoint on LQG in [arXiv:1012.4707v2 \[gr-qc\]](#), let me offer just two excerpts (emphasis and links added) and my comments:

p. 7: "Meaning of quantum mechanics.

"Hopes have been voiced that a quantum theory of gravity will clarify the mysteries of quantum theory. This is not the case of loop gravity, which uses **standard** quantum theory (in **whatever** interpretation is your favorite one), only *slightly* generalized to make room for the *peculiar way* **temporal evolution** is described in general relativity."

The same C. Rovelli stressed in his [gr-qc/0604045](http://arxiv.org/abs/gr-qc/0604045), p. 4: "The proper time [tau] along spacetime trajectories cannot be used as an independent variable either, as [tau] is a complicated non-local function of the gravitational field itself. Therefore, properly speaking, GR does not admit a description as a system evolving in terms of an observable time variable."

I do not know how "standard quantum theory" and LQG have been "slightly generalized" to "make room" for the **absence** in GR of "an observable time variable." Perhaps C. Rovelli is "slightly" confused with some *slightly* "partial observables". Well, it happens.

To understand the difference in the interpretations of "standard quantum theory", and their implications for LQG, see

Robert Geroch, *Geometrical Quantum Mechanics*, unpublished lecture notes, University of Chicago, 1974, pp. 62-71  
[http://academics.hamilton.edu/physics/smajor/Papers/geroch\\_gqm.pdf](http://academics.hamilton.edu/physics/smajor/Papers/geroch_gqm.pdf)

Second excerpt from [arXiv:1012.4707v2 \[gr-qc\]](http://arxiv.org/abs/1012.4707v2), p. 12:

"The "problem of time" is not anymore a conceptual problem in quantum gravity since the conceptual issues have been clarified, but remains a source of technical difficulties. The problems can in principle be solved using the relational formalism. That is, defining observables not with respect to unphysical space time points but in terms of relations between dynamical fields. (...) One possibility of constructing relational observables is to couple the theory to effective matter fields and use these as reference systems, in order to formally circumvent the difficulties deriving from general covariance [80]."

---

[80] C. Rovelli, "Quantum Reference Systems," *Class. Quant. Grav.* 8 (1991) 317–332.

Rovelli's claim that "the problems can in principle be solved using the relational formalism" is nothing but wishful thinking -- check out Karel Kuchar's research (references at this web site). Of course, he does not offer in [arXiv:1012.4707v2 \[gr-qc\]](http://arxiv.org/abs/1012.4707v2) reference to *any* research paper published by Karel Kuchar.

C. Rovelli does not mention Claus Kiefer's monograph [Quantum Gravity](http://www.worldscientific.com/DOI/10.1142/9789812700245_0006) (2nd ed., 2007) either. Notice Ch. 6.3 therein, 'Quantum Hamiltonian constraint', p. 194:

"The exact treatment of the constraint is the central (as yet open) problem in loop quantum gravity."

Why is that? Because LQG is stuck at its kinematical stage. To obtain the dynamics, the first off task is to make sure that, in the **classical limit** of LQG, we will be able to see "as far as we like" ([Lee Smolin](http://www.worldscientific.com/DOI/10.1142/9789812700245_0006)).

Forget it, Carlo. [LQG](http://www.worldscientific.com/DOI/10.1142/9789812700245_0006) is a joke, just like your "[scrupulous intellectual honesty](http://www.worldscientific.com/DOI/10.1142/9789812700245_0006)".

D. Chakalov

December 23, 2010, 14:33 GMT

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Subject: Re: arXiv:1012.1739v2 [gr-qc]  
Date: Fri, 24 Dec 2010 00:01:31 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: carlo rovelli <rovelli@cpt.univ-mrs.fr>  
Cc: Simone Speziale <simone.speziale@cpt.univ-mrs.fr>, Chris Isham <c.isham@imperial.ac.uk>, Karel V Kuchar <kuchar@physics.utah.edu>

Dear Carlo,

> If you call my (and other's) work a "pathetic joke", I just turn the  
> page and read something else: I am not interested in a dialogue  
> based on insults.

Okay, I admit it was too harsh. Sorry. Let me please correct my statement: I think loop quantum gravity (LQG) is indeed a joke, but a smart one. It isn't 'not even wrong', because one can learn a lot about quantum gravity by refuting LQG.

I also wish to say that, from all pupils of Chris Isham, I consider you the smartest. But you shouldn't scoffed at Karel Kuchar's Perennials with those "evolving constants" and "partial observables", because nobody can beat Karel on GR. He showed you where you went wrong, with very simple math (you know the reference, right?), but you didn't take notice.

You did not reply professionally to any of my email messages sent since Fri, 26 Nov 1999 (printed below), and I'm afraid you will never reply to my criticism of LQG posted at

<http://www.god-does-not-play-dice.net/#Rovelli>

Which is a pity, because I do believe you are smart, and will waste your professional life with that 'smart joke', LQG.

Please don't take this as an insult, and consider amending your latest review, arXiv:1012.4707v2 [gr-qc].

Again, this is all business; noting personal.

Wishing you and all your colleagues a nice white Christmas,

Dimi

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Subject: Request for opinion

Date: Fri, 26 Nov 1999 22:14:59 +0000

From: "Dimiter G. Chakalov" <dchakalov@email.com>

To: Carlo Rovelli <rovelli@science.unitn.it>

CC: Carlo Rovelli <rovelli@pitt.edu> ,

Fotini <f.markopoulou@ic.ac.uk> ,

Abhay Ashtekar <ashtekar@phys.psu.edu> ,

Chris Isham <c.isham@ic.ac.uk> , Don Page <don@phys.ualberta.ca> ,

Dorje Brody <d.c.brody@damtp.cam.ac.uk> ,

Bill Unruh <unruh@physics.ubc.ca> ,

"Dr J.N. Butterfield" <jb56@cus.cam.ac.uk> ,

Hitoshi Kitada <kitada@kims.ms.u-tokyo.ac.jp> ,

Jonathan Halliwell <j.halliwell@ic.ac.uk> ,

Joy Christian <joy.christian@wolfson.oxford.ac.uk>

Dear Professor Rovelli,

I am trying to comprehend how you [Ref. 1] and Prof. A. Ashtekar are trying to 'isolate time' or 'bring time' into quantum gravity. May I ask a question?

Since 1986, the main hope of the Ashtekar approach is that it may yield solutions to its own analogue of the Wheeler-DeWitt equation. This analogue involve functions of spin-connections, or loops in 3-space, and hence the picture is totally 'self-acting'. It is like Barron von Muenhausen who tried to lift himself and his horse by pulling himself up by his hair. In other words, you can't 'hold' on anything, for there is no background there.

If so, what could possibly 'bring the time' that we can measure with clocks from "spatiotemporal coincidences only" [Ref. 1]?

With kind regards,

Dimiter G. Chakalov  
[snip]

[Ref. 1] Carlo Rovelli. The century of the incomplete revolution: searching for general relativistic quantum field theory. Sun, 17 Oct 1999 19:43:18 GMT,  
<http://xxx.lanl.gov/abs/hep-th/9910131>

=====

Subject: The infinitesimal fluid element, Eq. 2.2, [arXiv:1012.0784v1](http://arxiv.org/abs/1012.0784v1) [[astro-ph.CO](#)]  
Date: Mon, 6 Dec 2010 07:56:54 +0200  
From: Dimi Chakalov <[dchakalov@gmail.com](mailto:dchakalov@gmail.com)>  
To: Syksy Räsänen <[syksy.rasanen@iki.fi](mailto:syksy.rasanen@iki.fi)>  
CC: Robert Geroch <[geroch@uchicago.edu](mailto:geroch@uchicago.edu)>,  
Raymond Chiao Y <[rchiao@ucmerced.edu](mailto:rchiao@ucmerced.edu)>,  
Robert M Wald <[rmwa@midway.uchicago.edu](mailto:rmwa@midway.uchicago.edu)>,  
Oyvind Gron <[oyvind.gron@iu.hio.no](mailto:oyvind.gron@iu.hio.no)>,  
Robert van den Hoogen <[rvandenh@stfx.ca](mailto:rvandenh@stfx.ca)>

Dear Dr. Räsänen,

Regarding the notion of 'time' introduced in your latest paper (details in the subject line), perhaps you may be interested to check out its possible structure and origin,

<http://www.god-does-not-play-dice.net/Margenau.html>

I believe the implications for "backreaction", the apparent FTL introduced with math [[Ref. 1](#)] and Gedankenexperiment [[Ref. 2](#)], and the puzzle of the physical spacetime [[Ref. 3](#)], are obvious.

An example of "backreaction" -- which might look FTL but isn't -- is the bootstrapping effect in a school of fish,

<http://www.god-does-not-play-dice.net/#shoal>

A penny for your thoughts.

Kindest regards,

Dimi Chakalov

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[Ref. 1] Robert Geroch, Faster Than Light? [arXiv:1005.1614v1](http://arxiv.org/abs/1005.1614v1) [[gr-qc](#)]

"Nature, apparently, always "turns on interactions" in a very special way."

....

Footnote 6: "Here, again, we are ignoring the diffeomorphism freedom, which, again, does not materially impact the present considerations."

[Ref. 2] R. Y. Chiao, How the conservation of charge can lead to a faster-than-c effect: A simple example, [arXiv:1012.0797v1](http://arxiv.org/abs/1012.0797v1) [[gr-qc](#)]

"This implies that at the quantum, microscopic level of description, the disappearance of an individual electron, such as at point A, must always be accompanied by its simultaneous reappearance at an arbitrarily far-away point on the surface, such as at point B, at exactly the same instant of time [6]. Otherwise, the principle of charge conservation would be violated at the quantum level of description of individual events.

"We shall call this counter-intuitive effect "instantaneous superluminality due to charge conservation." Note that this superluminal effect does not violate relativistic causality because ...

... .

....

"To sum up, charge conservation leads to situations in which causal, faster-than-c effects can occur. At the quantum level of description, such effects can lead to causally superluminal charge and mass currents inside matter."

[Ref. 3] R. J. van den Hoogen, Averaging Spacetime: Where do we go from here? [arXiv:1003.4020v1](https://arxiv.org/abs/1003.4020v1) [[gr-qc](#)]

"Can there be an alternative description for these observational effects that does not assume the existence of these mysterious dark quantities?"

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Subject: Re: [arXiv:1005.5052v2](https://arxiv.org/abs/1005.5052v2) [[astro-ph.CO](#)], "There is no gravity out there and no dark energy."  
Date: Tue, 4 Jan 2011 13:40:55 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: "Farley F." <F.Farley@soton.ac.uk>  
Cc: Baron Rees of Ludlow <mjr@ast.cam.ac.uk>

Dear Francis,

Thank you for your comprehensive reply.

- > The crucial point is that analysed in a static laboratory frame the galaxies
- > do not appear to be accelerating or decelerating.
- > Therefore nothing is pushing them or pulling them.
- > In this sense there is no dark energy nor gravity out there although gravity
- > acts locally because of inhomogeneties.

Please correct me if I'm wrong.

You are implying a preferred reference frame of 'the whole universe', in which one can imagine non-intersecting geodesics converging towards the past, after Weyl's Principle,

<http://www.god-does-not-play-dice.net/#Zinkernagel1>

In my opinion, such approach will produce mutually exclusive hypotheses, because this unique reference frame is both real and unreal. There are plenty of evidence in support of it (my favorite case is the [cosmic equator](#), e.g., Craig J. Copi et al., [arXiv:astro-ph/0605135v2](https://arxiv.org/abs/astro-ph/0605135v2)), yet we just can't stick to it, because it refers to something that is 'absolutely everywhere in no time'. We just call this entity "space".

If we take the Hubble Law literally, one option is to picture this 3-D space as some infinitely large warehouse, in which some "ambulances" are running away from any arbitrary "point" in the warehouse. Some astronomers really believe this may be the case. I personally consider it too primitive and brutal for our elegant and smart Mother Nature. I think She wouldn't have chosen the other option of "expanding" metric either, because it is also brutal.

So, I need to understand these two alternatives, bearing in mind that I may encounter mutually exclusive hypotheses, in which case I have to make a new one (which I [did](#)).

- > If you think that dark energy acts upon the metric, not upon the matter, that
- > is another story.

I think the so-called dark energy is an artifact from our incomplete knowledge of gravity; please check out Addendum at

<http://www.god-does-not-play-dice.net/Margenau.html>

- > Clearly in a normal static laboratory metric without expansion there is no
- > such thing.

It shouldn't, and can't show up there.

- > So my analysis does not reveal anything about your metric.
- >
- > As I understand Einstein's equivalence principle, gravity can be replaced
- > by an accelerating frame of reference.

I haven't been able to understand Einstein's equivalence principle in the past 38 years.

- > So for calculations on earth you can use a frame of reference that is
- > accelerating radially outwards.
- > This leads to the gravitational redshift etc.
- > Einstein did not ask what was pushing such a frame of reference outwards.

Angels, obviously :-)

Richard Feynman, Character Of Physical Law, [p. 8](#): "The next question was - what makes planets go around the sun? At the time of Kepler some people answered this problem by saying that there were angels behind them beating their wings and pushing the planets around an orbit. As you will see, the answer is not very far from the truth. The only difference is that the angels sit in a different direction and their wings push inward."

- > Surely it is just a mathematical trick: not supposed to represent reality.

Seriously: [I don't know](#).

Martin: What do you think?

- > One of Einstein's many fruitful thought experiments.
- >
- > NOW this frame of reference has morphed into "space". Space they imply
- > is accelerating outwards from the earth and has been doing so ever since the
- > earth was born. By now space must be going very fast indeed. The earth is
- > no longer a source of gravity, but a source of "space".

Voila! Please notice an [Arrow of Space](#) at the first link above.

- > I used to discuss these things with my good friend John Bell when we were
- > both at CERN. In the end he shook his head sadly and said, "You do not
- > understand general relativity".

I'm glad you don't, because only undergraduates "understand" GR and the [geodesic hypothesis](#).

- > In my paper I try to understand the kinematics of the SN1A redshifts without

- > any preconceptions about gravity or space, just extending laboratory physics
- > to these distances.

I'm very glad that your paper was published.

- > To my surprise the data fits very well.

Yes, sure, but the whole issue is *\*very\** tricky, after the freedom in GR to manipulate gravity 'by hand' and with "a simple static cartesian frame of reference with no curvature and use special relativity," as you put it.

- > What should we conclude ???? At least that dark energy and expanding space
- > is not proven or not the only game in town.

Not proven *and* not the only game in town.

- > For me, "space" has replaced the 19th century concept of the luminiferous
- > ether.
- > Nice idea, but you cannot see it, detect it or measure it.
- > It is better to work with what we can observe.

And keep an eye on what we cannot in principle observe: an omnipresent, hence "dark", entity. Details in the web page of Henry Margenau above.

Pity Martin cannot take part in our discussion. He said once that he has enough confidence in the multiverse to bet his dog's life on it,

<http://iopscience.iop.org/0264-9381/25/22/229001>

I am sure he will never take any risks with his beloved dog :-)

With all good wishes to you and Martin,

Dimi

- > \_\_\_\_\_
- > From: Dimi Chakalov <dchakalov@gmail.com>
- > Date: Tue, 4 Jan 2011 03:13:07 -0000
- > To: "Farley F." <F.Farley@soton.ac.uk>
- > Cc: Baron Rees of Ludlow <mjr@ast.cam.ac.uk>
- > Subject: [arXiv:1005.5052v2 \[astro-ph.CO\]](https://arxiv.org/abs/1005.5052v2), "There is no gravity
- > out there and no dark energy."

> Dear Francis,

> I couldn't find the sentence quoted in the subject line in your  
> abstract in Proc. R. Soc.

> If you adopt "a simple static cartesian frame of reference with no  
> curvature and use special relativity", under the assumption that "the  
> galaxies are receding from Earth at unchanging velocities in a fixed  
> metric with no curvature", how can you possibly find out that (i)  
> there is gravity out there and (ii) dark energy as "expansion" of the  
> metric? The latter will be totally invisible to you, hence your claim  
> in the subject line is not justified.

> Please correct me if I got your idea wrong.

> Regards,

>

> Dimi  
>  
-----

**Note:** Regarding the kinematics of the SN1A redshifts (the "ambulances") [above](#), notice a tacit, and erroneous, presumption that one can expand a **finite** volume of space to 'the whole universe', and apply the interpretation of redshift effects from the former to the latter, assuming that some unique reference frame may offer a bird's eye view on 'the whole universe'. The same anti-relativistic error is made in [NASA's drawing](#) of 'the cosmological time' *en bloc*, after assuming some unique reference frame for the [Weyl Principle](#). The simple explanation of this error is to examine carefully the *misleading* [balloon metaphor](#), bearing in mind that we deny the *physical* existence (local mode of spacetime) of both "the center" of the balloon and some 4-D spatial "direction" pointing to some not-yet-occupied space, waiting patiently for the universe to expand into. Instead, we keep them in the global mode of spacetime, which is assumed to be a *pre-geometric plenum* located "between" the points of the spacetime manifold, in which a [torsion-like](#) "loop" or "[handshaking](#)" is performed -- totally hidden by the "speed" of [light](#).

Hence one can postulate the [Arrow of Space](#) producing the global Heraclitean time, *bzw.* [potential reality](#), [biocausality](#), and the [relative scale principle](#) (RSP).

But if you subscribe to the "block universe", nothing could help you identify the error of assuming such unique reference frame. Unless you try to define an 'isolated system in GR', to address the energy balance of 'the whole universe' and speculate about its "dark energy", you may never notice the anti-relativistic error. So, try to define '[isolated system in GR](#)', with "dark energy". Try any [conformal](#) or you-name-it recipe, your choice. Can't make it.

Why? Because what makes the energy from *empty space* "dark" is the faculty of the whole universe to [act on itself](#). It's *self-acting*, after [Aristotle](#). Physically, only Baron Munchausen has managed to do it.

Alternatively, you may wish to start with a modification of [G F R Ellis' FI](#). Or keep quiet, like Sir Martin Rees and his dog. It's your free will choice.

D. Chakalov  
January 12, 2011  
Last updated: March 31, 2011

=====  
[Martin Rees wins £1m Templeton Prize](#)  
April 6, 2011  
<http://physicsworld.com/cws/article/news/45636>

"The cosmologist Martin Rees, former president of the Royal Society, has won this year's £1m Templeton Prize – the world's largest annual award given to an individual. He was awarded the prize for his "profound insights" into the nature of the cosmos that have "provoked vital questions that address mankind's deepest hopes and fears".

.....  
"As the author of more than 500 research papers, ... (Comment: If Martin Rees has started publishing research papers at age 18, for 50 years he should have produced on average over 10 research papers per year -- D.C.).

.....  
"He adds he had no qualms about accepting the award and that has not yet decided how he will spend the £1m prize money."

Probably by offering even deeper insights into the nature of the cosmos and provoking the ultimate vital questions that address mankind's deepest hopes and fears from ... [the multiverse](#) ? Just guessing.

D.C.  
April 7, 2011

=====

Subject: [arXiv:astro-ph/0411803v2](#)  
Date: Tue, 1 Feb 2011 15:41:40 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: mishak@utdallas.edu,  
aupadhye@kicp.uchicago.edu,  
aupadhye@princeton.edu,  
steinh@princeton.edu  
Cc: Michal Chodorowski <michal@camk.edu.pl>,  
Marvin Weinstein <niv@slac.stanford.edu>

Dear colleagues,

May I ask a question regarding your *\*very\** important article.

You have assumed that "the dark energy may be parameterized using an equation of state  $w(z) = P/p$ , where  $P$  and  $p$  are the pressure and dark energy density, respectively, and  $w(z)$  is an unknown function of red shift."

Are you assuming some absolute space in which objects recede with respect to any (=not privileged) location with *\*actual\** velocities, in line with the Hubble Law (e.g., Michal Chodorowski, A direct consequence of the expansion of space? [arXiv:astro-ph/0610590v3](#)) ?

Or are you assuming that the metric, or perhaps the [scale factor](#), may vary in such way that we perceive redshifted light from these objects, depending on the distance from us, but without *\*actual\** velocities associated with the redshift effect?

I endorse [this latter case](#), because the former doesn't make sense to me, as it implies some absolute space in which "more and more space appears" due to DDE.

Please advise.

Kindest regards,

Dimi Chakalov

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**Note:** Suppose the [scale factor](#) changes as function of the distance, like this:

1 "meter" table = 0\_\_\_\_\_1 , relative to observer A (cf. [below](#)).

1 "meter" galaxy = 0\_\_\_\_\_1 , relative to observer B (cf. [below](#)).

Observer A will see [redshifted light](#) from some objects receding from her with increasing "speed" proportional to the "increasing" volume of space, as she perceives a galaxy as many times "larger" than her 1 "meter" table. Observer B won't notice any difference to the "size" of *her* table, because a galaxy will be 1 "meter" to her. In other words, Observer B will be seen by Observer A as "very tall and fat", i.e., stretched to the size of a galaxy, while Observer B will only notice see that Observer A has shrunk to a tiny little table of 1 "meter".

Who has "the right meter" ? Nobody. This is the essence of [Relative Scale Principle](#). It is applicable only to '[finite things](#)'. There are two images from 'the universe as ONE' which is indeed **absolute**. It is placed at the two opposite ends of 'space', which is why we see "them" as [zero and infinity](#).

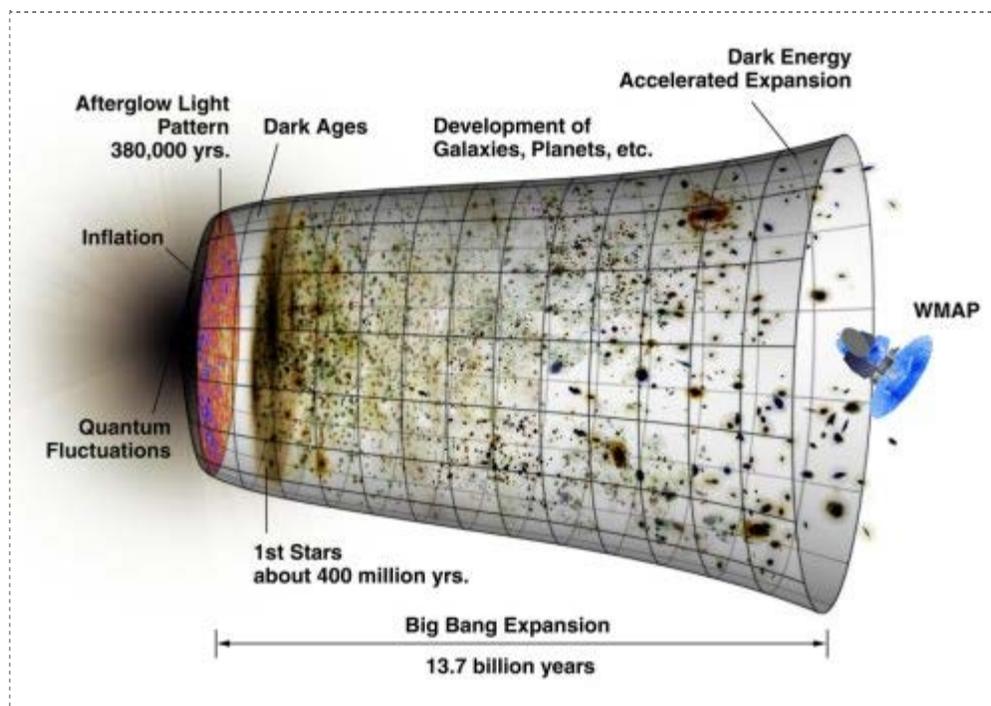
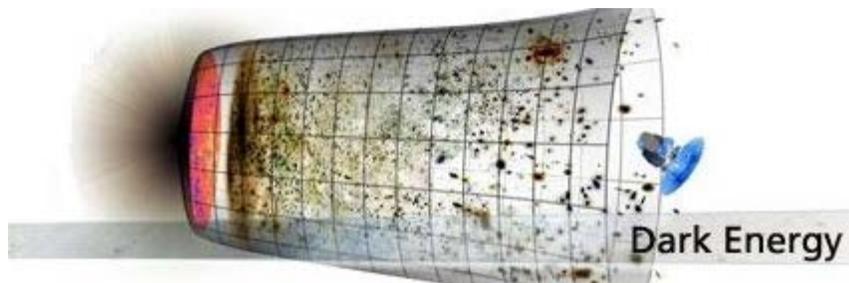
Notice that the "number" of points in the two cases above is the same: uncountably infinite (non-denumerable). This is the [non-Archimedean](#) world of *pure geometry* -- the grin of the cat without the cat, as only observed by Alice.

It goes without saying that nobody is interested. People keep arguing about the "expansion" of space "during" some "inflationary stage", as well as **actual** velocities of objects, as inferred from their redshifted light + Hubble Law, as if they have been sitting in some ideal/meta-observer reference

frame at which they can take a bird's eye view on the whole universe *en bloc*, and measure some **absolute** dimensions of the universe. You need [the reference fluid of GR](#).

**NB:** [People](#), let's make it clear, [once and for all](#). The error you've been making is very simple: **if** you take the stand of an observer placed in 3-D space, such that there are **finite** volumes of space that you can identify -- inside vs outside or Small vs Large -- you cannot, **not even in principle**, extend this viewpoint to some **absolute** "bird's eye view" to include 'the whole universe', as with the [NASA drawing](#), nor can you "see" the alleged "[curvature of space](#)".

If you could somehow reach the [non-Archimedean realm](#) of 'geometry', you may be able to see the whole universe *en bloc*, as depicted in the drawings below.



It doesn't matter if you step back [1 m](#), or move [1 m](#) closer to the universe -- you will see the same universe *en bloc*, because you're in the [non-Archimedean realm](#) of "infinity" (recall the 'Aleph-null bottles of beer on the wall' [here](#)). Only Chuck Norris has been there ([twice](#)). [You can't](#).

If you insist on talking about some redshifted "ambulances" receding from you with speed proportional to the distance, after the Hubble Law, keep in mind that you are again **confined** into the **finite** 3-D space -- left vs right and Small vs Large -- hence you can say NOTHING about the phenomenon which **creates this finite** 3-D space. You can *only* see its **END** result -- a *finite* 3-D space. You cannot see or "measure intrinsically" any "curvature" of spacetime nor "DDE of

[whatever]". You cannot see or "[measure intrinsically](#)" any GLOBAL parameter of spacetime.

In the framework of present-day GR, you cannot have any privileged class of "fundamental observers" ([Jean-Philippe Uzan](#)) nor absolute coordinates of Earth in the absolute reference frame of the cosmic equator ([Craig J. Copi et al.](#)). To be precise, "in Friedmann-Robertson-Walker solutions one has canonical clocks (e.g. the temperature of the cosmic background radiation) that not only break Lorentz invariance defining a cosmic (global) time but break the Galilei invariance defining observers which are **at rest** with respect to the cosmic background radiation" ([Luca Lusanna et al.](#)). The current GR can't explain the bold fact that your wristwatch does indeed read this "unphysical" (global) time ([Thomas Thiemann](#)).

The solution is simple and non-trivial: [dual age cosmology](#). That is, the age of the universe is finite in the global mode (currently some 13.7 billion years "after" The Beginning), and infinite/indecisive in the local mode of time, as read by your wristwatch. Once created by [[John 1:1](#)], the universe has "already" become eternal/infinite along both directions of the *local mode* of time, toward the past and the future.

Again, in present-day GR, you can't define any [external and absolute](#) parameter to map the END result from DDE to some cosmological "timeline", so that you can propose some "equation of state" (EOS) of DDE. It is just as wrong as are the following statements ("Big Bang 'soup recipe' confirmed," by Rolf H. Nielsen, *New Scientist*, [11 June 2003](#)):

"A [microsecond after](#) (absolute time - D.C.) the Big Bang, when the exploding fireball of the newborn Universe was only a [few kilometres across](#) (absolute space - D.C.), all matter existed in a special state."

Such statements about the [age of the universe](#) are not better than the "discovery" of the Archbishop of Armagh James Ussher that the Earth was formed at [6 p.m. on 22 October 4004 BC](#). Only [Chuck Norris](#) can, at least in principle, measure the absolute age of the universe, but hasn't yet publish his calculation.

[Wilma](#), did you notice how fast was the latest inflation? And look at the [scale factor](#): it changed *that* much by the time I finished my coffee!

[Fred](#), don't talk like a [Russian cosmologist](#). Get [real](#).

[D.C.](#)

February 8, 2011

Last update: March 17, 2011

=====  
Subject: arXiv:1103.5870 v3 ?  
Date: Wed, 6 Apr 2011 04:41:06 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Shuang Wang <swang@mail.ustc.edu.cn>,  
Miao Li <mli@itp.ac.cn>,  
Xiao-Dong Li <renzhe@mail.ustc.edu.cn>,  
Yi Wang <wangyi@hep.physics.mcgill.ca>  
Cc: Yi-Fu Cai <ycai21@asu.edu>

Dear Colleagues,

I like your review paper, [arXiv:1103.5870v2](#), very much. May I inform you about my work at

<http://www.god-does-not-play-dice.net/#error>

<http://www.god-does-not-play-dice.net/#Ellis>

Do you follow Shao Yong ?

Kindest regards,

Dimi Chakalov

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Examine the objects as they are and you will see their true nature; look at them from your own ego and you will see only your feelings; because nature is neutral, while your feelings are only prejudice and obscurity.

Shao Yong, 1011-1077

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**Note:** The manuscript by Miao Li *et al.* [[Ref. 1](#)] is the best review of the "dark" puzzle I've ever read. It is exceptionally clear and well organized. It is a joy to read and study.

My email [above](#) was prompted by the statement on p. 5: "The null energy condition is marginally satisfied." It will be nice if they elaborate on the adverb 'marginally'.

Basically, the energy conditions express the idea that the locally-measured energy density must be *strictly* positive everywhere and for all observers. Sounds trivial, like saying that the mass is always positive, right? Well, try to **prove it**.

The catch is in the presumption of **locally-measured** energy density. The "measurements" are actually *quasi-local* due to [gravity](#). "One cannot just integrate  $T_{\mu\nu}$ (Matter) over a 3-space to obtain a conserved total energy-momentum" ([R. Penrose, 1966](#)). Moreover, this whole 3-space has its own dynamics, but one cannot use any [external absolute background time](#) to write down EOS of the "dark" puzzle.

As Lau Loi So *et al.* acknowledged in their study with classical **pseudotensors**, "one can regard positivity as an important test for quasi-local energy expressions" ([arXiv:0901.3884v1](#)).

And the other way around. It's a bundle. But we cannot use pseudotensors. It is a bit as if you're doing an exercise in analytical chemistry, and are trying to prove that you have NaCl in your sample, but have contaminated it with NaCl (pseudotensors) from the outset. Classical pseudotensors cannot prove/disprove anything. Nobody knows how they work, once people manage to shape them the way they want them ("Never make a calculation until you know roughly what the answer will be!", John A. Wheeler), in order to calculate the result they know from the outset. Forget it. We need to find 'the right question' in the first place. The puzzle is best explained in MTW, [p. 467](#).

The null energy condition [[Ref. 1](#), p. 5], or rather the averaged null energy condition (ANEC), requires that the null-null component of the stress-energy tensor, integrated along a **complete** null geodesic, is [non-negative for all states](#) (Ulvi Yurtsever, [arXiv:gr-qc/9411056v1](#)).

But how do you envisage 'a complete null geodesic' in [an "expanding" space](#)? I can't. It is also totally unclear to me how some 'perfectly smooth ideal fluid' (cf. [Matt Visser](#)) would couple to type I matter fields, to prove that ANEC is satisfied at all. Surely Mother Nature has made it *strictly satisfied*, or else we would have observed anomalous, if not catastrophic, events (more [above](#)).

But again, these are just my scattered thoughts about the adverb 'marginally'. I think we shouldn't have jumped into conclusion that the "dark puzzle" originates **directly** from some mundane stuff with positive energy density: it comes out far too much, and suspiciously well-tuned during *all* cosmological stages. Clearly, there is "a long long way to go" [[Ref. 1](#)].

The review by Miao Li *et al.* [[Ref. 1](#)] is a gem. As [Alfred North Whitehead](#) noticed, "It requires a very unusual mind to undertake the analysis of the obvious."

D.C.

April 7, 2011

[Ref. 1] Miao Li, Xiao-Dong Li, Shuang Wang, and Yi Wang, Dark Energy, arXiv:1103.5870v2 [astro-ph.CO], <http://arxiv.org/abs/1103.5870v2>

p. 5: "Of course the [strong energy condition](#) is not something sacred. The null energy condition is

marginally satisfied."

.....

p. 153: "However, the problem of understanding the nature of dark energy is as daunting as ever, or perhaps some already hold the key to this understanding without being commonly accepted yet. Clearly, there is a long long way to go for both theorists and experimentalists."

=====

Subject: "Of course, it may just be that something else is wrong at a more fundamental level,"

[arXiv:1102.1148v1 \[gr-qc\]](#)

Date: Tue, 8 Feb 2011 04:30:20 +0200

From: Dimi Chakalov <dchakalov@gmail.com>

To: Johan Noldus <Johan.Noldus@gmail.com>

Cc: [Re Fiorentin Stefano](#) <stefano.refiorentin@fiat.com>

But of course. See

<http://www.god-does-not-play-dice.net/about.html#GR>

It applies also to the puzzle acknowledged by Rindler.

D.C.

----

Wolfgang Rindler, [Relativity](#), 2nd ed., Oxford University Press, 2006, Sec. 1.14, p. 22: "The equality of inertial and active gravitational mass then remains as puzzling as ever. It would be nice if the inertial mass of an accelerating particle were simply a back-reaction to its own gravitational field, but that is **not** the case."

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Subject: Re: "Of course, it may just be that something else is wrong at a more fundamental level,"

[arXiv:1102.1148v1 \[gr-qc\]](#)

Date: Tue, 8 Feb 2011 12:17:33 +0200

From: Dimi Chakalov <dchakalov@gmail.com>

To: johan noldus <johan.noldus@gmail.com>

> Well, meanwhile I provided an answer to [this question](#).

Wow. Now you should pack, shave, and leave for Stockholm... slowly, no rush.

Dimi

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Subject: [arXiv:1101.2177v1 \[astro-ph.CO\]](#)

Date: Wed, 12 Jan 2011 04:50:08 +0200

From: Dimi Chakalov <dchakalov@gmail.com>

To: Marvin Weinstein <niv@slac.stanford.edu>

Cc: Alfred Scharff Goldhaber <goldhab@max2.physics.sunysb.edu> ,

Alfred.Goldhaber@stonybrook.edu,

Ratindranath Akhoury <akhoury@umich.edu>

Dear Dr. Weinstein,

It is a real pleasure to read your recent paper. I will study it thoroughly over the weekend.

May I offer you my comments and ask for your opinion and corrections. I extend this immodest request to your colleagues as well.

You wrote: "Clearly, if after some finite time the universe has doubled in size, then we have twice as many fundamental volumes as we had before."

It seems to me that you imply Archimedean geometry,

<http://www.god-does-not-play-dice.net/#Blanchard2>

I mean, a 'fundamental volume' may be chosen in such way that the "number" of such volumes, in any [finite volume](#) of space, to be uncountably infinite (cf. Kurt Gödel, 'What is Cantor's Continuum Problem?', *American Mathematical Monthly*, Vol. 54, No. 9 (November 1947), pp. 515-525). Which could be interpreted as a non-Archimedean, and purely geometrical "cutoff", at which Alice could see 'the grin of the cat without the cat', placed in the l.h.s. of Einstein equation.

You believe that "there is no reservoir of degrees of freedom available for creating new degrees of freedom as the universe expands", but if the evolution of the universe is non-unitary, such "reservoir" will be needed to account for the \*emergence\* of new degrees of freedom from 'the unknown unknown'.

Regarding the "interacting theory where the general form of the behavior of the vacuum energy density has the same form as in the free case", and the "Why now?" paradox, please see Sec. Summary, pp. 35-36, in

<http://www.god-does-not-play-dice.net/ExplanatoryNote.pdf>

Your idea that the scale factor (or the lattice spacing) may be changing "in a spatially uniform manner" is one of [the toughest issues](#) I've ever faced. I am trying to propose a '[scale relativity principle](#)', which would treat the basic characteristics of 3-D space in a relational manner, that is, the notions of Large vs Small, inside vs outside, and left vs right, will no longer be absolute faculties of 3-D space, but will be relational, that is, 'relative to two observers', A and B. Keep observer A fixed at the length scale of tables and chairs, and allow a table of [length 1 m](#), relative to A, to shrink its "length" toward the Small, while being closely watched by its "co-moving" observer B. As the size of the (relative to A) table and observer B shrink toward the Planck scale, the observer B will always, at all times, measure "the same" length of 1 m of their table, due to altering the metric of space/[the scale factor](#) toward the Small. This could only be possible if the "number" of "fundamental volumes" is uncountably infinite. Conversely, if we let the length of the table and observer B to "enlarge" toward the Large, relative to the fixed observer A, the length of the table would look like approaching the cosmological horizon to observer A, while \*at the same time\* it will keep its relative length of 1 m to its co-moving observer B.

Does this make sense to you?

Please see also a modification of G F R Ellis' Finite Infinity at

<http://www.god-does-not-play-dice.net/#Beig>

Sorry for this unsolicited, and too long, email. Maybe you have similar ideas, in which case I will be more than happy to study them in details. I just don't want to invent the wheel.

All the best,

Dimi Chakalov

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**Note:** I wish to stress that Marvin Weinstein's [arXiv:1101.2177v1 \[astro-ph.CO\]](http://arxiv.org/abs/1101.2177v1) is a must to read and study. It is indeed a fundamental research. The only point at which I disagree with him is this (p. 7): "Clearly my discussion of this question is woefully inadequate and a more serious analysis of

these issues within the context of specific models is required in order to better assess the viability of the idea." In my opinion, his discussion isn't "woefully inadequate", but insightful, precise, clear, and professional. Surely we need further analysis, because nobody knows what '[space](#)' is. All I wanted to suggest is to get rid of all **fixed qualities** of 'space', such as the spatial relations Small vs Large, *etc.*, with the so-called [relative scale principle](#) (RSP). It is very easy to say it, but immensely difficult to actually *do it*. I hope to offer more on [November 25, 2015](#).

D.C.

January 12, 2011

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Subject: Request about 'how to catch a lion'  
Date: Thu, 20 Jan 2011 04:00:35 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: James M Chappell <james.m.chappell@adelaide.edu.au>

Dear Dr. Chappell,

I read your very interesting [arXiv:1101.3619v1](#), and wonder if you can help me find the proper mathematical expression of an old joke about space inversion, 'how to catch a lion'.

If you ask a mathematician how to catch a lion in Sahara, she would probably suggest that, given the existence of at least one lion there, she would drag a cage for lions in the middle of the desert, lock herself up, and then perform space inversion w.r.t. the cage surface, such that all points outside it will be converted inside the cage, and vice versa. At the end of the day, she will find herself outside the cage, while the poor lion will be locked inside. :-)

Question is, would she see a parity-reversal state of the lion, like inverting a right-hand rubber glove into a left-hand one? And how can we mathematically describe such space inversion?

Please note that the intrinsic properties of our physical space are encoded in the relations of left vs right, and inside vs outside or large vs small. Unlike time-reversal symmetry, these transformations do not produce physically indistinguishable outcomes. I believe this asymmetry is [the crux of 'space'](#).

Kindest regards,

Dimi Chakalov

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**Note:** Back in October 1998, I wrote an email to [Chris Isham](#), in which I offered the idea that the obvious asymmetry of time can **only** come from *asymmetry* of space. The reason is that the "separation" of time from space "takes place" only in our twisted imagination, so if we wish to search for some fundamental asymmetry, we should look closely at 'space'. Many years later, I came up with the [Arrow of Space](#). Not only it requires mathematical presentation of 'space inversion', but new mathematical ideas for describing '[potential reality](#)' as well.

**NB:** Think of the 'cage surface' [above](#) as a spherical trapped 2-D surface, which represents the structure of space at macroscopic scale, namely, the length scale at which we can imagine **three precisely separated** entities: a collection of points located inside the cage, another collection of points from the cage surface, and a third collection of points from the space located outside the cage surface. This is also an operational definition of '[finite space](#)', and a criterion about the "points" in such 'finite space' being FAPP 'strictly local'. In the case of quantum, gravitational, and living system, the "points" are [quasi-local](#).

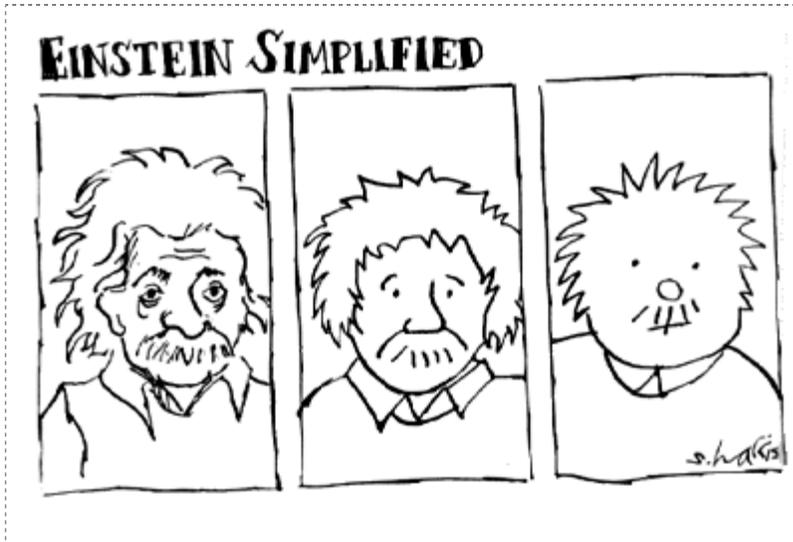
If I knew the math, I wouldn't be writing these lines. Perhaps one day some [young and hungry grad student](#) will crack the puzzle. Then perhaps we will learn how to [extract energy from space](#) with our [brains](#). If 'the universe as a whole' works like a huge [brain](#), the release of *positive* mass-energy from 'empty space' could be just a matter of learning a new skill, as difficult as [twirling a hula-hoop](#).

Of course, we first need to find out [the mechanism](#) by which only [one "charge" of mass](#) is produced in the local mode of spacetime. Is '[potential reality](#)' charge-neutral? How can AVCs (alien visiting craft) fly quietly and unconstrained by inertia-related dynamics (watch William Pawelec, [0:57:00-0:59:20](#))? Which begs the question of how to "separate" gravitational from inertial mass. [Locally](#), they do look identical in some '[free falling elevator](#)', but this 'elevator' belongs to the local mode of spacetime only. It can't fly like an [AVC](#). More on [25.11.2015](#).

D.C.

January 21, 2011

Last update: April 22, 2011



Subject: [0806.3293v4](#), [0907.0414v1](#), and [0907.0412v1](#)

Date: Tue, 15 Feb 2011 02:03:03 +0200

From: Dimi Chakalov <dchakalov@gmail.com>

To: Samuel E Gralla <sgralla@uchicago.edu>

Cc: Robert M Wald <rmwa@midway.uchicago.edu>,

Robert Geroch <geroch@midway.uchicago.edu>,

Anthony Lasenby <a.n.lasenby@mrao.cam.ac.uk>,

Luke Butcher <l.butcher@mrao.cam.ac.uk>,

Michael Hobson <mph@mrao.cam.ac.uk>

Dear Dr. Gralla,

In your review of the textbook by Hobson, Efstathiou, and Lasenby on amazon.com, you reiterated that "there are no solutions in general relativity with point particle stress-energy (see the paper by geroch and traschen)", and concluded:

"It is fine to present the calculation that point particle stress-energy will be conserved only for geodesic motion, but don't pretend there is anything more to it than a (very) suggestive calculation. Since no solutions exist for that stress-energy, you haven't shown anything about the motion of particles in GR. (At the very least, don't discuss the field equations without pointing out that there are no solutions!)"

Surely you and Bob Wald discussed the field equations \*and\* pointed out that there are no solutions, but how should gravitational **self-force** be rigorously defined?

I think "point particles" with gravitational self-force do **not** make sense in linearized approximations of GR. Distributional solutions of Einstein's equation with support on a timelike hypersurface ("shells") do not make any sense whatsoever, because they require 'spherical cows' -- linearized Einstein

equation and linearized Bianchi identity.

With such '[spherical cows](#)' you and Bob are eliminating the non-linear effect you are supposed to describe:

<http://www.god-does-not-play-dice.net/about.html#GR>

Am I wrong?

Regards,

Dimi Chakalov

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**Note:** By the same token, LIGO "scientific" collaboration eliminated the non-linear effect of [GW energy transfer](#) with their "post-Newtonian" [spherical cow](#) [Ref. 1].

It is unbelievable. Sounds like a dumb joke. Check out the 1976 article by Jürgen Ehlers *et al.*, and the pathetic 'spherical cow' by [Clifford M. Will](#):

Jürgen Ehlers, A. Rosenblum, J. Goldberg, and P. Havas, Comments on Gravitational Radiation and Energy Loss in Binary Systems, *Astrophys J Lett* **208** (1976) L77-L81

M. Walker and C. M. Will, The Approximation of Radiative Effects in Relativistic Gravity: Gravitational Radiation Reaction and Energy Loss in Nearly Newtonian Systems, *Astrophys J Lett* **242** (1980) L129-L133

The reason why the [post-post-linear approximation](#) to GR can be effective is in the [linearized flattening "collapse"](#), which also makes the geodesic hypothesis *highly misleading* and [mathematically unclear](#).

I will be happy to elaborate, after [Jürgen Ehlers](#), cf. [Ehlers.pdf](#), Sec. 5.

D. Chakalov

February 28, 2011

[Ref. 1] Clifford M. Will, On the unreasonable effectiveness of the post-Newtonian approximation in gravitational physics, [arXiv:1102.5192v1 \[gr-qc\]](#)

"... gravitational radiation involves spacetimes that are highly non-symmetrical and highly dynamical. No exact solution of Einstein's equations is known that describes the emission and propagation of gravitational waves from a source, and the reaction of the source to the emission of those waves.

"As a result, most of our understanding of gravitational radiation has come from approximations to Einstein's equations. (...) The underlying idea is to treat space-time as being that of flat Minkowski spacetime as the zeroth approximation, and to modify it by successive corrections.

....

"Nevertheless it is no less mysterious: we have no good understanding of why this approximation ([post-post-linear approximation](#) - D.C.) to general relativity should be so effective.

....

"However, the discovery revealed an ugly truth about the "problem of motion". As Ehlers et al. pointed out in an influential 1976 paper [17], the general relativistic problem of motion and radiation was full of holes large enough to drive trucks through. They pointed out that most treatments of the problem used "delta functions" as a way to approximate the bodies in the system as point masses.

"As a consequence, the "self-field", the gravitational field of the body evaluated at its own location, becomes infinite. While this is not a major issue in Newtonian gravity or classical electrodynamics, the non-linear nature of general relativity requires that this **infinite self-field** contribute to gravity.

In the past, such infinities had been simply swept under the rug.

"Similarly, because gravitational energy itself produces gravity it thus acts as a source throughout spacetime. This means that, when calculating radiative fields, integrals for the multipole moments of the source that are so useful in treating radiation begin to diverge.

"These divergent integrals had also been routinely swept under the rug. Ehlers et al. further pointed out that the true boundary condition for any problem involving radiation by an isolated system should be one of "no incoming radiation" from the past. Connecting this boundary condition with the routine use of retarded solutions of wave equations was not a trivial matter in general relativity. Finally they pointed out that there was no evidence that the post-Newtonian approximation, so central to the problem of motion, was a convergent or even asymptotic sequence. Nor had the approximation been carried out to high enough order to make credible error estimates.

....

"The one question that remains open is the nature of the post-Newtonian sequence; we still do not know if it converges, diverges or is asymptotic.

....

"Wigner remarked that the effectiveness of mathematics in the natural sciences was mysterious. The unreasonable effectiveness of the post-Newtonian approximation in gravitational physics is no less mysterious."

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Subject: [arXiv:1102.5486v1 \[math-ph\]](#), refs [9] and [10]  
Date: Tue, 1 Mar 2011 05:08:55 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Christian Wiesendanger <christian.wiesendanger@zuerimail.com>  
Cc: martiz64@libero.it, angelo.loinger@mi.infn.it

Dear Dr. Wiesendanger,

I haven't been able to understand the Equivalence Principle and its various formulations, so I very much applaud your suggestion that gravitational energy momentum  $p_G$  is different by its very nature from the inertial energy-momentum  $p_I$ .

Yet it seems to me that their observed numerical equality is not accidental, since any residual energy-momentum from numerically different values of  $p_G$  and  $p_I$  would look like coming from some "ether". That is, in the framework of present-day GR, such residual energy-momentum would look like "dark energy of the ether". Which may be the case chosen by Mother Nature:

<http://www.god-does-not-play-dice.net/about.html#GR>

I will appreciate your critical comments on the ideas at the link above, as well as those from your colleagues.

Kindest regards,

Dimi Chakalov

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Subject: Essentially unknowable "veiled reality"  
Date: Tue, 25 Jan 2011 19:20:38 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Bernard d'Espagnat <mireille.calvet@th.u-psud.fr>

Cc: Roland Omnes <roomnes@wanadoo.fr>,  
Alain Aspect <alain.aspect@institutoptique.fr>

Dear Dr. d'Espagnat,

I am surprised that you again omitted Henry Margenau in your recent paper [Ref. 1]. I looked in your latest book "On Physics and Philosophy" (Princeton University Press, 2006; ISBN: 978-0691119649), and found out that John Bell was cited 51 times, yet you haven't mentioned Henry Margenau, not even once. Which is rather odd, given the fact that his views were published many years prior to yours:

<http://www.god-does-not-play-dice.net/Margenau.html>

You won the 2009 Templeton Prize and pocketed £1 million, and I wonder if you plan to update your papers with references to the articles and books published by Henry Margenau.

Yours sincerely,

Dimi Chakalov

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[Ref. 1] Bernard d'Espagnat, Quantum Physics and Reality, arXiv:1101.4545v1 [quant-ph], <http://arxiv.org/abs/1101.4545>

p. 12: "Things being so, I proposed [30, 5, 4] a balanced view consisting in considering that the mind-independent reality notion is meaningful, that this entity - which most presumably is not imbedded in space-time - truly 'is' (exists, and not merely in our thought), but is **essentially unknowable** (in the sense of not being describable with concepts), so that what both commonsense and science refer to and are able to really describe is merely what it generates in our mind and we called empirical reality.

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p. 12, Footnote 9: "In other terms, pertinent as the celebrated Wittgenstein axiom "whereof we cannot speak, thereof we must keep silent" may be, it remains true that even though such an unknowable reality is not something we should try to describe, still we may entertain the idea of its existence."

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**Note:** What is *the* intrinsic color of an octopus? What is 'the base state' in QM? Henry Margenau called this phenomenon *Onta*. Its mental presentation can be verified above.

Just like Bernard d'Espagnat, Karl Popper wrote a whole book on "propensities", but mentioned only a paper by Henry Margenau from 1937 (p. 23). Anyway.

D.C.

January 25, 2011

=====

Subject: Re: arXiv:1005.3767v1 [quant-ph], Sec. 4

Date: Fri, 8 Apr 2011 19:12:08 +0300

From: Dimi Chakalov <dchakalov@gmail.com>

To: Diederik Aerts <diraerts@vub.ac.be>

Cc: Sandro Sozzo <ssozzo@vub.ac.be>,

Sonja Smets <sonsmets@gmail.com>,

Liane Gabora <liane.gabora@ubc.ca>,

Jan Broekaert <jbroekae@vub.ac.be>,

Sven Aerts <saerts@vub.ac.be>

Dear Diederik,

I still haven't received your reply to my email from Fri, 21 May 2010 05:06:16 +0300.

Regarding your arXiv:1104.1322v1 and SCoP conjecture, check out

<http://www.god-does-not-play-dice.net/#Bedingham>

"A spoken thought is a lie" ([Fedor Tyutchev](#)). The UNspeakable cannot fit in any Hilbert space whatsoever,

[http://www.god-does-not-play-dice.net/#Specker\\_addendum](http://www.god-does-not-play-dice.net/#Specker_addendum)

Entanglemently yours,

Dimi

=====

Subject: [arXiv:0906.0315v2 \[gr-qc\]](#)  
Date: Fri, 28 Jan 2011 04:34:09 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Daniel Sudarsky <sudarsky@nucleares.unam.mx>  
Cc: Alejandro Perez <perez@cpt.univ-mrs.fr>,  
Claus Kiefer <kiefer@thp.uni-koeln.de>,  
David Polarski <polarski@lpta.univ-montp2.fr>,  
Alessandro Teta <teta@univaq.it>,  
Wojciech Hubert Zurek <whzurek@gmail.com>,  
Jonathan Halliwell <j.halliwell@imperial.ac.uk>,  
Maximilian Schlosshauer <schlosshauer@nbi.dk>,  
Jorge Pullin <pullin@phys.lsu.edu>,  
IGUS Jim <hartle@physics.ucsb.edu>,  
Zeh <zeh@uni-heidelberg.de>

Hi Daniel,

It is a pleasure to read your article at  
<http://arxiv.org/abs/0906.0315>

Regarding Sec V from Kiefer-Polarski [arXiv:0810.0087v2 \[astro-ph\]](#): I am really surprised that Claus still writes about "decoherence".

Claus: Could you please try to elaborate on the Nevill Mott paper? See Alessandro Teta, arXiv:0905.1467v1 [math-ph], pp. 9-10,  
<http://arxiv.org/abs/0905.1467>

You may also wish to consider a proposal to falsify "decoherence" at  
<http://www.god-does-not-play-dice.net/#decoherence>

I trust Claus will reply professionally, it just may take some time. Hope other proponents of "decoherence" will also make the effort to face the bold facts.

Additionally, please don't miss Henry Margenau,  
<http://www.god-does-not-play-dice.net/Margenau.html>

All the best,

Dimi

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**Note:** Once you explain the tracks observed in a cloud chamber (produced by an alpha-particle

emitted by a source in the form of a [spherical wave](#)) with some "decoherence", please apply the same "decoherence" mechanism to the [Nebulae supercomputer](#). [Good luck](#).

D.C.  
January 28, 2011

=====

Subject: No-boundary quantum state?  
Date: Tue, 12 Apr 2011 04:51:49 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Thomas Hertog <hertog@apc.univ-paris7.fr>, IGUS Jim <hartle@physics.ucsb.edu>  
Cc: Claus Kiefer <kiefer@thp.uni-koeln.de>, Friedrich W Hehl <hehl@thp.uni-koeln.de>, Jonathan Halliwell <j.halliwell@imperial.ac.uk>, profdonpage@gmail.com, c.johan.hansson@ltu.se, caseyblood@gmail.com, s\_parrott@toast2.net, zeh@uni-heidelberg.de, nturok@perimeterinstitute.ca

Dear Tom and Jim,

In your latest [arXiv:1104.1733v1 \[hep-th\]](#), you wrote:

"First a theory of dynamics summarized by a Hamiltonian or action. Second a theory of the universe's quantum state. Without theories of both there are no predictions of any kind.

.....

"It is striking to think that these everyday asymmetries of the world emerged 14Gyr ago, and have remained pointing in the same direction since, as a consequence of the universe's quantum state."

I would like to raise two questions.

Firstly, I noticed that you carefully avoid any of those 3000+ paper dealing with the "expansion" of space due to the so-called dark energy of [whatever]. Can your "closed spacelike three-surface" ([arXiv:1009.2525v2 \[hep-th\]](#)) accommodate some form (your choice) of "dark energy"?

Secondly, is your "quantum state" compatible with KS Theorem?

[http://www.god-does-not-play-dice.net/#Specker\\_addendum](http://www.god-does-not-play-dice.net/#Specker_addendum)

I'm afraid the answer to these questions will be in the negative, but maybe some of your colleagues can help.

Regards,

Dimi

=====

Subject: The principle of explanatory closure  
Date: Fri, 15 Apr 2011 13:07:30 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Lee Smolin <lsmolin@perimeterinstitute.ca>  
Cc: [snip]

Lee:

You mentioned in [arXiv:1104.2822v1 \[quant-ph\]](#) some "principle of explanatory closure: anything that is asserted to influence the behavior of a real system in the world must itself be a real system in the universe. It should not be necessary to postulate anything outside the universe to explain the physics

within the one universe where we live."

Apart from the typo ("explanaory"), I think the notion of 'outside the universe' is oxymoron.

As to 'real system in the universe', check out the KS Theorem,

[http://www.god-does-not-play-dice.net/#Specker\\_addendum](http://www.god-does-not-play-dice.net/#Specker_addendum)

I raised this fundamental issue in my email to you from February 9, 2002, to which you responded on Sat, 23 Feb 2002 11:36:43 +0000 (BST) as follows:

"So far as I can tell, you do not formulate a clear objection, you just make accusations that there is a problem and ask people to disagree with you. This is not a very constructive way to proceed."

If you wish to waste your time -- that's fine with me, but why are you involving other people, who obviously have real priorities?

Dimi

=====

Subject: Thèse d'Habilitation à Diriger des Recherches,  
[arXiv:1101.5061v1 \[gr-qc\]](http://arxiv.org/abs/1101.5061v1)

From: Dimi Chakalov <dchakalov@gmail.com>

Date: Thu, 27 Jan 2011 05:08:50 +0200

To: Etera Livine <etera.livine@ens-lyon.fr>

Cc: Hanno Sahlmann <sahlmann@apctp.org>,  
Johan Noldus <johan.noldus@gmail.com>,  
Achim Kempf <kempf@uwaterloo.ca>

Hi Etera,

May I offer my comments.

p. 5: "All the information is encoded in the wave-function, which defines the probability amplitude of possible events."

As we all know, this is untrue:

<http://www.god-does-not-play-dice.net/Margenau.html>

p. 7: "... it is also believed that a deeper theory such as quantum gravity (...) should be based on deeper principles and would help to shed lights on the true physical meaning of the quantum theory."

Please see Addendum at the link above.

"This "graviton" would carry the gravitational interaction the same way that the photon carries the electromagnetic force."

No need for any "graviton": see above.

p. 8: "Quantum mechanics and general relativity are two theories based on solid principles. Quantum Gravity should go beyond these theories, and thus some of these solid principles should not be true."

**Must not** be true: see above.

p. 9: "[Loop quantum gravity](#) (...) start with a careful analysis of the classical phase space of general relativity."

LOG is 'looking for the right answer to a wrong question'. See again Addendum at the link above.

p. 77: "Thanks to everybody who has collaborated and worked and discussed with me about physics during all these years!"

I take this as acknowledgment of my email from Wed, 26 Jan 2005 12:13:06 +0000 (cf. below).

"And thanks to everyone who managed to read this thesis up to here!"

I appreciate your sense of humor!

Dimi

-----  
Subject: How to determine the semi-classical regime in a background independent fashion?  
Date: Wed, 26 Jan 2005 12:13:06 +0000  
From: Dimi Chakalov <dimi@chakalov.net>  
To: Etera Livine <elivine@perimeterinstitute.ca>  
CC: [snip]  
BCC: [snip]

Dear Etera,

I read your recent "Some Remarks on the Semi-Classical Limit of Quantum Gravity", [gr-qc/0501076 v1](http://arxiv.org/abs/gr-qc/0501076v1) [Ref. 1], and recalled a famous saying from Confucius:

"The hardest thing of all is to find a black cat in a dark room, especially if there is no cat."  
[skip]

=====  
Subject: [arXiv:1102.1867v1 \[gr-qc\]](http://arxiv.org/abs/1102.1867v1)  
Date: Thu, 10 Feb 2011 04:21:05 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: lbszab@rmki.kfki.hu, joergf@maths.otago.ac.nz  
Cc: sparling@math.pitt.edu, nester@phy.ncu.edu.tw, niall@ucc.ie, schoen@math.stanford.edu, yau@math.harvard.edu, robert.beig@univie.ac.at, seri@math.princeton.edu, sola@ecm.ub.es, calcagni@aei.mpg.de, domenico.giulini@itp.uni-hannover.de, wadih@unb.br, witten@ias.edu

Dear Jörg and László,

I am very suspicious about that "pure gauge term" [Ref. 1]. Perhaps you or some of your colleagues can discover a \*perfectly well defined\* energy-momentum density of the gravitational "field": see Addendum at

<http://www.god-does-not-play-dice.net/about.html#GR>

The task is [strictly mathematical](#).

All the best,

Dimi

-----  
[Ref. 1] Jörg Frauendiener and László Szabados, A note on the post-Newtonian limit of quasi-local

energy expressions, arXiv:1102.1867v1 [gr-qc],  
<http://arxiv.org/abs/1102.1867>

"Though in general relativity there is no well defined energy-momentum \*density\* of the gravitational 'field', in asymptotically flat configurations its total (ADM) energy could be defined, and one of the greatest successes of classical general relativity in the last third of the 20th century is certainly the proof by Schoen and Yau that the total gravitational energy is strictly positive definite. The logic of one of its simplest proofs, due to Witten (and simplified and corrected by Nester), is that we can rewrite the total energy as an integral of some expression (the so-called Sparling form) on a spacelike hypersurface, and by Witten's \*gauge condition\* the integrand could be ensured to be pointwise strictly positive definite.

"Thus the negative definite part of the Sparling form in the integrand is a pure gauge term."

=====

Subject: 6 sec earlier  
Date: Tue, 1 Mar 2011 00:11:09 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Marcus Du Sautoy <simonyi.professor@maths.ox.ac.uk>  
Cc: michael.brecht@bccn-berlin.de, margret.franke@bccn-berlin.de,  
frank.freyer@gmail.com, haynes@bccn-berlin.de,  
klaus-robert.mueller@tu-berlin.de, bourlard@idiap.ch,  
info@bbci.de

Dear Dr. Du Sautoy,

I watched a brief video about your "6 sec" musings at

<http://www.forbiddenknowledgetv.com/page/555.html>

The whole story about your free will, after [Benjamin Libet](#), has quite different explanation. Please be assured that no "computation" is going on in your brain.

I wonder if anyone has explained to you [the binding phenomenon](#).

Try a simple case of mental rotation: imagine a cube made of some white plastic material, with 3 cm rib, painted blue, which you cut into 27 little cubes, 1 cm each, and ask yourself the question: how many little cubes have 3 painted sides, 2, 1, and zero?

The entity in your brain, which builds up the cube and does the rotation and examination of its colored sides, is driven by your free will.

It is UNSpeakable, like the Platonic ideas in your \*brain\*,

[http://www.god-does-not-play-dice.net/#Leydesdorff\\_101](http://www.god-does-not-play-dice.net/#Leydesdorff_101)

It does not perform any "computations" whatsoever. Only Marxist-Leninist philosophers believe in such crap (pardon my French).

If you wish to train your brain, check out

<http://www.god-does-not-play-dice.net/about.html#China>

All the best,

Dimi Chakalov

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But what consciousness is we know not and how it is that anything so remarkable as a state of consciousness comes about as a result of irritating nervous tissue, is just as unaccountable as the appearance of the Djinn when Aladdin rubbed his lamp.

Thomas Henry Huxley, 1866

To avoid misunderstandings, let me introduce the term and the notion of *BrainMonad* (please notice the spelling), after Leibniz. It is [ONE entity](#) due to the phenomenon of [entanglement](#).

The BrainMonad is *not* physical, in the sense of [res extensa](#), hence it can never show up in the righthand side of Einstein field equation. It is not *res cogitans* either, because it does act on the physical world, although [via geometry only](#).

It is the ultimate 'steering wheel' **with** which we exercise our free-will decisions and actions. It is our "[bridge](#)" to the quantum-gravitational realm of [res extensa](#). The popular term for its diverse manifestations is known as [Chi](#). It is also a *dual entity*, in the sense that, if we look at it from its "other end" at the human psyche, it will be perceived introspectively as 'the human self'. In the experiment with the cube [above](#), **you** are 'the driver' operating with *your* 'steering wheel', although 'you & your steering wheel' **is** an inseparable *non-localizable* unit.

Let me try to explain. Consider the qualia of 'blue' (*res cogitans*): it refers to EM radiation with particular wavelength *and* has various neurophysiological presentations in your brain, all of which are [localized res extensa](#). Hence you may "separate" the two entities, given their entirely different nature. With the **dual** nature of the BrainMonad, you cannot make such "separation" anymore: it is [not](#) physical but '[potential reality](#)', and is also the "filter" *through* which the human mind and consciousness is explicated at the macro-world of biological systems. Thus, there is no "quantum consciousness" in the quantum realm, but only 'quantum potential reality'. There should, however, exist 'potential reality' associated with the human brain and all living creatures, which is supposed to keep the *potential brain states* -- the BrainMonad **through** which mind and consciousness enter the macroscopic world of biological systems; hence the "filter" metaphor above. But again, you [cannot](#) "separate" the BrainMonad into two "parts" (e.g., 'the driver' vs. the 'steering wheel'), as you could do with the qualia of 'blue' vs. its physical & neurophysiological presentations.

Introspectively, the actions performed *with* the BrainMonad are carried out *by* our [self-referential faculties](#) of **free will** and 'itself contemplating' ([Aristotle](#)), within an 'extended instant *now*' from our perception of the [Arrow of Space](#). Notice that an 'extended instant *now*' (global mode of spacetime), **during** which the [negotiations](#) between the two sides of Einstein field equation "take place" (depicted with the famous [Escher drawing](#)), is *the* crucial requirement for our "[atemporal](#)" mind and consciousness as well.

Physically, the BrainMonad is a new (to some theoretical physicists, at least) form of reality, called here '[potential reality](#)', in the framework of 'the universe as a [brain](#)'. As [John Bell](#) put it, "there is a real causal sequence which is defined in the aether." Should we require the theory to "account for the *present* correlations between these *present* phenomena" (*idem*), you need the BrainMonad (global mode of spacetime) to **exclude** "the aether" from the local/physical mode of spacetime, thereby ensuring a Lorentz invariant theory.

Physicists would call the BrainMonad 'absolute structure' ([James Anderson](#)), 'reference fluid', and 'ether'. They are, of course, trying to avoid it (cf. [Karel Kuchar](#)), because it does **not** carry any localizable physical stuff that could be '[directly observable](#)'. In their parlance, the BrainMonad would always be "dark", as referred to 'the universe as a [brain](#)' and to the smaller one which is right above your neck -- the BrainMonad belongs to 'the global mode of spacetime'. As stressed earlier (cf. my note from [February 8, 2011](#)), we cannot reach it from the physical 3-D space, because it is [non-Archimedean reality](#) (recall the 'Aleph-null bottles of beer on the wall' [here](#)). Only Chuck Norris has

been there ([twice](#)).

The BrainMonad comes from Aristotle. The first-cause argument "begins with the fact that there is change in the world, and a change is always the effect of some cause or causes. Each cause is itself the effect of a further cause or set of causes." This chain moves in a series that is completed at a special **cut off**, called 'the First Cause' (reference [here](#)).

In summary, the BrainMonad is a *bona fide* [Unmoved Mover](#): "something which moves [other things] without [itself] being moved [by anything]." It produces the ultimate **cut off** on 3-D space, as introduced with '[Finite Infinity](#)', thanks to which space is being *self-wrapped* (cf. [Einstein](#)).

You can't do [Quantum Theory](#) and [General Relativity](#) without it. **No way.**

To paraphrase Isaac Newton and John Wheeler [[1](#)], only the BrainMonad can *create* geometry and determine the distribution of energy flow "throughout all SPACE," *en bloc*. We don't like "miracles" and "dark energy", do we?

Why is this [difficult to understand](#), I wonder. Except for the term of *BrainMonad*, everything said above is widely known.

Of course, [many people seriously hate such ideas](#), simply because 'the universe as a [brain](#)' could have its own Mind, known as *The Universal Mind*: read [Henry Margenau](#). But your emotional and cultural attitudes are entirely different issue which shouldn't interfere with [quantum gravity](#).

Just one simple example for the doctrine of *trialism*: following the 'trunk' metaphor [above](#), the 'arm' and the 'nose' spring from their common source ([John 1:1](#)), hence if one of them goes first into existence, it will *certainly*, with unit "probability", wind up in pre-established harmony ([Leibniz](#)) with the other one. No need for any "[multiverse](#)", "[googolverse](#)", "[considerations of habitability](#)", and other murky parapsychology.

And just one simple argument: suppose you, my dear reader, managed to grasp the examples [here](#) and [here](#). Did you use your brain? Sure. But you reject the theory, correct? Okay, suppose your brain isn't equipped with a BrainMonad, but is making some "[neuronal computations](#)". What was the probability to "compute" the meaning of the [four examples](#) correctly?

To make the question more precise, imagine 100 curious chimpanzees rotating frantically 100 Rubik cubes. What is the probability for all chimpanzees to complete the task at *one instant*?

Perhaps you can now understand the "chance" for setting up the initial conditions of the alleged big bang to match the universe we live in: one part in  $10^{1230}$ , as calculated meticulously by [R. Penrose](#). At this point you should [either](#) embrace the oxymoronic "anthropic reasoning", "multiverse", *etc.*, [or](#) the BrainMonad. That's your free will choice.

"[just another crank](#)" D.C.

March 2, 2011

Last update: March 15, 2011

[1] J. A. Wheeler, Geometrodynamics and the issue of the final state. In: *Relativity, Groups and Topology*, Les Houches Summer School of Theoretical Physics 1963, Edited by C. DeWitt and B. S. DeWitt (New York, Gordon & Breach, 1964), p. 333:

"... the description of right lines and circles, upon which geometry is founded belongs to mechanics. Geometry does not teach us to draw these lines, but requires them to be drawn ..."

"Thus one comes to a new insight into the great issue raised by Isaac Newton in the opening pages of his *Principia*. He wrote that geometry requires one to construct straight lines, but does not provide one with the means to carry out the construction; only mechanics provides the means. He is obviously asking

the question, how does mechanics accomplish this miracle?

.....

p. 365: "The discussion as just outlined was sufficient to lead from the earlier concept of Mach's principle (Formulation 1) -- The inertial properties of an object are determined by the distribution of mass-energy throughout all space -- to a Formulation 2 closer in spirit to general relativity: The geometry of SPACETIME and therefore the inertial properties of every infinitesimal test particle are determined by the distribution of energy and energy flow [throughout all SPACE](#)."

=====

Subject: The age of the universe  
Date: Fri, 4 Mar 2011 15:09:26 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Martin Rees <mjr@ast.cam.ac.uk>  
Cc: Carolin Crawford <csc@ast.cam.ac.uk>,  
Carlos Frenk <C.S.Frenk@durham.ac.uk>,  
Mario Livio <mlivio@stsci.edu>,  
Marvin Weinstein <niv@slac.stanford.edu>,  
Christian Wiesendanger <christian.wiesendanger@zuerimail.com>,  
Hamish Johnston <hamish.johnston@iop.org>

Hi Martin,

Regarding your talk at  
<http://www.bbc.co.uk/programmes/b00yz3gy>

The [error](#) you've been making is explained at  
<http://www.god-does-not-play-dice.net/#error>

Details at  
<http://www.god-does-not-play-dice.net/#BrainMonad>

If you or any of your colleagues replies professionally, I will be happy to elaborate.

Take care,

Dimi

=====

Subject: Conformal Treatment of Infinity  
Date: Tue, 8 Mar 2011 15:40:16 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Roger Penrose <penroad@herald.ox.ac.uk>  
Cc: Laszlo Szabados <lbszab@rmki.kfki.hu>,  
Jörg Frauendiener <joergf@maths.otago.ac.nz>,  
Ericourgoulhon <eric.gourgoulhon@obspm.fr>,  
Adam Helfer <adam@math.missouri.edu>,  
Norbert Straumann <norbert.straumann@gmail.com>,  
Karel V Kuchar <kuchar@physics.utah.edu>,  
Domenico Giulini <domenico.giulini@itp.uni-hannover.de>,  
Chris Isham <c.isham@imperial.ac.uk>,  
Robert M Wald <rmwa@midway.uchicago.edu>,  
Robert Geroch <geroch@midway.uchicago.edu>

Dear Roger,

Regarding your idea published in 1964 [Ref. 1], check out  
<http://www.god-does-not-play-dice.net/#BrainMonad>

<http://www.god-does-not-play-dice.net/about.html#GR>

Perhaps it will be a good idea if you and your colleagues get serious about GR.

Regards,

Dimi

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[Ref. 1] R. Penrose, Conformal Treatment of Infinity. In: Relativity, Groups and Topology, Les Houches Summer School of Theoretical Physics 1963, Edited by C. DeWitt and B. S. DeWitt (New York, Gordon & Breach, 1964), p. 565:

Fig. 1. The infinite physical space-time  $_M$  is mapped into an unphysical "finite" conformally equivalent manifold  $M$ , with boundary  $J$  corresponding to the "infinity" of  $_M$ .

=====

Subject: [arXiv:1103.1427v1 \[gr-qc\]](https://arxiv.org/abs/1103.1427v1)  
Date: Wed, 9 Mar 2011 14:03:47 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Eduardo I Guendelman <guendel@bgu.ac.il>

Hi Eddie,

You acknowledged that you "still do not understand why the observed vacuum energy density must be positive instead of possibly a very small negative quantity," yet you picked "the state (with a lower vacuum energy density) that best represents the present state of the universe."

Not surprisingly, your wild guess is totally wrong.

If you are serious about your [arXiv:1103.1427v1 \[gr-qc\]](https://arxiv.org/abs/1103.1427v1), see

<http://www.god-does-not-play-dice.net/about.html#GR>

<http://www.god-does-not-play-dice.net/#BrainMonad>

But if you're doing it as a hobby -- don't bother to read and study. Have a beer instead :-)

Dimi

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**Note:** Last year, I wrote to Eduardo Guendelman regarding his "Gravitational Theory with a Dynamical Time", [arXiv:0911.0178v2 \[gr-qc\]](https://arxiv.org/abs/0911.0178v2), and received an emotional reply that the Bianchi identity is a mathematical theorem, hence there is "no ambiguity" involved here. However, the Bianchi identity cannot be applied for the case of 'GR with DDE', firstly because neither Eduardo Guendelman nor anyone else can determine the energy **density** at a "point": MTW, [p. 467](#).

The ambiguity comes from the fact that the present-day GR cannot formulate '[the right question](#)' in the first place. Moreover, [thousands of papers](#) on DDE have been published so far, with the same error of "[expanding space](#)".

Again, in the present-day GR, the notion of '[dynamical time](#)' is an oxymoron. You may eventually fix GR if you make the dynamical time *quasi-local* -- check out the first link [above](#). In one sentence, the quasi-local time in 'GR with DDE' originates from '[change of space](#)'.

For more on the current GR, see H. Ohanian, [arXiv:1010.5557v1 \[gr-qc\]](https://arxiv.org/abs/1010.5557v1), p. 3 and endnote 2 on p. 31. Hans Ohanian claims that Eq. 1 (p. 3) "determines **the rate** (emphasis mine - D.C.) at which the nongravitational matter receives energy and momentum from the gravitational field." Unfortunately,

he wasn't joking, and neither is Eduardo Guendelman ([arXiv:1103.1427v1 \[gr-qc\]](https://arxiv.org/abs/1103.1427v1), p. 25):

"... the cosmological constant term representing the zero point fluctuations can be formulated correctly and unambiguously in the Einstein frame (leading to a consistent effective action) without reference to the original frame, this is because the quantization is performed in the Einstein frame, not in the original frame."

You can produce lots of calculations based on a wrong theory. For example, you may "split" the metric  $g_{mv}$  into two "parts": "background part, for which we could take flat space-time, and a dynamical part", as suggested by [G. 't Hooft](#). Or you may wish to introduce "two measures theory", as advocated by E. Guendelman ([arXiv:1103.1427v1 \[gr-qc\]](https://arxiv.org/abs/1103.1427v1)). In the latter cases, you can produce a calculation that yields results consistent with the "observed" vacuum energy density. The best known examples for such tricks are the pseudo-tensors: MTW, [p. 467](#).

If you're good in math, you may abuse GR as much as you can. Take, for example, [G. 't Hooft](#): "In typical LIGO experiments, the amplitude [x] is very small, [something like  \$10^{-20}\$  or smaller](#) (and indeed **dimensionless**), ... (...) To be precise: [in practice](#) you only need the linear parts of Einstein's equations, and you have to build wave packets by superimposing these plane waves."

Here's an old joke. Three men in a mental clinic, Tom, Dick, and Harry, have to pass a test before their eventual release. The test is very simple: how much is  $2 + 2$ . The doctor asks Tom, and he replies: '11'. 'Are you sure?' 'Of course', says Tom, ' $2+2$  makes 11. *What else?*' 'Well, you'll have to stay here for another month or two', says the doctor. Same question to Dick. He immediately replies -- 'Tuesday'. 'Are you sure?' 'Of course', says Dick, ' $2+2$  makes Tuesday. *What else?*' 'Well, you too will have to stay here for another month or two', says the doc. Finally comes Harry. Same question, and he immediately strikes back with '4'. 'Congratulations', says the doc, 'you passed the test and may check out tomorrow. But how did you actually **calculate** it?' 'Easy', Harry replies, 'I simply divided Tuesday by 11 and got 4. *What else?*'

Trouble is, once people like [G. 't Hooft](#) and his colleagues from LIGO "scientific" collaboration 'divided Tuesday by 11' and calculated the effect on LIGO's arms from "something that is **dimensionless**" (exact quote from Kip Thorne's [Physics 237-2002 Course](#)) -- without having a [quantum theory](#) -- we all will have pay for their parapsychology: see [ExplanatoryNote.pdf](#).

They may abuse GR as much as they can, and will waste [billions of dollars and euro](#) for chasing a dimensionless ghost. There is nothing we can do to stop them.

Meanwhile, Eduardo Guendelman wrote (Thu, 10 Mar 2011 17:30:02 GMT):

- > I can explain why there is a positive energy density, the result
- > of this calculation surprised me, is not obtained
- > by forcing anything, it comes naturally and beautifully.

But of course you can. If, for example, you choose [Hüseyin Yilmaz](#)' theory, you can produce even better [calculations](#). Once you ignore the [unsolved problems](#) of GR, you can do *anything* you want. But if you are keen to explain "why there is a positive energy density", you should also explain why we always observe only one "charge" of mass. That may be tough, because the latter is not localizable (MTW, [p. 467](#)) in the framework of current GR which is still "essentially not anything more than a theory of the gravitational field, which was somewhat artificially isolated from a **total field** of as yet unknown structure" ([Einstein](#)).

We do have localizable and gravitating physical stuff (e.g., [broccoli, shorts, milk](#), etc.) which is bootstrapped by the non-localizable "gravitational field" (much like your brain produced localized '[meaning](#)'), only this physical stuff has **quasi-local mass**, in the sense that its [fleeting explications](#) do **not** and **cannot** fix any background spacetime, hence we can eliminate gravity 'by hand' (modulo higher derivatives) at any given "point" from such **non-existing** background spacetime, in line with Einstein's Equivalence Principle (MTW, [p. 467](#)). Which is why [linear approximations](#) can produce very effective, and also highly deceptive, calculation tools.

We cannot have a continual trajectory of "points" (cf. the [geodesic hypothesis](#)) at which the [locality assumption](#) holds, but a continual trajectory of **quasi-local** "points", just like those from the [trajectory of a fish](#). Thus, the answer to the question 'does the [zero point energy](#) gravitate?' is YAIN.

Yes -- because all physical stuff (e.g., [broccoli](#), [shorts](#), [milk](#)) does gravitate; no -- because their [common source](#) doesn't.

All this is not obtained by forcing anything, it comes naturally and beautifully, but of course people like Eduardo Guendelman will ignore it.

D.C.

March 9, 2011

Last update: March 11, 2011

=====

Subject: Re: arXiv:1103.1427v1 [gr-qc]  
Date: Sat, 12 Mar 2011 12:48:08 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Eduardo Guendelman <guendel@bgu.ac.il>  
Cc: lbszab@rmki.kfki.hu, joergf@maths.otago.ac.nz

Dear Eduardo,

- > of course it is not an irrelevant issue and you cannot avoid it in
- > deciding for example on whether there is gravitational radiation or not,
- > but if you study the question of the accelerated universe, then
- > only the question of whether there is a piece proportional to the
- > metric in the energy momentum appears to decide this question.

That 'piece' in question (MTW, [p. 467](#)) is inherently quasi-local,

<http://www.god-does-not-play-dice.net/#Jorg>

- > In summary, what you are worried about is not an irrelevant issue and you
- > cannot avoid it in the full theory, but there are some questions in cosmology
- > for example, or in finding exact solutions (another example), where this does
- > not appear to affect one way or the other

If you're using some '[spherical cow](#)' approximation to bypass this issue, that would be a different story.

- > by contrast, gravitational radiation would be something where this would be
- > fundamental.

Thank you for your clarification. It is my understanding that if you study the accelerated universe, gravitational radiation is essential issue (which is why I wrote a lot about it). Anyway.

Regards,

Dimi

=====

Subject: Re: arXiv:1103.1427v1 [gr-qc]  
Date: Sat, 12 Mar 2011 13:07:59 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Eduardo Guendelman <guendel@bgu.ac.il>  
Cc: lbszab@rmki.kfki.hu, joergf@maths.otago.ac.nz

On Sat, Mar 12, 2011 at 11:19 AM, Eduardo Guendelman <guendel@bgu.ac.il> wrote:

- >
- > Dear Dimi,

- > the vacuum energy density is a very, very special case,
- > its energy momentum tensor is a constant times the metric, so not only it
- > has zero covariant divergence but also every covariant derivative of its
- > energy momentum tensor is zero

Georges Lemaitre noted in 1934 that "in order that absolute motion, i.e., motion relative to the vacuum, may not be detected, we must associate a pressure [X] to the energy density [X] of vacuum",

<http://www.god-does-not-play-dice.net/Szabados.html#Peebles>

If you imply some Lorentz-invariant form of vacuum energy density (e.g., G. Marsh, [arXiv:0711.0220v2](http://arxiv.org/abs/0711.0220v2), Eq 2), then I can understand your confusion below.

- > no body has devised (not even in theory) a way to radiate or emit vacuum
- > energy, it is conserved separately from the other pieces of the energy
- > momentum tensor

Well, I wrote something about this issue at

<http://www.god-does-not-play-dice.net/#Guendelman>

Dimi

=====

Subject: [arXiv:1103.2335v1](http://arxiv.org/abs/1103.2335v1) [[astro-ph.CO](http://arxiv.org/abs/1103.2335v1)], Sec. 4.4.2: "expansion H(z) changes radial distances"

Date: Mon, 14 Mar 2011 17:04:40 +0200

From: [Dimi Chakalov](mailto:dchakalov@gmail.com) <dchakalov@gmail.com>

To: George <george.ellis@uct.ac.za>

Cc: Paul Steinhardt <steinh@princeton.edu>, William R Stoeger <wstoeger@as.arizona.edu>, Thomas Buchert <buchert@obs.univ-lyon1.fr>, Jean-Philippe Uzan <uzan@iap.fr>, Roy Maartens <roy.maartens@port.ac.uk>, Malcolm MacCallum <m.a.h.maccallum@qmul.ac.uk>, Alain Blanchard <alain.blanchard@ast.obs-mip.fr>, Michal Chodorowski <michal@camk.edu.pl>, Robert van den Hoogen <rvandenh@stfx.ca>

George, you're thinking like Chuck Norris:

<http://www.god-does-not-play-dice.net/#error>

The evolving cosmological "constant" is not related to some "Ricci tensor contribution", nor is some 'perfect fluid' ([p. 3](#)).

And the reason you can place [ $\lambda$ ] in either side of the EFE (ibid.) is that it acts on both sides of the EFE,

<http://www.god-does-not-play-dice.net/about.html#GR>

Will be happy to elaborate, should you or your colleagues respond professionally.

[Dimi](#)

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**Note:** Searching for a *physical*, after [Georges Lemaitre](#), form of "dark energy" (George Ellis, [p. 17](#)) is like searching for an elephant in a china shop (details [here](#)), under the condition that the elephant is much larger than the store itself. [Chuck Norris](#) may be interested, however. He is the only person to

pass from the physical world to the [non-Archimedean realm](#) (global mode of spacetime), and back to the Archimedean world of 3-D space. Only Chuck Norris can verify the claim that "expansion  $H(z)$  changes radial distances," and I think George Ellis should mention him in his forthcoming arXiv:1103.2335 v2 [astro-ph.CO].

Seriously, [George Ellis](#) is a great physicist. He offered a brilliant insight about what he called [Finite Infinity](#), which is *conditio sine qua non* for understanding the nature of [inertia and gravity](#), and perhaps the "dark energy": if we can define **the entire** universe as "spatially self-enclosed" ([Einstein](#)), by "passing to an appropriate asymptotic regime such that **all** gravitational effects are localized inside of it" ([Adam Helfer](#)), it might be possible to crack the puzzle of DDE. It won't be a *physical* solution, because DDE introduces 'absolute motion' to the physical world, while being in '**absolute rest**'. It is the Aristotelian [First Cause](#). Its *physical* manifestation goes via **geometry** only, by ways of [self-acting](#).

Of course you can't trace back the very *source* of DDE. That's what makes it "dark". Sorry for repeating this again.

In the [current formulation of GR](#), based on the unfortunate [splitting of spacetime](#) into two "parts", the alleged dynamics of the scale factor,  $R = R(\mathbf{t})$  (cf. [Brian P. Dolan](#)), refers to 'change **in** space' [[Ref. 1](#)], but such 'change', denoted with  $\mathbf{t}$ , is severely restricted by the dynamics of the other "part" (called 'space'). In order to capture the 'dynamical dark energy of [whatever]', you need to discover the [dynamics of space](#), that is, '*the change of space*' along the [Arrow of Space](#).

Forget about that "perfect fluid" (George Ellis, [p. 3](#)). It "evolves" along  $\mathbf{t}$  taken from 'change **in** space' [[Ref. 1](#)], which is "a genuine property of Lorentzian geometry, that is, of the existence of one axis of time of a **different nature** to the space axes" ([José Senovilla](#)). Hence the corollary about the "edge" of spacetime: "This is some kind of boundary, or margin, which is not part of the space-time but that, somehow (sheer poetry - D.C.), it is accessible from within it" (*idem*).

It's a whole new ball game. You should do better than [Georges Lemaitre](#) in 1934.

D.C.

March 14, 2011

Last updated: March 19, 2011

[Ref. 1] [Robert Geroch](#), *General Relativity from A to B*. University of Chicago Press, Chicago, 1981, [pp. 20-21](#):

"There is no dynamics within space-time itself: nothing ever moves therein; nothing happens; nothing changes. (...) In particular, one does not think of particles as "moving through" space-time, or as "following along" their world-lines. Rather, particles are just "in" space-time, once and for all, and the world-line represents, **all at once** the complete life history of the particle."

Comment: Your brain cannot function in such dead frozen "[block](#)", firstly, and secondly -- only [Chuck Norris](#) could see it "[all at once](#)". Anyway.

D.C.

March 17, 2011

Last updated: December 4, 2012

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Subject: Re: [arXiv:1103.2335v1 \[astro-ph.CO\]](#), Sec. 4.4.2: "expansion  $H(z)$  changes radial distances"

Date: Wed, 16 Mar 2011 23:11:44 +0200

Message-ID:

<AANLkTimK0+\_ =CqvdwE3U14kboGgLcrPRSxbHbSoHKEuu@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: George <george.ellis@uct.ac.za> ,

Paul <frampton@physics.unc.edu> ,

Paul Steinhardt <steinh@princeton.edu> ,

William R Stoeger <wstoeger@as.arizona.edu>,  
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Norbert Straumann <norbert.straumann@gmail.com>,  
Karel V Kuchar <kuchar@physics.utah.edu>,  
Domenico Giulini <domenico.giulini@itp.uni-hannover.de>,  
Chris Isham <c.isham@imperial.ac.uk>,  
Robert M Wald <rmwa@midway.uchicago.edu>,  
Robert Geroch <geroch@midway.uchicago.edu>,  
Roger Penrose <penroad@herald.ox.ac.uk>

P.P.S. I inserted today a drawing of the "accelerated" universe at

<http://www.god-does-not-play-dice.net/#error>

According to [Chris Isham](#), I am "just another crank" who does not know "enough theoretical physics to help with any research in that area," but he hasn't yet produced any evidence in support of his second claim. I trust you can help him find my errors -- please don't hesitate to raise your professional questions and objections.

Other people declared, in the same bold fashion, that I know nothing about the global economy:

<http://ow.ly/3UI4a>

Anyway. I do hope to hear from you.

["just another crank" D.](#)

On Wed, Mar 16, 2011 at 5:04 AM, Dimi Chakalov <dchakalov@gmail.com> wrote:

>  
> P.S. I updated today (16.03.11) the explanatory note at  
>  
> <http://www.god-does-not-play-dice.net/#Ellis>  
>  
> If there is anything left unclear, it will be \*entirely\* my fault.  
>  
> Please don't hesitate to raise your professional questions and objections.  
>  
> D.  
>  
-----

**Note:** More than 48 hours have passed since my email from Wed, 16 Mar 2011 23:11:44 +0200 [above](#), yet nobody has even confirmed its receipt. The same reaction was in [June - August 2008](#) -- those noble academic scholars won't reply to some "[crank](#)".

About eight years ago, an [11-year-old boy](#) wanted to know what the Big Bang sounded like for a school project. That's a smart kid. I don't want him to study GR and QM *exclusively* from these people [above](#): he will be taught about the Gauss-Bonnet theorem [[Ref. 2](#)] and the "stress-energy tensor" of the *vacuum* [[Ref. 3](#)], and will get lost forever.

As Max Planck pointed out many years ago, [the future lies with youth](#).

D.C.

March 19, 2011

[Ref. 2] Gautam Dutta, Effects of Curvature on Dynamics, arXiv:1012.0432v2 [physics.gen-ph], <http://arxiv.org/abs/1012.0432>

p. 4 (emphasis added - D.C.): "This is like the perfect rolling of a wheel on a surface, where the part of the wheel near the point of contact is **always at rest** with respect to the surface. The vector being parallel transported must retain its direction with respect to the coordinate system on this rolling plane. This process defines the parallel transport of a vector in a curved space.

"The direction of motion at each point on the path is along the tangent to the path. This is also a vector on the rolling tangent plane. As we move, this vector may change its orientation with respect to the coordinate system on the tangent plane. If it doesn't then the path is called a geodesic on the curved surface.

.....

pp. 5-6: "So it is a measure of the curvature of the curve within the manifold, called **the intrinsic curvature** of the curve. (...) The Gauss-Bonnet theorem given by Eq. 2 gives a way to access the curvature of the manifold, with respect to the external higher dimensional Euclidian space, through the intrinsic curvature of a curve which can be measured within the manifold.

.....

p. 9: "In the theory of gravity according to General Relativity [1,11], a massive object causes a curvature of the space-time around it. All objects in the vicinity of the massive body moves in this curved space-time. The trajectory is obtained by evaluating the geodesic path in this space-time."

---

[1] Robert. M. Wald, General Relativity. (The University of Chicago Press, Chicago and London 1984)

[11] C. W. Misner, K. S. Thorne, J. A. Wheeler, Gravitation. (Freeman, San Francisco 1973)

[Ref. 3] [John C. Baez](#) and Emory F. Bunn, The Meaning of Einstein's Equation, January 4, 2006 <http://math.ucr.edu/home/baez/einstein/einstein.html>

"It is hard to imagine the curvature of 4-dimensional spacetime, but it is easy to see it in a 2-dimensional surface, like a sphere.

"The sphere **fits nicely** in 3-dimensional flat Euclidean space, so we can visualize vectors on the sphere as 'tangent vectors'. (...) Our curved spacetime need not be embedded in some higher-dimensional flat spacetime for us to understand its curvature, or the concept of tangent vector. The mathematics of tensor calculus is designed to let us handle these concepts '**intrinsically**' -- i.e., working solely within the 4-dimensional spacetime in which we find ourselves."

<http://math.ucr.edu/home/baez/einstein/node2.html>

.....

"For the vacuum to not pick out a preferred notion of 'rest', its **stress-energy tensor** must be proportional to the metric. (...) Here pressure effects dominate **because** (Sic! - D.C.) there are more dimensions of space than of time!"

<http://math.ucr.edu/home/baez/einstein/node8.html>

See also:

Open Questions in Physics, Original by John Baez, Updated June 1997 by JCB,

[http://www.math.ucr.edu/home/baez/physics/General/open\\_questions.html](http://www.math.ucr.edu/home/baez/physics/General/open_questions.html)

"Is gravity really curvature, or what else--and why does it then look like curvature? An answer to this question will necessarily rely upon, and at the same time likely be a large part of, the answers to many of the other questions above."

But look at "Updated March 2006 by JCB":

[http://www.math.ucr.edu/home/baez/physics/General/open\\_questions.html#big](http://www.math.ucr.edu/home/baez/physics/General/open_questions.html#big)

The question above, from June 1997, is missing. Obviously, by March 2006 John Baez has figured out whether gravity is really "curvature", or something else.

Pity John Baez doesn't communicate with "cranks", because I have some nice questions about his understanding of GR [\[Ref. 4\]](#).

D.C.

March 19, 2011

[Ref. 4]. [John Baez](#), Fundamental Physics: Where We Stand Today, November 2, 2007, [p. 4](#).

General relativity says that freely falling objects trace out paths in spacetime that are 'as straight as possible', but that matter curves spacetime according to **Einstein's equation**:

**Given any small ball of freely falling test particles initially at rest relative to each other, the rate at which its volume starts shrinking is proportional to: the energy density at the center of the ball, plus the sum of the pressures in all three directions.**

or more precisely:

$$\left. \frac{\ddot{V}}{V} \right|_{t=0} = -\frac{1}{2}(\rho + P_x + P_y + P_z)$$

in units where  $c = 8\pi G = 1$ .

=====

Subject: Re: KS Theorem  
Date: Mon, 18 Apr 2011 13:07:30 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Carlos Castro <xxxxxx@xxxxx.com>  
Cc: Matej Pavsic <xxxxxx@xxxxx.com>

Dear Carlos,

> I do not know much about the subtleties behind the many interpretations  
> of QM.

The KS Theorem is not about subtleties nor "understanding QM".

> I think in pictures. I get confused with so many words

Here's the picture: think of a table with three rows and three columns. You have 9 contextual observable quantum states, none of which is special or privileged. Yet depending on the order in which you count them, the last one will always be "uncolored" or UNdecidable. So, if you count these quantum states as you'd read a text in English, the last one, residing at "template" No. 9, will be UNdecidable. If you reverse the order of counting, starting from No. 9 (think of Arabic), then the last quantum state at "template" No. 1 will be UNdecidable.

The conclusions about the meaning of 'contextual' are straightforward, after Schrödinger's 1935 paper and his letter to Einstein from [November 1950](#).

All references are one-click away. Will be happy to learn what you found difficult at

[http://www.god-does-not-play-dice.net/#Specker\\_addendum](http://www.god-does-not-play-dice.net/#Specker_addendum)

It will be entirely my fault, of course.

Best regards to you and Matej.

Dimi

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**Note:** Since the KS Theorem is **not** about '[projective measurements](#)' (details from [Waegell & Aravind](#) and [C. Isham](#)), it is very important to understand the meaning of 'contextual observable quantum states, **none** of which is special or privileged'.

If you think of [9 possible contextual "states"](#) of a [blond girl](#), one of these "states" could be 'naked' (UNdecidable), so it goes into the UNcolored KS sphere (Helena Granström, [p. 2](#)). Point is, any of the remaining 8 "dressed"/contextual states emerge from **the same** 'naked' or UNdecidable KS state. None of these 8 observable or "dressed" states is somehow special or privileged, so if you count/measure them in a **different** order, state #1 (say) will become "naked", while the previously "naked" state #9 will obtain some contextual/"dressed" value. Why is this [difficult to understand](#), I wonder.

In March 1926, Heisenberg suggested the so-called [uncertainty principle](#). An ontological interpretation of the non-commutativity can be suggested with the following Gedankenexperiment: suppose one could somehow **force** an electron in its natural habitat to occupy a "point-like" position identical to the one we *imagine* for macroscopic objects, say, a bullet shot at a wall. No way, says Werner Heisenberg, because the momentum of *the same* electron will have to be far too "uncertain", after the so-called [uncertainty principle](#). But isn't the "point-like" position of an electron left on a screen [identical in nature](#) to the "point-like" position of a bullet that has hit a wall?

It can't punch a screen or a wall with "position" only. In the case of a *single* electron, we face the old conundrum of explaining the generation of observable paths in Wilson cloud chambers, after Nevill Mott (cf. Alessandro Teta [above](#)).

It is obvious that the *physical presentation* of an electron, observed in the double-slit setup [above](#), cannot be [identical](#) to the one pertaining to 'an electron in the quantum realm *out there*'. Same holds for their "waves": they cannot be *the* genuine [quantum waves](#) in 'the quantum realm *out there*'. We inevitably **distort** a quantum object upon forcing **it** to show up at the length scale of tables and chairs. Not surprisingly, nobody has managed to reconcile QM with [Special Relativity](#), nor has observed "empty waves" traveling in Minkowski spacetime.

Briefly, the KS Theorem also suggests that the UNdecidable, pre-quantum, *potential* quantum state - - the "[quantum elephant](#)" -- may not suffer from any "[non-commutativity](#)" nor "quantum jumps". They could be an artifact from the unanimated macroscopic measuring devices. If you use a brain, you may picture the UNdecidable, pre-quantum, *potential* quantum state (never in plural) [very well](#), with your [BrainMonad](#).

Dead matter makes quantum jumps; the living-and-quantum matter is [smarter](#).

Yes, I know you seriously hate the Kochen–Specker (KS) Theorem, and of course the Conway–Kochen [Free Will Theorem](#) refuting the "[block universe](#)" paradigm. But your emotions cannot change the rules of Quantum Theory.

["just another crank"](#) D.C.

April 19, 2011

Last updated: September 2, 2011

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Subject: Re: [arXiv:1109.6049v1 \[quant-ph\]](#)  
Date: Sun, 2 Oct 2011 14:36:13 +0300  
Message-ID:  
<CAM7Ekxkzbadn4ztaugJhJxD7nxG-kW3ykY=1N4SVTZ4oy5q0Q@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Carlos Perelman <xxxxxx@xxxxxx.com>  
Cc: Daniel Bedingham <d.bedingham@imperial.ac.uk>,  
Warren Leffler <>wkleffler@aol.com>

Dear Carlos,

> If UNdecidable quantum states do not live in a Hilbert space,  
> could they live in an extended Hilbert space ?

The task is quantum gravity, and I'm not aware of any such extension. See, e.g., the 'mediating field' by Daniel Bedingham, [arXiv:1103.3974v1 \[quant-ph\]](#) -- I'm afraid it won't work, because the "time parameter" we use by referring to a physical clock is due to "expansion" of space ([scale factor](#) is function of "time"), so we have to resolve [the "dark" energy](#) \*from the outset\*,

<http://www.god-does-not-play-dice.net/#Leffler>

It's a bundle, and the more requirements you put on the table, the narrower is the choice to resolve the puzzle from KS Theorem and Schrödinger.

Henry Margenau had a brilliant guess: "not always there",

<http://www.god-does-not-play-dice.net/Margenau.html>

I suggest the UNdecidable quantum state (never in plural, because it is [ONE](#) entity) is 'never there', that is, it never lives in the physical spacetime. It only casts 'events' with **unit probability** -- one at a time -- so we never encounter Schrödinger's cat or any "measurement problems" (that was my idea from [October 2002](#)).

But how do we make 'one at a time' ? By an Arrow of Space,

[http://www.god-does-not-play-dice.net/#Zinkernagel\\_note](http://www.god-does-not-play-dice.net/#Zinkernagel_note)

Well, that's tough. No math that I know is available.

[snip]

Best wishes,

Dimi

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**Note:** The "*chooser*" (recall that quantum theory is a theory of choices without a chooser, [Philip Pearle](#)) of [the physical content](#) of the instant 'now' -- one at a time, along the [Arrow of Space](#) -- is the **universe itself**, acting as ONE entity. It selects, by acting on itself, **one** physical thing to fill in the instant 'now', always with unit probability ([Machian Quantum Gravity](#)).

I shouldn't have said "no math that I know is available," but 'no math that I know can fit the bill'.

D. Chakalov  
October 2, 2011

=====

Subject: Re: The first second of the Universe  
Date: Sun, 2 Oct 2011 17:53:31 +0300  
Message-ID:  
<CAM7Ekx=pUO78arYQVQb2Y4jNXX21jv62znxvMyeeXz8oiEQz\_Q@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Dominik Schwarz <dschwarz@physik.uni-bielefeld.de>  
Cc: [Claus Kiefer](mailto:kiefer@thp.uni-koeln.de) <kiefer@thp.uni-koeln.de>, [claus.laemmerzahl@zarm.uni-bremen.de](mailto:claus.laemmerzahl@zarm.uni-bremen.de), [emf@math.uni-bremen.de](mailto:emf@math.uni-bremen.de), [giulini@zarm.uni-bremen.de](mailto:giulini@zarm.uni-bremen.de), [b.hartmann@jacobs-university.de](mailto:b.hartmann@jacobs-university.de), [lechtenf@itp.uni-hannover.de](mailto:lechtenf@itp.uni-hannover.de), [obers@nbi.dk](mailto:obers@nbi.dk), [p.schupp@jacobs-university.de](mailto:p.schupp@jacobs-university.de), [marco.zagermann@itp.uni-hannover.de](mailto:marco.zagermann@itp.uni-hannover.de), [grieser@mathematik.uni-oldenburg.de](mailto:grieser@mathematik.uni-oldenburg.de)

Hi Dominik,

Regarding my email from [Mon, 19 May 2003 17:17:15 +0300](mailto:Mon_19_May_2003_17:17:15_+0300), please see

<http://www.god-does-not-play-dice.net/#Leffler>

I think we need to improve Quantum Theory in the first place, to address the Hilbert-space problem ("What is the appropriate inner product that encodes the probability interpretation and that is conserved in time?" [C. Kiefer](#), Conceptual issues in quantum cosmology, gr-qc/9906100), and offer a viable model of gravity,

<http://www.models-of-gravity.org/research/research-topics/gravity-models/>

Will be happy to elaborate, should you or your colleagues are interested. The task seems to be [strictly mathematical](#).

All the best,

Dimi

=====



Subject: What makes a spacetime 'time orientable' ?  
Date: Mon, 3 Oct 2011 04:22:00 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Waldyr A Rodrigues Jr <walrod@ime.unicamp.br>  
Cc: Muhammad Sharif <hasharif@yahoo.com>, [enotte@userena.cl](mailto:enotte@userena.cl), [roldao.rocha@ufabc.edu.br](mailto:roldao.rocha@ufabc.edu.br)

Dear Waldyr,

I am trying to understand your [arXiv:1109.5272v2 \[math-ph\]](https://arxiv.org/abs/1109.5272v2), and would like to ask for your opinion on the question in the subject line.

Can you \*derive\* time-orientability from something -- anything ?

I haven't read your Lecture Notes in Physics 722, but it seems to me that the textbook by Sachs and Wu, which you frequently quote (R. K. Sachs and H. Wu, General Relativity for Mathematicians, Springer-Verlag, New York, 1977), doesn't address the fundamental issue of the \*origin\* of time-orientability.

Please advise. I will highly appreciate the opinion of your colleagues, too.

Thank you for your time and consideration.

Best regards,

Dimi

=====

Subject: Re: What makes a spacetime 'time orientable' ?

Date: Mon, 3 Oct 2011 05:06:51 +0300

From: Dimi Chakalov <dchakalov@gmail.com>

To: Waldyr A Rodrigues Jr <walrod@ime.unicamp.br>

Cc: Muhammad Sharif <hasharif@yahoo.com>, enotte@userena.cl, roldao.rocha@ufabc.edu.br

P.S. To quote from Sachs and Wu, p. 27:

"The requirement of time orientability is suggested by our knowledge of thermodynamical processes on the earth, now. The second law of thermodynamics implies that one can distinguish past directions from future directions on earth by measuring the increase in entropy. It seems somewhat reasonable to assume that thermodynamics will smoothly determine future directions in the whole universe.

"No one knows if this is true, but if we ever really met beings going the wrong way in time, trying to communicate with them would presumably be as confusing as trying to talk to some of the regents of the University of California."

It seems to me equally reasonable to associate time-orientability with the dynamics of [scale factor](#), as driven by the so-called "dark" energy of [\[you-name-it\]](#), but it will be pure poetry, as the excerpt from Sachs and Wu above.

I hope you have a better idea.

Best - D.

On Mon, Oct 3, 2011 at 4:22 AM, Dimi Chakalov <dchakalov@gmail.com> wrote:

>

> Dear Waldyr,

[snip]

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**Note:** The problem of tracing down the **origin** of time is well-known since Aristotle: recall the [First Cause](#). Its *physical* manifestation goes *via geometry* only, and will inevitably look like [self-acting](#). That's what makes it "[dark](#)".

*Mens agitat molem* (Vergil, [The Aeneid](#), Ch. 6, 727). In German: *Der Geist bewegt die Materie*. Just a suggestion, for the forthcoming [models of gravity](#).

D. Chakalov  
October 3, 2011, 14:00 GMT

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Subject: [arXiv:1109.6049v1 \[quant-ph\]](#)  
Date: Fri, 30 Sep 2011 02:20:34 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Warren Leffler <wkleffler@aol.com>, wleffler@losmedanos.edu  
Cc: Chris <c.isham@imperial.ac.uk>, Andreas <andreas.doering@comlab.ox.ac.uk>, Jeremy <jb56@cam.ac.uk>

<http://arxiv.org/abs/1109.6049>

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Dear Warren,

It is a real pleasure to read your paper. Thank you!

I think the *\*imposition\** of "a probability distribution (and therefore a countably additive measure)" ([p. 2](#)) is what makes certain explications (=eigenvalues of self-adjoint operators) of quantum objects 'colorless' (in Hilbert space dim 3 or more), so they have to be shifted in the [uncolored KS sphere](#); general remarks on the KS Theorem at

<http://www.god-does-not-play-dice.net/#Castro>

BTW Erwin Schrödinger mentioned the improper use of probabilities for UNdecidable states in November 1950; references at my web site.

So, the message from Schrödinger and KS Theorem is that we have to avoid probabilities for describing the UNdecidable quantum state: it cannot live in *\*any\** Hilbert space (some people are trying to catch it with [toposification of Quantum Theory](#)).

All the best,

Dimi

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**Note:** Let's go back to the three quantum guys, [Tom, Dick, and Harry](#).

To mimic the case of Hilbert space dim **2**, suppose Tom and Dick are explicating their "states" by raising their hands, either left or right. We say that Tom and Dick don't possess any pre-existing (prior to observation) "hands", and agree that their "hands" are [contextual](#)'.

If the two guys are *entangled*, QM says that measurement on one "part" of the entangled system {Tom, Dick} changes the [probability](#) of the outcome of measurements on the "second part" of the system. It is like tossing one quantum coin with two "entangled" states, heads-and-tails; the difficulties to grasp the nature of entanglement is in the notion of **ONE**-ness, as with the [shoal of fish](#).

Yet we still have the usual QM formalism employing Hilbert space and probability calculus, which **requires** the sum of probabilities to add to unity. So, if we see Tom having raised his right hand, we *know* that we *will* observe the left hand of Dick with **certainty**.

To explain the crux of KS Theorem, in the case of Hilbert space dim **3** (or more), we instruct [Tom, Dick, and Harry](#) to (i) raise one hand vertically and stretch the other horizontally, and (ii) align to each other in such way that their hands will consume all three dimensions of space, along three orthogonal axes in space.

Suppose Tom raises his hands along (+x, +y) axes, and Dick raises his hands along (-x, -y) axes. Then Harry would have the options to raise his hands along (z, y) and (z, x) axes, in order to comply with the unitary rule which **requires** the sum of probabilities to add to unity.

However, in certain cases the unitary rule, **imposed** on Harry, makes him hand-*less* (say, if you set consistent spins for 30 out of 33 directions, the final three must paradoxically be both 1 and 0; cf. [Zeeya Merali](#)). He simply cannot show up the "quantum state" of his hands, in the macroscopic 3-D space and simultaneously with **all** "quantum states" of the hands of Tom and Dick.

Surely Harry has explicable "hands", but they cannot be shown under the conditions of **the unitary rule**. If next time Harry takes the initiative and raises his hands according to the rules above, Dick can follow him, but **not** Tom. This time, Tom will be stripped of "hands". If Tom and Harry raise their hands, then Dick will be hand-*less*. Why is this difficult to understand, I wonder.

It is impossible to decompose/distill **all** explicable "quantum states", in the case of Hilbert space dim **3** (or more), in such way that **they all** will have well-defined macroscopic manifestation, in 3-D space and in **one** instant, as recorded with your wristwatch. This is the crux of Kochen-Specker (KS) Theorem.

Notice that the meaning of unitary rule is 'something **will** happen with certainty'. This rule isn't applicable to the UNdecidable KS state which can never ever show up as 'eigenvalues of self-adjoint operators' and 'physical reality' in general.

To sum up, the UNdecidable KS state can **never** obey to the unitary rule plus the requirement to display 'the *complete* catalogue of expectation values' in the macroscopic 3-D space.

It is impossible *in principle* to apply "counterfactual definiteness" (recall that Bell's theorem is based on counterfactual definiteness) in Hilbert space dim **3** or more. Any musings of the type 'if we had made a certain alternative measurement (rather than the one we did make) we would have obtained such-and-such result with such-and-such probability' are **wrong**: we have encountered not just 'contextual phenomena' but the brand new, UNdecidable, pre-quantum KS state as well. From the perspective of Boolean logic, it is both "is" & "is not" (YAIN, in German).

Contrary to the opinion in [Wiki](#), the existence of such *pre-quantum* element of reality is demonstrated by the KS Theorem. It isn't 'physical reality' though. It is a much broader form of reality known since Plato, called here 'potential reality'.

The KS Theorem is **not** "a complement to Bell's theorem", as claimed in [Wiki](#), because you can't employ any 'counterfactual definiteness' in the presence of the UNdecidable pre-quantum KS state.

If the KS Theorem were wrong, one could introduce an experimental **context**, then write down the **full** 'catalogue of expectation values' in 3-D space, and prove [Schrödinger](#) wrong by counterfactual definiteness: 'a variable would have a *definite* value *before* I measure it; then measuring it would simply mean *ascertaining the context-dependent* value that it *had out there*.'

We must drop the unitary rule and Hilbert space, to understand the **artifacts** of QM formalism and grasp the UNdecidable pre-quantum KS state.

There is no other way to solve the measurement problem and the macro-objectification problem, to reconcile Quantum Theory with [Special Relativity](#), and then with General Relativity. The only way to solve the old cosmological "constant" paradox is to start with the *potential reality* in the quantum vacuum, which does not possess 'positive energy density', hence does **not** gravitate.

We need to change the quantum theory from current QM textbooks, and the current GR as well. Just follow the legacy of [Schrödinger](#) and [Margenau](#).

Unfortunately, nobody seems to care. Nobody. Even Chris Isham, who is aware, at least [since 2002](#), of my efforts to endorse the legacy of [Schrödinger](#) and [Margenau](#), decided to instead explore a "[toposification](#)" of quantum theory. He collected \$75,000 research grant from [FOXi](#) and dubbed me "[just another crank](#)".

Another prominent theoretical physicist, Lee Smolin, who is also fully aware of my efforts, collected last year [\\$47,500 from FOXi](#) and \$6,000 from FOXi 2007-Spring [mini-grant](#) to "support travel for collaborators working on a book about the nature of time in physics and cosmology -- in progress." He never responded to my proposals either.

Two years ago, I asked 75 (seventy-five) prominent physicist to endorse the submission of my manuscript to [\[gr-qc\]](#) -- two flatly denied, the rest didn't even bother to respond (Chris Isham included). An enormous amount of money, earned with hard labor by millions of taxpayers, has been wasted, and [even more](#) is scheduled to be wasted.

People just don't care about quantum gravity. It's a well-known phenomenon, not limited to theoretical physicists: look what happened with [Peter H. Duesberg](#).



D. Chakalov  
September 30, 2011  
Last updated: October 1, 2011

=====

Subject: On the limits of quantum theory  
Date: Mon, 29 Aug 2011 18:36:16 +0300  
Message-ID:  
<CAM7Ekxmw-q=nDV=DLbbQCIOH=9Q-2PSu4T0=bR1jzBWQJProFg@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: George <George.Ellis@uct.ac.za>  
Cc: Charles Baily <baily@colorado.edu>,  
Hans Havlicek <havlicek@geometrie.tuwien.ac.at>,  
Josef Tkadlec <tkadlec@fel.cvut.cz>,  
Gennaro Auletta <auletta@unigre.it>,  
Chris <c.isham@imperial.ac.uk>,

Karl <svozil@tuwien.ac.at>

George F R Ellis, On the limits of quantum theory: contextuality and the quantum-classical cut,  
arXiv:1108.5261v1 [quant-ph]  
<http://arxiv.org/abs/1108.5261>

Hi George,

I cannot understand why you avoided all facts contradicting your ideas (e.g., "omnipresence of state vector reduction," p. 7).

You didn't even mention the KS Theorem,

<http://www.god-does-not-play-dice.net/#KS>

You wrote (p. 2): "before a measurement is made, the state vector  $|\phi\rangle$  can be written as a linear combination of [unit orthogonal basis vectors](#)," referring to Chris Isham's textbook (Lectures on Quantum Theory: Mathematical and Structural Foundations, London: Imperial College Press, 1995, pp. 5-7).

No combination of "unit orthogonal basis vectors" can possibly describe 'the quantum state' -- it is inherently UNdecidable; cf. the link above.

The initial 'quantum state' cannot be "fully known" (p. 3) in principle. Also, it does not undergo any "collapse" or "[decoherence](#)".

If you or any of your colleagues cannot understand the arguments at the link above, it will be entirely my fault -- please write me back with your questions, and I will elaborate.

Just please don't treat Quantum Theory like some fashion designer. Face the KS Theorem.

All the best,

Dimi

=====

Subject: Re: The Free Will Theorem, [quant-ph/0604079 v1](#)  
Date: Wed, 20 Apr 2011 23:27:24 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Specker Ernst <ernst.specker@math.ethz.ch>  
Cc: Simon Kochen <kochen@math.princeton.edu>

Dear Professor Specker,

Thank you for your kind email. It is a great honor and privilege to hear from you.

I learned too late about the Colloquium commemorating your [90th Birthday](#) (October 29-30, 2010), and wasn't able to attend. I only wanted to tell you two things.

As my dad used to say, there isn't such thing as 'retired eagle' -- eagles either fly and fight, or drop dead while flying. You are a real Eagle.

And secondly, I will fight for your Theorem until I see it in QM textbooks -- properly explained, along with its immediate implications. You set the stage in [1960](#), yet the established theoretical physics community is still struggling to understand that "it is impossible to have consistent predictions about a quantum mechanical system (not considering exceptional cases)."

With best regards and deep admiration,

Yours faithfully,

Dimi Chakalov

On Wed, 20 Apr 2011 18:41:44 +0000,  
Message-ID: <929AD7A99986E043A5B7E8423EB731350BC54C@MBX22.d.ethz.ch>,  
Specker Ernst <ernst.specker@math.ethz.ch> wrote:

>  
> Dear Dimi Chakalov  
> Thank you - I will try to understand it.  
> Kind regards  
> Ernst Specker  
>  
> \_\_\_\_\_  
> From: Dimi Chakalov [dchakalov@gmail.com]  
> Sent: Wednesday, April 20, 2011 4:32 PM  
> To: Simon Kochen  
> Cc: Specker Ernst;  
> Subject: Re: The Free Will Theorem, [quant-ph/0604079 v1](#)  
>  
> P.P.S. Update at  
> <http://www.god-does-not-play-dice.net/#Castro>  
>  
> D.C.

=====  
Subject: Re: [arXiv:0711.4650v3 \[quant-ph\]](#), " ... we need only EPR, Bell, and Kochen-Specker."  
Date: Sat, 23 Apr 2011 12:41:50 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Adam Brandenburger <adam.brandenburger@stern.nyu.edu>  
Cc: Noson Yanofsky <noson@sci.brooklyn.cuny.edu>,  
Samson Abramsky <samson@comlab.ox.ac.uk>,  
Andreas <andreas.doering@comlab.ox.ac.uk>

Dear Adam,

Thank you for informing me about your new manuscripts.

> "[A Unified Sheaf-Theoretic Account of Non-Locality and Contextuality](#)" (by  
> Samson Abramsky and Adam Brandenburger)

I think the drawing on p. 2 is unrelated to the precise interpretation of KS Theorem, which is not about any "hidden" [whatever]. It is about \*the\* quantum state which cannot fit into any Hilbert space whatsoever. If this is your interpretation of 'hidden', I will agree with you.

If you use Hilbert space and probabilities (or some toposicaficated version of quantum theory, like [Andreas](#)), you aren't addressing the KS Theorem,

<http://www.god-does-not-play-dice.net/#Castro>

Please let me know if you are unable to understand the arguments -- it will be **entirely** my fault.

> "[What Does a Hidden Variable Look Like?](#)" (by Adam Brandenburger and H.  
> Jerome Keisler)

If you use your brain, you can almost "feel" the UNSpeakable quantum state of your brain at

[http://www.god-does-not-play-dice.net/#Leydesdorff\\_101](http://www.god-does-not-play-dice.net/#Leydesdorff_101)

Wishing you and your colleagues a very happy Easter,

Dimi

P.S. BTW did you look at my 9/11 web page?

<http://tinyurl.com/USD-bancor>

D.

=====

Subject: The mediating field, [arXiv:1103.3974v1 \[quant-ph\]](http://arxiv.org/abs/1103.3974v1)

Date: Tue, 22 Mar 2011 04:56:14 +0200

From: Dimi Chakalov <dchakalov@gmail.com>

To: Daniel Bedingham <d.bedingham@imperial.ac.uk>

Cc: Karl <svozil@tuwien.ac.at> ,

Sun Yi <fantadox@gmail.com>

Dear Dr. Bedingham,

You introduced a 'mediating field' which "enables interactions to be smeared without reference to a preferred foliation of spacetime", and I wonder if you can test it with your brain,

[http://www.god-does-not-play-dice.net/#Leydesdorff\\_101](http://www.god-does-not-play-dice.net/#Leydesdorff_101)

In the case of the quantum world, the object explained at the link above should provide "quantum omniscience" (Karl Svozil, [arXiv:1103.3980v1 \[quant-ph\]](http://arxiv.org/abs/1103.3980v1)),

<http://www.god-does-not-play-dice.net/Margenau.html>

<http://www.god-does-not-play-dice.net/#KS>

<http://www.god-does-not-play-dice.net/about.html#GR>

I will appreciate your comments, as well as the feedback from your colleagues.

Kindest regards,

Dimi Chakalov

-----

**Note:** To understand the UNdecidable, pre-quantum, *potential* quantum state which [cannot fit in any Hilbert space](#), try to answer the question posed by Erwin Schrödinger in 1935: "But then what does it mean?"

It means that the three *quantum* guys, [Tom, Dick, and Harry](#), have the faculty of acquiring context-dependent "quantum states" in a way similar (but not identical) to the sayings quoted [above](#). If you observe, for example, (i) Harry with specific configurations of his hands, then (ii) without any hands whatsoever, and then (iii) with some new configurations of his hands, you will not observe '**the same** Harry but with different configurations of his hands'. Every time Harry shows up, you will see a **brand new** "Harry-like" version of his UNdecidable, pre-quantum, *potential* quantum state which (i) carries his Genidentität ([Kurt Lewin](#)), and (ii) cannot live in any Hilbert space whatsoever.

Why? Because [Tom, Dick, and Harry](#) don't have any pre-existing, non-contextual "quantum states" prior to their observation. The "quantum states" that we can *physically* observe are born anew from their common UNdecidable, pre-quantum, *potential* quantum state. Read again Erwin Schrödinger, from 1935:

"In general, a variable *has* no definite value before I measure it; then measuring it does *not* mean ascertaining the value that it *has*. But then what does it mean?"

The essence of KS Theorem is that it demonstrate "something that is **not** found among projective measurements in quantum theory" ([Yeong-Cherng Liang et al.](#)). Namely, we cannot, not even in principle, think of some '*complete* catalog of expectation values', in Schrödinger's terminology. In the **specific** setup of KS experiment, all possible classical-*able* states of [Tom, Dick, and Harry](#) cannot have simultaneously well-defined "hands": one of the three quantum guys will have to be shifted *temporarily* to his "uncolored KS sphere" (Helena Granström, [p. 2](#)).

Think of these contextual classical-*able* states as **templates** available to fill in with/by *the* UNdecidable, pre-quantum, *potential* quantum state: if you check out **all** templates in 3-D space, some of them will be left empty ("uncolored") under the particular examination, but if you check them out in a different sequence or '[order](#)', those which have been left empty ("uncolored") during the first counting will now possess contextual ("colored") classical-*able* states, at the expense of the same number of contextual ("colored") classical-*able* states from the first counting, which will now lose any "color" and will have to be shifted *temporarily* to their "uncolored KS sphere".

Why? Because otherwise the UNdecidable, pre-quantum, *potential* quantum state ("quantum omniscience", [K. Svozil](#)) will be inevitably decomposed into a **set** of classical-*able* states, or '*complete* catalog of expectation values'. Thank God, this is impossible [[Ref. 1](#)].

To sum up, recall Cantor's definition of 'set' (1895):

By a 'set' we understand any gathering-together **M** of determined well-distinguished objects **m** of our intuition or of our thinking (which are called the 'elements' of **M**) into a whole.

The UNdecidable, pre-quantum, *potential* quantum state (never in plural) belongs *exclusively* to the '[whole](#)'. That is, to 'the universe as a whole' or 'the universe as ONE'. All these "well-distinguished objects" emerge from **it** (not Him) along the [Arrow of Space](#), yet no "set" can possibly provide its *complete* decomposition or '*complete* catalog of expectation values'. Details [here](#).

One immediate corollary is that the toposification program of [Chris Isham](#) is destined to fail, because it assumes that some "toposificated" presentation of '*complete* catalog of expectation values' might eventually exist. As to GR, the elimination of the idea of "[curvature](#)" is straightforward: instead of introducing some fictitious "[external higher dimensional Euclidian space](#)" and then "handle these concepts '[intrinsically](#)' -- i.e., working solely within the 4-dimensional spacetime in which we find ourselves," we employ the same UNdecidable, pre-quantum, *potential* quantum-gravitational state (never in plural), as explained [above](#). Check out the prerequisites [here](#), and a widespread error [here](#).

Of course, nobody will pay attention -- my Crackpot Index (J. Baez) is **80**. It is much higher than the one acquired by [Andrea Rossi](#).

D.C.

March 23, 2011

Last updated: April 12, 2011

[Ref. 1] Specker, E. (1960), Die Logik Nicht Gleichzeitig Entscheidbarer Aussagen. *Dialectica*, **14**: 239-246. Translated by Michael Seevinck, [arXiv:1103.4537v1](#).

"... speculations about the "Infuturabilien" ['future contingencies', Michael Seevinck] also belong here, that is, the question whether the omniscience of God also extends to events that would have occurred in case something would have happened that did not happen.

---

S. 243:

Die Schwierigkeiten, die durch Aussagen entstehen, welche nicht zusammen entscheidbar sind, treten besonders deutlich hervor bei Aussagen über ein quantenmechanisches System. Im Anschluss an die dort übliche Terminologie wollen wir solche Gesamtheiten von Aussagen als nicht gleichzeitig entscheidbar bezeichnen; die Logik der Quantenmechanik ist zuerst von Birkhoff und von Neumann in [1] untersucht worden. Auf ihre Ergebnisse soll zurückgekommen werden. In einem gewissen Sinne gehören aber auch die scholastischen Spekulationen über die «Infuturabilien» hierher, das heisst die Frage, ob sich die göttliche Allwissenheit auch auf Ereignisse erstrecke, die eingetreten wären, falls etwas geschehen wäre, was nicht geschehen ist. (Vgl. hiezu etwa [3], Bd. 3, S. 363.)

.....

"Is it possible to extend the description of a quantum mechanical system through the introduction of supplementary -- fictitious -- propositions in such a way that in the extended domain the **classical propositional logic** holds (whereby, of course, for **simultaneously decidable** proposition negation, conjunction and disjunction must retain their meaning)?

"The answer to this question is negative, except in the case of Hilbert spaces of dimension 1 and 2.

....

"That such an embedding is not possible from dimension 3 and higher follows from the fact that it [this embedding] is not possible for a [three-dimensional space](#).

....

"An elementary geometrical argument shows that such an assignment is impossible, and that therefore it is **impossible** to have consistent predictions about a quantum mechanical system (not considering exceptional cases)."

-----

### Addendum

To explain the meaning of the statements "nature is contextual" and "the values only come into being during the act of measurement" [[Ref. 2](#)], notice that the assumption of 'noncontextuality', which is proven wrong, implies that the first statement is true: nature is indeed *contextual*.

The second statement, about how the values 'come into being', introduces the puzzle more precisely, as stressed by Schrödinger in 1935 (cf. [above](#)). In modern terms, it is about **revealing** Boolean-valued "quantum states" (always in plural) from a **non-Boolean**, UNdecidable, pre-quantum, *potential* quantum state (never in plural).

Even if we fix a 'context' by means of some 'complete set of compatible projective measurements (CSCPM)' [[Ref. 2](#)], we cannot, not even in principle, reduce/factorize the **non-Boolean**, UNdecidable, pre-quantum, *potential* quantum state into a **set** (cf. G. Cantor [above](#)) of Boolean-valued "quantum states".

It can't be decomposed into *any set*. It can't fit in *any* Hilbert space whatsoever. It is **impossible** to have "consistent predictions about a quantum mechanical system" ([Ernst Specker, 1960](#)).

Some people hope to bypass these unsolved issues simply by proclaiming them wrong: we can't handle "incompatible frameworks," says [Bob Griffiths](#). Of course he can't make it, "due to the mathematical properties of the quantum Hilbert space" and the "framework based on **unitary time** evolution" ([CH: Questions and Answers](#)). The latter is an anti-relativistic Newtonian "time" that cannot be observed in principle, but Bob doesn't care. And neither does [Sean Carroll](#): "the state of the system at any one time is sufficient to determine its future and past evolution in time." If your wristwatch were able to read this "unitary time", how come nobody managed to reconcile QM with

Special Relativity, since 1931? Moreover, the very "definition" of time-as-read-by-your-wristwatch is totally unphysical: no physical object can **reproduce** our Gedankenexperiment about 'one second'. Anyway.

The implications for "quantum computing" (it must operate in a Hilbert space whose dimensions may be grown exponentially), the mythical "decoherence" (the alleged quantum-to-classical "transition"), and the search for some "god particle" are obvious. The latter is horribly expensive, but ... who cares?

"just another crank" D.C.

Crackpot Index: 80

April 1, 2011

[Ref. 2] Mordecai Waegell, P.K. Aravind, Parity proofs of the Kochen-Specker theorem based on the 24 rays of Peres, arXiv:1103.6058v1 [quant-ph]

<http://arxiv.org/abs/1103.6058>

pp. 11-13: "One of the simplest types of measurement that can be carried out on a quantum system is a projective measurement. Such a measurement amounts to asking the system if it has a certain property or not, and the system replies with either a yes or a no (to which we attach the values 1 and 0, respectively). A set of projective measurements is said to be compatible if there exist special states of the system for which the measurements always yield the same values, **no matter in what order** they are carried out or how often they are repeated.

"A complete set of compatible projective measurements (CSCPM) is a maximal set of such measurements, i.e., one that cannot be enlarged by adding further measurements of the same type. For a pair of two-level systems (or qubits), which is one of the physical settings in which the Peres rays can be realized, the number of measurements in a CSCPM is four.

"An important property of a CSCPM is its exclusivity: whenever it is carried out on any state of a system, exactly one of the measurements returns the value 1 and all the others return the value 0. The properties of CSCPMs laid out so far are all well established experimental facts.

.....

"A realist, who believes that the values observed for a CSCPM exist even before measurement, and who also subscribes to the assumption of noncontextuality (i.e., the notion that the value observed for a particular projective measurement is **independent** of the CSCPM it is carried out as a part of) would be faced with the task of assigning a 0 or a 1 to each of the Peres rays in such a way that each basis contains exactly one 1 and three 0's in it.

"However the various parity proofs presented in this paper demonstrate that this task is impossible, and so the realist's position is refuted. The key assumption made by the realist that undermines his position is the assumption of noncontextuality."

=====

Subject: [lrr-2011-5](#)

Date: Tue, 2 Aug 2011 16:34:01 +0300

Message-ID:

<CAM7EkxmUd8wFJ\_nNPQR9T-56TdNyNuiSGf6LsqxfW4x30pgakw@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: sheila.rowan@glasgow.ac.uk,

matthew.pitkin@glasgow.ac.uk,

stuart.reid.2@glasgow.ac.uk,

james.hough@glasgow.ac.uk

Cc: Leonid.Grishchuk@astro.cf.ac.uk,

B.Sathyaprakash@astro.cf.ac.uk,

Stefan.Krueckeberg@dfg.de,

Bernard.Schutz@aei.mpg.de,

karsten.danzmann@aei.mpg.de,

council@stfc.ac.uk

Dear colleagues,

I wonder if you have a clue about "the nature of the gravitational interaction" at the production of GWs by "very large masses" being accelerated in "very strong gravitational fields" (Sec. 2).

Can you suggest a theory of "very strong gravitational fields" producing very strong "ripples in the curvature of space-time" and very strong "tidal effect" (Sec. 3) ?

If you don't have such theory of "very strong gravitational fields", how can you possibly claim that your linearized approximation is the correct theory describing some *veeery* weak GWs ?

<http://www.god-does-not-play-dice.net/#LIGO>

Sincerely,

Dimi Chakalov

*Ceterum autem censeo, LIGO esse delendam*

**Note:** Energy transport by GWs is a "fundamentally **nonlinear** phenomenon" (Hermann Bondi). Even if you imagine some sufficiently strong, to be detected, GW that is *veeery* weak upon reaching Earth, its energy transport will be, again, a "fundamentally **nonlinear** phenomenon", which cannot, *not even in principle*, be modeled with respect to some undisturbed "background":

"For weak waves, it is possible to define their energy with reference to the "**background**" or undisturbed geometry, which is there **before** the wave arrives and **after** it passes" (Bernard Schutz).

No, it is impossible to define GW energy with any linearized approximation of GR.

You will **kill** the very effect you wish to measure.

*Ceterum autem censeo, LIGO esse delendam.*

D. Chakalov

August 2, 2011

=====

Subject: [Copy] Email sent to Living Reviews in Relativity

From: contact.lrr@livingreviews.org

To: dchakalov@gmail.com

Message-Id: <20110802151856.BD051174074@v-linux.aei.mpg.de>

Date: Tue, 2 Aug 2011 17:18:56 +0200 (CEST)

Hello Dimitar G. Chakalov,

This is a copy of the email you sent to Living Reviews in Relativity. If appropriate to your message, you should receive a response quickly. You successfully sent the following information:

Email: dchakalov@gmail.com

Phone:

Website: <http://www.god-does-not-play-dice.net/#LRR>

Subject: To make a comment

Message:

My objections to lrr-2011-5 can be read at

<http://www.god-does-not-play-dice.net/#LRR>

Pity you don't care. But after the failure of the "enhanced" and "advanced" LIGO, you most certainly

will.

Dimi Chakalov

-----  
Other Data and Information:

Time Stamp: Tuesday, August 2nd, 2011 at 5:18 pm

=====  
Subject: GWs cannot be detected with LIGO or LISA  
Date: Sat, 2 Apr 2011 19:12:59 +0300  
Message-ID:  
<AANLkTi=gA9\_fiUe\_6GFoCamGAD+84Np=ZAEhUgBLwXS9@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: [Leonid.Grishchuk@astro.cf.ac.uk](mailto:Leonid.Grishchuk@astro.cf.ac.uk),  
B.Sathyaprakash@astro.cf.ac.uk,  
[snip]  
Cc: Bernard Schutz <Bernard.Schutz@aei.mpg.de>

Dear Colleagues,

Do not let Bernard Schutz fool you,  
[http://www.god-does-not-play-dice.net/#note\\_6](http://www.god-does-not-play-dice.net/#note_6)

Check out a simple expose of GR at  
<http://www.god-does-not-play-dice.net/about.html#GR>

The forthcoming scandal about LIGO will be enormous:  
<http://www.god-does-not-play-dice.net/Szabados.html#SBG>

The unresolved tasks of GR are [strictly mathematical](#), and have nothing to do with its linearized approximation,  
<http://www.god-does-not-play-dice.net/#Gray>

Should you (B. Schutz included) cannot understand the arguments, please drop me a line, and I will elaborate.

Kindest regards,

Dimi Chakalov

----

**Note:** [Joshua Goldberg](#) believes that the famous 1962 paper by [Bondi et al.](#) has resolved the issue of energy transport by GWs. As Hermann Bondi stressed in February 1990, "the question of the "reality" of the waves essentially concerned whether they transported energy. Such transport is a fundamentally **nonlinear** phenomenon."

Perhaps the main reason why we cannot understand this **nonlinear** phenomenon is that we still don't have a definition of 'isolated system in GR': the seemingly simple expression [r --> \[infinity\]](#) (reference [here](#), pp. 1728-1734) is the biggest unresolved *mathematical* problem in GR. In the case mentioned by [Bernard Schutz](#),  $r$  is roughly  $(10^{10})^9$  km, so all "regional" definitions "in regions at least as large as a wave-length" (*ibid.*) are sheer poetry and wishful thinking.

And of course the *source* of the so-called '[dynamic dark energy](#)' is unknown. One immediate corollary is that [the "ban" on dipole radiation](#) doesn't hold any more. Obviously, the present-day GR is an essentially incomplete theory.

Even in the framework of the current GR, "a gravitational wave can only give rise to **longitudinal** oscillations, that is, oscillations in the direction of wave propagation", as demonstrated by [Pereira et al.](#)

The people from LIGO "scientific" collaboration ([848 distinguished experts](#)) don't care. They deeply believe that the *linearized approximation* of the current, incomplete GR is applicable to the task of detecting GWs. Which is wrong. The linearized approximation of GR is a [shut-up-and-calculate tool](#) which can be used for adjusting the [GPS system](#), say. It cannot be used for fundamentally **nonlinear** phenomena such as the energy transport by GWs.

May I offer LIGO "scientific" collaboration two simple ways to refute the objections above, and defend their expectations from the "enhanced" and the "advanced" LIGO, as well as their multi-billion project LISA.

**1.** Ensuing from strong GWs produced by your "sources", demonstrate that you can obtain some *veeery* weak GWs propagating on undisturbed background:

"For weak waves, it is possible to define their energy with reference to the "**background**" or undisturbed geometry, which is there **before** the wave arrives and **after** it passes" (Bernard Schutz, [p. 317](#)).

If you fail to obtain such [weak limit](#) from strong GWs, you have no right to claim that you understand what you're doing.

To quote [M. Maggiore](#) (p. 32): "In special (unrealistic - D.C.) cases one can find exact wave-like solutions of the full nonlinear Einstein equations, see, e.g. Misner, Thorne and Wheeler (1973), Section 35.9, and then there is no need to perform a [separation](#) (Sic! - D.C.) between the background and the waves. However, it would be **hopeless** to look for exact solutions for the gravitational waves emitted by realistic astrophysical sources."

*Voila*, straight from the horse's mouth.

**2.** Ensuing from your "linearized approximation", try to resolve the problems from its immediate consequences presented with the SBG argument:

<http://www.god-does-not-play-dice.net/Szabados.html#SBG>

You cannot keep just the 'good bits' from your "linearized approximation" and ignore its immediate consequences, because the latter refute your "linearized approximation" with **reductio ad absurdum**. It's a bundle.

Of course, LIGO "scientific" collaboration won't reply. I raised my concerns eight years ago, in [February 2003](#), but never received any professional reply. It is so much easier to enjoy their hobby and waste **billions** of taxpayers' money.

**Shame on you, LIGO "scientific" collaboration.**

D. Chakalov, April 7, 2011

*Ceterum autem censeo, LIGO esse delendam*

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Subject: [arXiv:1104.2927v1 \[hep-th\]](#), ref. [2], p. 165, Eqs (7.6.4) and (7.6.5)

Date: Mon, 18 Apr 2011 15:30:58 +0300

From: Dimi Chakalov <dchakalov@gmail.com>

To: Charles Schwartz <schwartz@physics.berkeley.edu>

Cc: Steven Weinberg <weinberg@physics.utexas.edu> ,

lbszab@rmki.kfki.hu,

joergf@maths.otago.ac.nz,

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nester@phy.ncu.edu.tw,  
niall@ucc.ie,  
schoen@math.stanford.edu,  
yau@math.harvard.edu,  
robert.beig@univie.ac.at,  
seri@math.princeton.edu,  
sola@ecm.ub.es,  
calcagni@aei.mpg.de,  
domenico.giulini@itp.uni-hannover.de,  
wadih@unb.br,  
witten@ias.edu,  
guendel@bgu.ac.il

Dear Charles,

Regarding Weinberg's "[Gravitation and Cosmology](#)" ([arXiv:1104.2927v1 \[hep-th\]](#), ref. [2]), I think the alleged energy-momentum tensor of gravitation, Eq. (7.6.4), and "the total energy-momentum "tensor" of matter and gravitation" -- "the energy-momentum "tensor" of the gravitational field itself" (exact quote from p. 165) -- do not make any sense whatsoever.

These statements are not some "approximations", as you or some of your colleagues might argue. They are **terribly** misleading.

Anything that pertains to the gravitational field \*itself\* is [quasi-local](#). It's a whole new ball game,

<http://www.god-does-not-play-dice.net/#Jorg>

Shall I elaborate?

See also

[http://www.god-does-not-play-dice.net/#wine\\_cellars](http://www.god-does-not-play-dice.net/#wine_cellars)

Regards,

Dimi

=====

Subject: Expansion of space -- with respect to what?

Date: Tue, 2 Aug 2011 21:07:21 +0300

Message-ID:

<CAM7EkxkP0S1Vz-7914KTtF3kxWCFcaOS8sMac4JzMNshh-Ka8g@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: mfrancis@physics.usyd.edu.au,

gfl@physics.usyd.edu.au,

luke.barnes@phys.ethz.ch

Cc: [Michal Chodorowski](#) <michal@camk.edu.pl> ,

ybolotin@gmail.com,

oleg.lemets@gmail.com,

denyerokhin@gmail.com

Dear colleagues,

Please correct me if I'm wrong.

I think 'expansion of space' cannot be defined with respect to **itself**, e.g., the increase over time of the distance between observers. One should somehow place these observers "at rest with respect to the cosmic fluid", as you suggested in [arXiv:astro-ph/0707.0380](#).

Problem is, we cannot directly observe this "cosmic fluid", because we cannot switch from Archimedean to [non-Archimedean geometry](#),

<http://www.god-does-not-play-dice.net/#error>

If the 'expansion of space' is the physical manifestation of the phenomenon of transience (the Heraclitean time), then its driving force \*must\* be hidden, or else we can't have any theory of relativity: the ether will be exposed. If so, you have a bona fide candidate for the source of that (sorry) "dark energy".

Notice that the bi-directional talk between matter and geometry (John Wheeler) is valid for just one instant, while the phenomenon of transience presupposes absolute past, present, and future -- "You cannot step into the same river twice, for fresh waters are ever flowing in upon you" (Heraclitus).

In GR parlance, more and more space ... "[appears](#)".

Will be happy to elaborate.

All the best,

Dimi Chakalov

-----

**Note:** Before going into discussion on 'expansion of space', recall the main unresolved puzzle: **finite time interval** & **space volume**. Mother Nature creates 'finite things' -- Large vs Small -- with **infinitesimals** along the **Arrow of Space**, while people think about GR as **bartenders** and offer totally unfeasible Gedankenexperiments about '**one second**'. The difference between you and Mother Nature is that She can add as many infinitesimal "points" as you wish to a **finite** volume of space, and it won't change a bit. Why? Because we're dealing with **non-Archimedean geometry**. But if you add just one period of the transition between the two hyperfine levels of the ground state of the cesium-133 atom -- from 9,192,631,770 to 9,192,631,771 -- you'll ruin the "definition" of '**one second**'. Again, I will be happy to elaborate. Just notice that you have the same conundrum of "expansion/contraction" of space in [GW parapsychology](#).

D.C.

August 3, 2011

=====

Subject: Re: Expansion of space -- with respect to what?

Date: Wed, 3 Aug 2011 23:54:53 +0300

From: Dimi Chakalov <dchakalov@gmail.com>

To: barnesl <barnesl@phys.ethz.ch>

Cc: mfrancis@physics.usyd.edu.au,

gfl@physics.usyd.edu.au,

Cc: [Michal Chodorowski](#) <michal@camk.edu.pl>,

[snip]

Dear Luke,

Thank you for your reply.

> The first problem in your email is the claim: "we cannot directly observe  
> this cosmic fluid." Yes we can.

I meant [the reference fluid of GR](#), after Hilbert and Einstein.

> It comes in a number of components, some of which are observable.

> The best example is the Cosmic Microwave Background (CMB).

Beautiful. Are you going to explain 'the increase of the distance between observers' w.r.t. CMB?

Because you can't do it 'with respect to **itself**'. Only Baron Munchausen can do such self-referential miracles.

- > I have also failed to "notice" that "the bi-directional talk between matter
- > and geometry (John Wheeler) is valid for just one instant". I've read most
- > of John Wheeler's General Relativity textbook and I'm pretty sure he didn't
- > notice that either.

You can be damn sure he didn't notice it. "These are the laws of an instant in canonical gravity. (...) In general relativity, dynamics is entirely generated by constraints. The dynamical data do not explicitly include a time variable," says [Karel Kuchar](#) [snip]

- > All the best with your theory

It's Heraclitus' theory. If you ignore it, you will keep wondering about 'more and more space appears' for many years to come.

If you wish to respond professionally, do yourself a favor: follow the links at

<http://www.god-does-not-play-dice.net/#Heraclitus>

All the best,

Dimi

=====

Subject: Re: [arXiv:1107.5894v1 \[physics.gen-ph\]](#)

Date: Thu, 4 Aug 2011 13:28:47 +0300

From: Dimi Chakalov <dchakalov@gmail.com>

To: Рылов Юрий <yrylov2006@yandex.ru>

Cc: Laszlo Szabados <lbszab@rmki.kfki.hu> ,

Adam Helfer <helfera@missouri.edu>

Юрий Алексеевич,

- > About relative localization of the gravitational field.

In GR, you don't have any '[localization of the gravitational field](#)' in the first place; see my web site for references. The "localization" cannot be 'relative to itself', nor 'relative to any \*finite\* volume of space', which is why I asked about your thoughts regarding 'localization relative to [the rest of the universe](#)'. It is the last remaining option IMHO.

If some day you or any of your colleagues discover the proper mathematical presentation of 'quasi-local', we all will hear about it on CNN Breaking News.

- > My relation to connection with Mach's approach can be expressed by
- > "Глубокая философия на мелком месте" .

I know what you mean. If some day you or any of your colleagues discover the origin and mechanism of those "[instantaneous](#)" inertial reaction "forces", ... see above.

More at

<http://www.god-does-not-play-dice.net/#Heraclitus>

All the best,

Dimi

>> Hi Yuri,  
>> Ernst Mach would have probably said that there is a sense to ask about  
>> the value of gravitational field at the point  $x$ , but \*only\* relative  
>> to the values of the gravitational field at 'the rest of the  
>> universe',  
>> <http://www.god-does-not-play-dice.net/about.html#GR>  
>> Do you agree with such [Machian relational ontology](#)?  
>> Regards,  
>> Dimi  
>

=====

Subject: Jonathan Dowling on enhancing LIGO's "sensitivity"  
Date: Thu, 24 Mar 2011 23:58:08 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Jonathan <jdowling@phys.lsu.edu>  
Cc: Jorge Pullin <pullin@lsu.edu>,  
Barry Sanders <sandersb@ucalgary.ca>,  
Kavita Rajanna <mail@fqxi.org>,  
Carlton Caves <caves@info.phys.unm.edu>

<http://physicsworld.com/cws/article/news/45535>

"Dowling says that if the American LIGO detector could operate with a sensitivity that scales as  $1/N^{3/2}$  rather than as  $1/N^{1/2}$  then either its sensitivity could be greatly increased or its laser power enormously reduced, which would avoid potential heating and deformation of the facilities' optics. "This opens up a whole new ball game in nonlinear interferometry," he adds."

-----

Jonathan:

You are again wrong. LIGO has been a dead turkey from the outset: just drive the [linearized approximation of GR](#) to its inevitable "predictions", and you'll get reductio ad absurdum,

<http://www.god-does-not-play-dice.net/Szabados.html#SBG>

You already wasted \$102,061 from FQXi, remember?

Would you like to learn \*exactly\* why you failed, or shall I follow your advice (Fri, 08 Feb 2002 00:25:08 -0800, Message-ID: <3C638B65.88ACE03@earthlink.net>) "Never give oxygen to Morons....." ?

D. Chakalov

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\$102,061 Quantum Measurement in the Timeless Universe  
[http://fqxi.org/grants/large/awardees/view/\\_details/2008/dowling](http://fqxi.org/grants/large/awardees/view/_details/2008/dowling)

"Our goal is to reconcile this timeless nature of the universe with quantum theory's definite "arrow of time." To accomplish this, we need to go back to the foundations of quantum theory and re-write the measurement postulate itself, using the modern-day tools of information theory."

=====

Subject: Re: Jonathan Dowling on enhancing LIGO's "sensitivity"  
Message-ID: <4D8C0613.3000902@lsu.edu>  
Date: Thu, 24 Mar 2011 22:03:47 -0500  
From: [Jonathan Dowling](mailto:jpwdowling@gmail.com) <jpwdowling@gmail.com>  
Reply-To: [jdowling@lsu.edu](mailto:jdowling@lsu.edu)  
Organization: LSU  
To: Dimi Chakalov <dchakalov@gmail.com>  
CC: Jonathan <[jdowling@phys.lsu.edu](mailto:jdowling@phys.lsu.edu)>,  
Jorge Pullin <[pullin@lsu.edu](mailto:pullin@lsu.edu)>,  
Barry Sanders <[sandersb@ucalgary.ca](mailto:sandersb@ucalgary.ca)>,  
Kavita Rajanna <[mail@fqxi.org](mailto:mail@fqxi.org)>,  
Carlton Caves <[caves@info.phys.unm.edu](mailto:caves@info.phys.unm.edu)>

Gobble, gobble, gobble — quack!

--

Dr. Jonathan P. Dowling  
Hearne Professor of Theoretical Physics  
Co-Director, Hearne Institute for Theoretical Physics

Quantum Sciences and Technologies Group  
Department of Physics & Astronomy  
Louisiana State University  
202 Nicholson Hall, Tower Drive  
Baton Rouge, LA 70803

Tel: (225) 578-0887  
Admin: (225) 578-2163  
Fax: (225) 578-0824

Email: <mailto:jdowling@lsu.edu>  
Admin: <mailto:quantum@phys.lsu.edu>  
URL: <http://phys.lsu.edu/~jdowling/>

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**Note:** The response from [Jonathan P. Dowling](mailto:jdowling@lsu.edu) -- "Gobble, gobble, gobble — quack!" -- is an exact summary of his knowledge in GR and foundations of quantum theory, and his relentless efforts to reconcile the timeless nature of the universe with quantum theory's definite "arrow of time", using the modern-day tools of information theory. All this for just \$102,061 from [FOXi](http://www.foxi.org) (oxygen is free).

Back in February 2002, I wrote:

---



Now, I declare that I will accept your view iff you can suggest a theory of [Lorentz invariant nonlocality](#).

Please answer my objections above, and then state the conditions under which you will declare that the task for quantum computing is not feasible **in principle**.

I extend this request to all physicists reading this critical note on "quantum computing", regardless of who their contractor is -- DoD, DERA, or someone else.

Let's put our cards on the table. It's about time.

Sincerely yours,

D. Chakalov  
February 9, 2002

P.S. Carlton M. Caves, whose work on "quantum computing" is partly sponsored by U.S. Office of Naval Research, also decided to play ostrich [[Ref. 9](#)], just like his colleague Jonathan P. Dowling [[Ref. 5](#)]. But what if they stand on ONR concrete instead of sand?

D.C.  
February 11, 2002

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Jonathan P. Dowling is already Co-Director of Hearne Institute for Theoretical Physics at Louisiana State University. He still cannot, of course, suggest a theory of [Lorentz invariant nonlocality](#), only now he is milking [FOXI](#).

[Christoph Adami](#), the co-author of [arXiv:quant-ph/0202039v1](#), has also left the Quantum Computing Technologies Group (Section 367, Jet Propulsion Laboratory, Caltech), and is now interested in "how evolution shapes biological and engineering systems, and how information evolves in these systems".

The third person, [Carlton M. Caves](#), is still involved in "[quantum computing](#)". His dreams are explained at his web site [here](#):

"Crudely speaking, the classical counterpart can occupy any one of a complete set of orthogonal quantum states, whereas the quantum system can occupy not only the orthogonal states, but also any linear superposition of the orthogonal states. **Hilbert space is a big place!**---this slogan underlies research on information and complexity in quantum systems. Even simple quantum systems, having only a few Hilbert-space dimensions, have the potential for considerable complexity because of quantum superposition."

None of these people have read [Ernst Specker](#).

Not surprisingly, the "[quantum computing](#)" project at Jet Propulsion Laboratory (Quantum Computing Technologies Group, Section 367), has been abandoned:

<http://cs.jpl.nasa.gov/qct/>

D.C.  
March 25, 2011

=====

Subject: Re: Netiquette  
Date: Mon, 4 Apr 2011 04:59:01 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: ra@ift.unesp.br, jpereira@ift.unesp.br  
Cc: ratra@phys.ksu.edu, pjep@princeton.edu

Dear Ruben,

Thank you for your kind feedback. I have learned a lot from you and Jose, and am very much looking forward for more.

I found a crucial point in your textbook (cf. attached),

§ 3.42 Finite distances in space have no meaning in the general case, in which the metric is time-dependent. If we integrate  $\int dl$  and take the infimum (as explained in § 2.45), the result will depend on the world-lines. Only constant gravitational fields allow finite space distances to be defined.

... and am wondering what kind of 'time' you imply by saying that the metric is "time-dependent": is this some global time from the dynamic dark energy of [X], defined w.r.t. the vacuum [X] being at 'absolute rest' ?

For an opposite viewpoint, look at Peebles and Ratra, arXiv:astro-ph/0207347v2, footnote 19, p. 15: <http://arxiv.org/abs/astro-ph/0207347>

"This defines a preferred frame of motion, where the stress-energy tensor is diagonal, which is not unexpected because we need a preferred frame to define  $k_c$ . It is unacceptable as a model for the properties of dark energy, of course."

I think the preferred frame of motion/global time is unavoidable, hence must be made 'acceptable',

<http://www.god-does-not-play-dice.net/about.html#GR>

A penny for your thoughts!

All the best,

Dimi

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>> Dear Jose and Ruben,  
>>  
>> I mentioned one of your fundamental papers at  
>>  
>> <http://www.god-does-not-play-dice.net/#LIGO>  
>>  
>> All the best,  
>>  
>> Dimi  
>>

-----

**Note:** Ruben Aldrovandi and Jose Geraldo Pereira will probably prefer to avoid the issue of 'the global time' in which the metric is "time-dependent" (cf. [above](#)). The issue is indeed [very tricky](#), because any time you look at your wristwatch, you can only "measure" the so-called coordinate (physical) time, much like the story about [KS Theorem](#).

So, what kind of animal is 'the global time' ?

Think of [GMT](#). It isn't some preferred place located in Greenwich, UK. All clocks around the world read some local, *coordinate* time, yet the "intrinsic time interval associated to any timelike displacement" (T. Jacobson, pp. [18-19](#)) belongs to 'the global time'. It is like a global metronome which keeps all local "times" in accord with the infinitesimal timelike displacement along the [Arrow of Space](#).

Thanks to this 'global metronome' from the dynamic dark energy of [X] -- defined with respect to the vacuum being at **absolute rest** -- we can suggest Gedankenexperiment about '[one second](#)', which no *physical* object can possibly reproduce. Physically, it's a miracle, and I don't like it.

In the case of GR, all [one-second](#) local readings are "global" as well, in the sense that they are "a legitimate definition of (global) time" (Butterfield and Isham, [1999](#)). Yet we can never observe 'the global time' directly: see again the story about [KS Theorem](#).

The vacuum/ether/reference fluid **must not** be 'physical' or Lorentz-invariant stuff, because it will be **exposed**. It can only be "[dark](#)", as some (otherwise smart) people called it.

Jim Peebles and Bharat Ratra won't like it, of course. Eighteen years ago, Jim Peebles acknowledged (*Principles of Physical Cosmology*, [p. 193](#)):

"The resolution of this apparent paradox is that while energy conservation is a good local concept, as in equation (6.18), and can be defined more generally in the special case of an isolated system in asymptotically flat space, there is not a general global [energy conservation in general relativity](#)."

Of course not. Any "general global energy conservation" in today's GR is red herring (check out a polite and obfuscated explanation from Sean Carroll [here](#)). You can't have "an isolated system" in present-day GR in the first place, and can only seek the "right" answer to a wrong question (MTW, [p. 467](#)).

The only truly isolated system is The Universe -- cf. Eq. 1 on p. 35 from [ExplanatoryNote.pdf](#); its *total* energy is always conserved — it is always zero — during *the* global time from the [Arrow of Space](#). The symmetry transformations (cf. [below](#)) and energy conservation law, along the lines of Noether's Theorem ([Hamiltonian](#) formulation), are expected to be worked out by [25.11.2015](#).

In summary, [the metric](#) is always time-dependent in *the* global time. The obvious fact that we enjoy **finite** things, such as '[one second](#)' and '[one meter](#)', requires careful reexamination of the [differentiable manifold](#) postulated in the [current GR](#). We don't like miracles, do we?

D.C.

April 4, 2011

Last updated: April 5, 2011, 20:45 GMT

=====

Subject: Tachyons in GR

Date: Wed, 30 Mar 2011 05:57:40 +0300

From: Dimi Chakalov <dchakalov@gmail.com>

To: Charles Schwartz <schwartz@physics.berkeley.edu>

Dear Dr. Schwartz,

I just finished reading your latest [arXiv:1011.4847v2 \[math-ph\]](#), and came to the conclusion that I may never understand the three forms of mass -- see [Ref. 2] in

<http://www.god-does-not-play-dice.net/about.html#Villata>

See also [the footnote](#) on L74 at

<http://space.mit.edu/home/tegmark/dimensions.pdf>

... and some Russian speculations,

<http://arxiv.org/abs/gr-qc/0304018>

All the best,

Dimi Chakalov

----

**Note:** I tried to raise the question of space inversion [above](#), because the theory outlined at this web site **requires** that the dimensions of 'space' and of 'time' will swap places, that is, an "inverted" spacetime will have 3-D time and 1-D space. These two worlds (one of them will be "mirror") cannot interact over an extended spacetime domain: they could "meet" only on [null-surfaces](#). Anyway.

D.C.

March 30, 2011

=====

Subject: Knocking on the Specker's door  
Date: Fri, 1 Apr 2011 01:15:05 +0300  
Message-ID:  
<AANLkTinZi97V-WwWbYtc1AmUcLAH8ng0dYEPZ9NfCcV8@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Guido Tonelli <cms.outreach@cern.ch>  
Cc: James.Gillies@cern.ch, cern.courier@cern.ch, pippa.wells@cern.ch,  
james.dacey@iop.org, michael.banks@iop.org, randall@physics.harvard.edu,  
georgi@physics.harvard.edu

The hunt for the elusive Higgs, Mar 31, 2011  
<http://physicsworld.com/cws/article/multimedia/45587>

Guido Tonelli (06:37): "We need billions of events to produce a handful of candidates."

Dear Dr. Tonelli,

You already took billions of euro -- all taxpayers' money -- and still haven't sorted out your "theory".

You cannot detect an artifact from your incomplete hypothesis. You will face Georgi's UNparticles. If you insist on the standard hypothesis, the number of quarks will jump to 8 and more, in a [Fibonacci sequence](#).

May I suggest you to consult Ernst Specker,  
<http://www.god-does-not-play-dice.net/#Bedingham>

Sincerely,

Dimi Chakalov

=====

Subject: "Fantastically stupid students ... "  
Date: Fri, 26 Mar 2010 14:57:49 +0200  
Message-ID:  
<bed37361003260557x34e959b3n9581ea36185d6e06@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: [John Baez](mailto:baez@math.ucr.edu) <baez@math.ucr.edu>  
Cc: david.corfield@tuebingen.mpg.de, alex@math.ucr.edu,  
t.leinster@maths.gla.ac.uk, shulman@math.uchicago.edu,  
urs.schreiber@gmail.com, s.willerton@sheffield.ac.uk

"Fantastically stupid students - five times I repeat proof, already I understand it myself, and still they don't get it."

This Week's Finds in Mathematical Physics (Week 294)  
<http://math.ucr.edu/home/baez/week294.html>

[John:](#)

Regarding your last email from [14 Jan 2002](#), check out a simple explanation, with two clear drawings, at

<http://www.god-does-not-play-dice.net/#Bahn>

Any chance to qualify for your 'This Week's Finds in Mathematical Physics' ?

Or maybe the grapes are too high for you ?

[http://en.wikipedia.org/wiki/Cognitive\\_dissonance](http://en.wikipedia.org/wiki/Cognitive_dissonance)

Dimi

=====

Subject: Re: Black Holes and Schwarzschild's actual solution  
Date: Mon, 15 Nov 2010 13:06:03 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Christian Corda <cordac.galilei@gmail.com>  
Cc: Stephen Crothers <thenarmis@gmail.com>, Diego Lucio Rapoport <xxxxxxx@xxxxx.xxx>, Jeremy Dunning-Davies <J.Dunning-Davies@hull.ac.uk>

On Mon, Nov 15, 2010 at 12:11 PM, Christian Corda <cordac.galilei@gmail.com> wrote:  
[snip]

> Mr. Chakalov is a poor man who understand **NOTHING** about physics  
> and mathematics. He contacted my in the past by trying to convince me  
> that gravity-waves do not exists but I stopped to discuss with him when  
> I realized that he does not understand the principle of overlapping waves,  
> i.e. a principle that people learn during High School...

Instead of shouting with capital letters, all you have to do is prove me wrong:

<http://www.god-does-not-play-dice.net/Szabados.html#SBG>

On Thu, 18 Sep 2008 14:07:04 +0200 (CEST), Subject: Re: Netiquette, <christian.corda@ego-gw.it> wrote:

>  
> I can agree with your point of view, but the important point here is that  
> such a overlapping and conflating, like [spaghetti bolognese](#), could in  
> principle, generate a signal which is different from zero in the arm of an  
> interferometer.

So, you agreed with my point of view -- see SBG argument at the link above -- but claim that one can "generate a signal which is different from zero in the arm of an interferometer".

How would you extract such signal from the '[spaghetti bolognese](#)' ?

You've keeping quiet for two years.

Don't be shy, Christian. Go ahead. Make your best shot.

D.

=====

Subject: Re: Black Holes and Schwarzschild's actual solution  
Date: Mon, 15 Nov 2010 16:27:22 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Diego Lucio Rapoport <xxxxxxx@xxxxx.xxx>,  
Cc: Stephen Crothers <thenarmis@gmail.com>,  
Christian Corda <cordac.galilei@gmail.com>

Dear Diego,

> of course, a man that strives to assess GR by probing for gravitational  
> waves at a distance of  $10_{24}$ , without having a quantum theory, is a defender  
> of the faith, not a scientist.

Moreover, it's a dimensionless ghost that shows up only with ... " $2.3 \times 10^{-26}$ " ,

<http://www.god-does-not-play-dice.net/#Jones>

Anyway.

All the best,

Dimi

>> On Mon, Nov 15, 2010 at 12:11 PM, Christian Corda  
>> <cordac.galilei@gmail.com> wrote:  
>> [snip]  
>>  
>> > Mr. Chakalov is a poor man who understand NOTHING about physics  
>> > and mathematics.  
[snip]

-----

**Note:** Regarding the subject of this email correspondence, Black Holes and Schwarzschild's actual solution, I will post Christian Corda's reply to [Stephen Crothers](#), regarding 'The Schwarzschild Solution and its Implications for Gravitational Waves: Part I' at

<http://www.sjcrothers.plasmareources.com/Waves-1.pdf>

[Stephen Crothers](#): "The quantity  $r$  appearing in 'Schwarzschild's solution' has never been correctly identified by the physicists. It is irrefutably the inverse square root of the Gaussian curvature of a spherically symmetric geodesic surface in the spatial section, not a distance of any kind in the manifold. The signatures of the black hole, an infinitely dense point-mass singularity and an event horizon, have never been identified anywhere, and so no black hole has ever been found."

Here's what Christian Corda wrote to Stephen Crothers:

Subject: Re: Black Holes and Schwarzschild's actual solution  
Date: Mon, 15 Nov 2010 11:11:32 +0100  
Message-ID:  
<AANLkTima0pZPngN1fbWUg5GcHxVX53PcBFHnznJ3ne=F@mail.gmail.com>  
From: Christian Corda <cordac.galilei@gmail.com>  
To: Stephen Crothers <thenarmis@gmail.com>  
Cc: Diego Lucio Rapoport <xxxxxxx@xxxxx.xxx>,  
dchakalov@gmail.com

Christian Corda: "I want have NOTHING to do with lowest people like Mr. Dimi Chakalov and Mr. [Diego Lucio Rapoport](#)."

[snip]

"Originally, I was "philosophically" in agreement with you (Stephen Crothers - D.C.).

"Unfortunately, by performing the computation, I realized that you (Stephen Crothers - D.C.) should be wrong. In fact, I have shown in my latest paper <http://arxiv.org/abs/1010.6031> that the "the original Schwarzschild solution" results physically equivalent to the solution re-adapted by Hilbert, i.e. the solution that is universally known like "the standard Schwarzschild solution", and the authors like you, who claim that "the original Schwarzschild solution" implies the non existence of black holes give the wrong answer. The misunderstanding is due to an erroneous interpretation of the different coordinates. I further clarify this point.

"In my opinion, it is wrong also claiming that Hilbert's supposed mistake spawned the black hole. The concept of black-hole arises from the study of the INTERNAL geometry of the collapsing star, not from the EXTERNAL solutions like the ones of Schwarzschild, Hilbert, Brillouin etc. The key point is that, when you match the internal solution with the external solutions, ALL the geodesics of the collapsing matter look to fall in a single point in the core of the star. This happens in both of the cases of the original Schwarzschild line element and of the Hilbert's one.

"I have shown this point in my paper <http://arxiv.org/abs/1010.6031> . It is also simple to show that this key point remains when one matches ANY other EXTERNAL solution given by any other analytic function  $R(r)$  without violation of spherical symmetry and without violation of  $Ric = 0$  with the **internal** solution.

"Thus, the infinite number of analytic functions that satisfy  $Ric = 0$  become, for this reason, i.e. for the collapsing of the matter in a single point in the core of the star in the internal solution, NOT infinite different solutions for the external geometry, but THE SAME solution in infinite different coordinate systems!! They describes the singular and EXTERNAL spacetime of a sole un-dimensional point where all the mass is collapsed. If one finds the way to avoid ALL the geodesics of the collapsing matter to fall in a single point in the INTERNAL, not in the EXTERNAL solution the matter does not arrive to the horizon and the black-hole does not form.

"On the other hand, you (Stephen Crothers - D.C.) also claim that the quantity  $r$  that appears in the "Schwarzschild solution" is NOT a radius of anything in the associated manifold and that it is NOT even a distance in the associated manifold but that it is the inverse square root of the Gaussian curvature of the spherically symmetric geodesic surface in the spatial section of the "Schwarzschild" manifold.

"Even admitting that you (Stephen Crothers - D.C.) are right, in my opinion this point is NOT important. In fact, you can call this quantity like you prefer, but in any case he remains a coordinate for a 4-dimensional manifold, i.e. the spacetime, that we use to describe physics. The interpretation of coordinates is NOT univocally defined in General Relativity."

=====

Subject: [arXiv:1002.4153v1](http://arxiv.org/abs/1002.4153v1) [gr-qc]

Date: Tue, 23 Feb 2010 07:23:51 +0200

Message-ID:

<bed37361002222123g55b2b1b0j738aed180f0ff096@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Curt Cutler <Curt.J.Cutler@jpl.nasa.gov> ,

Michele Vallisneri <vallis@vallis.org>

Cc: Kip <kip@tapir.caltech.edu>

Gentlemen:

Your [custom-made mock data](#) will only mock you:

<http://www.god-does-not-play-dice.net/Szabados.html#SBG>

If this email does not automatically bounce back, I will consider it delivered.

Once the scandal with LIGO erupts, you will be kindly asked to explain your self-mocking. I'll be there to help.

Sincerely,

D. Chakalov

=====

Subject: Allgemeine Relativitätstheorie Neufassung ?  
Date: Thu, 25 Mar 2010 17:43:40 +0200  
Message-ID:  
<bed37361003250843u104281c0h9e233d4ee4d2888b@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: To: Helmut Friedrich <hef@aei.mpg.de>,  
Hermann.Nicolai@aei.mpg.de,  
Norbert Straumann <norbert.straumann@gmail.com>,  
Domenico Giulini <domenico.giulini@itp.uni-hannover.de>,  
John Stachel <john.stachel@gmail.com>,  
Claus Kiefer <kiefer@thp.uni-koeln.de>,  
Karel V Kuchar <kuchar@physics.utah.edu>,  
Charles Torre <torre@cc.usu.edu>

P.S. Details and drawings (25.03.2010) at

<http://www.god-does-not-play-dice.net/#Bahn>

Should you have questions, please write me back.

D.C.

-----  
Subject: A future directed, time-like unit vector field  
Date: Tue, 31 Mar 2009 05:46:18 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Helmut Friedrich <hef@aei.mpg.de>  
Cc: Hermann.Nicolai@aei.mpg.de, Curt.Cutler@aei.mpg.de

Dear Dr. Friedrich,

You acknowledged that a future directed, time-like unit vector field, for which no natural choice exists in general, is characterized indirectly and becomes explicitly available only after solving the equations ([arXiv:0903.5160v1 \[gr-qc\]](http://arxiv.org/abs/0903.5160v1), p. 17).

I've been trying to argue that this problem can only be solved by recovering the reference fluid in GR.

[snip]

=====

Subject: [ATTN Mike Lazaridis: Total confusion, total socialism at PI](#)

Date: Mon, 29 Mar 2010 16:25:32 +0300

Message-ID:

<bed37361003290625q7a232020w3ec65bf3bec8cbb8@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Neil Turok <nturok@perimeterinstitute.ca>, Robert W Spekkens <rspekkens@perimeterinstitute.ca>,

Lucien Hardy <lhardy@perimeterinstitute.ca>,

Chris Fuchs <cfuchs@perimeterinstitute.ca>,

John Berlinsky <jberlinsky@perimeterinstitute.ca>,

John Matlock <jmatlock@perimeterinstitute.ca>,

psi@perimeterinstitute.ca,

lsmolin@perimeterinstitute.ca, fmarkopoulou@perimeterinstitute.ca,

elivine@perimeterinstitute.ca, dgottesman@perimeterinstitute.ca,

hburton@perimeterinstitute.ca, tthiemann@perimeterinstitute.ca,

rmyers@perimeterinstitute.ca, lfriedel@perimeterinstitute.ca,

marzano@perimeterinstitute.ca, dbenedetti@perimeterinstitute.ca,

sbilson-thompson@perimeterinstitute.ca,

fconrady@perimeterinstitute.ca, bdittrich@perimeterinstitute.ca,

jryan@perimeterinstitute.ca, psingh@perimeterinstitute.ca,

ipremont-schwarz@perimeterinstitute.ca,

cweinstein@perimeterinstitute.ca, ywan@perimeterinstitute.ca

Please pass this email to Mr. [Mike Lazaridis](#), permalink

<http://www.god-does-not-play-dice.net/#Lazaridis>

----

Dear Mr. Lazaridis,

I'm afraid your people are seriously confused.

For example, Neil Turok ("[What Banged?](#)", 5 March 2008) speculates that "a cyclical model of the universe becomes feasible in which one bang is followed by another, in a potentially endless series of cosmic cycles"; Lucien Hardy and Robert Spekkens ([arXiv:1003.5008v1 \[quant-ph\]](#)) deeply believe that "the mathematics of Hilbert space is sufficient for quantum theory"; and Chris Fuchs' "best candidate" ([arXiv:1003.5182v1 \[quant-ph\]](#)) "involves a mysterious entity called a symmetric informationally complete quantum measurement" (this "mysterious entity" is also supported by U.S. Office of Naval Research Grant No. N00014-09-1-0247, as Chris Fuchs acknowledged).

Perhaps you will be interested to check out KS Theorem,

<http://www.god-does-not-play-dice.net/#KS>

Please notice the letter by Schrödinger from November 1950, quoted at the link above.

Your people have always ignored my arguments, and have [never replied](#) professionally. Surely they *all* are "[crazy enough](#)", but I'm afraid they got your money and their [Barbies](#), and don't care anymore. That's the result from working in a total socialism, after your generous financial support,

[http://en.wikipedia.org/wiki/Mike\\_Lazaridis#Philanthropic\\_work](http://en.wikipedia.org/wiki/Mike_Lazaridis#Philanthropic_work)

If you insist on supporting PI, that's your choice. Just don't expect anything but total confusion & socialism.

Yours sincerely,

Dimi Chakalov

----

Note: Here's the opposite opinion, by the former [PR guru Howard Burton](#):

WATERLOO, ON, May 2007 - "[Howard Burton](#), Founding Executive Director, has left Perimeter Institute for Theoretical Physics (PI) and is seeking new challenges. (...) Burton had headed the Institute, fostered through the determination and overwhelming generosity of Mike Lazaridis, PI's founder and Board Chair, since inception and achieved an impressive list of accomplishments."

Where is this "impressive list", I wonder. Check out [Peter Knight](#). If you wish to play with your hobby, get a job at some university and teach there, like a typical [Cambridge don](#). Don't waste Mike Lazaridis' money. Is this simple enough?

If I was in the shoes of Mike Lazaridis, I would introduce a few simple rules, effective immediately. For example: You want to study quantum cosmology, quantum gravity, quantum information, quantum computing, or quantum [*whatever* -- make sure it sounds very exciting] ?

Fine, but you won't get paid for sheer philosophy anymore -- enough is enough. If you wish to work at PI, you must clearly define the underlying presumptions in your hypothesis, and declare -- in writings -- the conditions under which you **will** acknowledge that your hypothesis is **wrong**, after which you will have to either start from scratch, or leave PI. That's the difference between philosophy and science, and also the recipe for success, which I'm sure [Mike Lazaridis](#) knows very well.

Besides, just like with [RIM Blackberry Bold](#), you need a healthy competition to top the [competitors](#). I will be happy to compete with any quantum scholar at PI. Please don't hesitate.

D. Chakalov

March 30, 2010

=====

Subject: BMO Financial Group Isaac Newton Chair in Theoretical Physics at Perimeter Institute ?

Date: Fri, 3 Dec 2010 00:04:27 +0200

Message-ID:

<AANLkTimWjzEKeXA+FYLYsq+VJ=piiivvK9ZJSoWnuBLek@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: David A Galloway <feedback@bmo.com>

Dear Mr. Galloway,

I learned that you have decided to invest \$4m in 'BMO Financial Group Isaac Newton Chair in Theoretical Physics at Perimeter Institute', provided your money are matched by an equal amount of \$4m from Mr. Mike Lazaridis et al.:

[http://physicsworld.com/blog/2010/11/by\\_matin\\_durrani\\_the\\_bmo.html](http://physicsworld.com/blog/2010/11/by_matin_durrani_the_bmo.html)

"As for what the BMO Financial Group Isaac Newton Chair in Theoretical Physics at Perimeter Institute will do during their 10-year stint, well, they'll be "free to engage in investigator-driven research, without limits or mandates"."

"The chair will be "identified through a highly competitive international search, and only scientists of the highest international calibre will be considered"."

I've been trying to contact Perimeter Institute for many years, on different occasions, prompted by the "research" papers published by their "leading" scientists, and even left a memo to Mr. Mike Lazaridis at my web site:

<http://www.god-does-not-play-dice.net/#Lazaridis>

Nobody has so far replied.

In my not-so-humble-opinion, Perimeter Institute has become a very convenient place for particular group of theoretical physicists to scratch their ego -- nothing more, nothing else. Your money, as well as those from Mike Lazaridis, will be converted into a string of esoteric publications without any significant value.

To be precise: the research at Perimeter Institute (PI) is \*incompatible\* with the legacy of Margenau and Schrodinger.

One of the two parties, PI vs Margenau & Schrodinger, is on a wrong track. Details at

<http://www.god-does-not-play-dice.net/Margenau.html>

Please feel free to pass this email to any interested individual.

NB: I will be more than happy to engage in professional discussion with any research scientist at PI.

If you happen to know Mr. [Mike Lazaridis](#) personally, please convey him my best regards and deep admiration.

Looking forward to hearing from you,

Yours faithfully,

Dimi Chakalov  
35 Sutherland St  
London SW1V 4JU, UK

=====

Subject: [Global existence for the Einstein equations](#)

Date: Tue, 6 Apr 2010 13:10:34 +0300

Message-ID:

<w2pbed37361004060310t33f53375x866186ed0f69f6ed@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Philippe G LeFloch <pglefloch@gmail.com>, LeFloch@ann.jussieu.fr

Cc: Bing-Long Chen <mcschl@mail.sysu.edu.cn>, rendall@aei.mpg.de,

blanchet@iap.fr, larsa@math.miami.edu, eric.gourgoulhon@obspm.fr,

alanw@math.berkeley.edu, e.deadman@damtp.cam.ac.uk,

j.m.stewart@damtp.cam.ac.uk, demetri@math.ethz.ch,

seri@math.princeton.edu, Xiao Zhang <xzhang@amss.ac.cn>,

Lau Loi So <s0242010@gmail.com>

Dear Dr. LeFloch,

May I share with you and your colleagues my concerns about your efforts.

In your latest paper with Alan Rendall ([arXiv:1004.0427v1 \[gr-qc\]](#)), you tackled the initial value problem for the Einstein equations, and tried to elaborate on "a global foliation of the maximal future development of a given initial data set", with "a *local-in-time* existence result in the class of spacetimes with bounded variation. The present work is a continuation of this work and is aimed at constructing a global foliation of such spacetimes."

You take for granted that the spacetime of GR is "time-oriented" ([arXiv:0812.5053v1 \[gr-qc\]](#)). In my

opinion, the *time-orientability of 3-D space* can be achieved \*only and exclusively only\* if the 3-D space itself is dynamical. That is, the (global) time in GR comes from the dynamics of space: check out the "stack of Photoshop layers"

<http://www.god-does-not-play-dice.net/#Bahn>

and

<http://www.god-does-not-play-dice.net/#light>

If you stick to GR textbooks and consider some stuff that only changes its coordinates in 3-D space, without allowing the 3-D space itself to evolve (cf. the two drawings at the first link above), you are confined into a frozen block world, which will never, in \*no circumstances\* allow you to prove the global existence for the Einstein equations and solve the initial value problem. It's a **dead turkey**.

Sorry for being frank. Should you or any of your colleagues disagree, I will be happy to quote from your papers and pin down [the exact cause](#) of your insurmountable problems.

Kindest regards,

Dimi Chakalov

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**Note:** People like [G. 't Hooft](#) claim that "the energy in gravity and that in matter always balances out to zero" (see also [M. Montesinos](#)), and seek comfort in the [Bianchi identities](#) (George F R Ellis and Henk van Elst, [Eq. 2](#)); application in Sec. 15.2, 'Bianchi universes and observations', from Wainwright and Ellis' [Dynamical systems in cosmology](#). Notice there Eq. 5.31, which (supposedly) fixes the relation between a "dimensionless time [tau] and clock time t". But all this pertains to [GR without DDE](#): see Landau and Lifshitz, [The Classical Theory of Fields](#), 4th ed., 1980, Ch. 11, [p. 301](#); more from [Denisov and Logunov](#).

If you believe in such dubious things like 'dynamics of [GR without DDE](#)', try to define some "dimensionless time [tau]" that can be used to seek 'the right answer to the right question', to paraphrase MTW, [p. 467](#). That's the test of the pudding: in what sort of [time](#) is the energy of gravitational field "conserved"?

As to the recent paper by Philippe LeFloch and Alan Rendall, I think the Gowdy symmetry assumption and the "future-oriented, time-like, unit vector" ([p. 10](#)) are 'searching for the right answer to the wrong question'. It reminds me of the old joke about a drunken man, who has lost his key somewhere in the dark, but is searching for it under the street lamp, simply because it is brighter there. Here, the key is in the "dark" energy from "empty" space.

D.C.

April 6, 2010

=====

Subject: [Smooth ghosts](#) in mathematical general relativity: a sampler

Date: Thu, 8 Apr 2010 05:32:15 +0300

Message-ID:

<g2gbed373610040719321b626bec9p9224645eb97610af@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Piotr Chrusciel <chrusciel@univ-tours.fr>, chrusciel@maths.ox.ac.uk

Cc: Gregory Galloway <galloway@math.miami.edu>,

Daniel Pollack <pollack@math.washington.edu>,

Torsten Asselmeyer-Maluga <torsten.asselmeyer-maluga@dlr.de>,

Carl H Brans <brans@loyno.edu>, Helge Rose <rose@first.fhg.de>,

Helmut Friedrich <hef@aei.mpg.de>, Hermann.Nicolai@aei.mpg.de,

Norbert Straumann <norbert.straumann@gmail.com>,

Domenico Giulini <domenico.giulini@itp.uni-hannover.de>,

John Stachel <john.stachel@gmail.com>, Claus Kiefer <kiefer@thp.uni-koeln.de>,

Karel V Kuchar <kuchar@physics.utah.edu>, Charles Torre <torre@cc.usu.edu>, rendall@aei.mpg.de, Robert M Wald <rmwa@midway.uchicago.edu>

Piotr,

Regarding my email from Wed, 21 Jun 2006 06:41:45 +0300: I'm afraid you've included too many ghosts in your latest essay [Ref. 1]. You and your co-authors listed twenty "Open problems" in Appendix A (*ibid.*, pp. 69-70), none of which deals with the puzzle of "smoothness",

<http://www.god-does-not-play-dice.net/#Torsten>

Moreover, regarding the positive mass conjecture [Ref. 2], you believe it has been "solved", but how would you reconcile the so-called dark energy with the dominant energy condition [Ref. 1, p. 37] ? You never mentioned this 'dark energy from empty space' in [Ref. 1].

If you wish to reply professionally, please write up an update to your essay, arXiv:1004.1016 v2 [gr-qc].

If you or any of your colleagues cannot understand the arguments at the link above, it will be entirely my fault. Feel free to write me back, and I will do my best to explain. The puzzle of 'smoothness' is very old, and there are two alternative approaches: one of them doesn't work, and the other is being explored at my [web site](#).

Regards,

Dimi

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[Ref. 1] Piotr Chrusciel, Gregory Galloway, and Daniel Pollack, Mathematical general relativity: a sampler, arXiv:1004.1016v1 [gr-qc], 372 refs; <http://arxiv.org/abs/1004.1016>

Sec. 2.1. Lorentzian manifolds, p. 3:

"A Lorentzian manifold is a smooth (Hausdorff, paracompact) manifold...

"A Lorentzian metric is a smooth assignment to each point  $p \in M$  ...

--

p. 6: "The notion of a causal curve extends in a natural way to piecewise smooth curves, ...

"There are various ways to make the phrase "continuous assignment" precise, but they all result in the following fact (it isn't a 'fact' but mathematical poetry - D.C.): A Lorentzian manifold  $(M_{n+1}, g)$  is time-orientable if and only if it admits a smooth timelike vector field  $Z$ . If  $M$  is time-orientable, the choice of a smooth time-like vector field  $Z$  fixes a time orientation on  $M$  ...

"By a space-time we mean a connected time-oriented Lorentzian manifold  $(M_{n+1}, g)$ . Henceforth, we restrict attention to space-times."

--

p. 9: "By a smooth time function we mean a smooth function  $t$  with everywhere past pointing timelike gradient. This implies that  $t$  is strictly increasing along all future directed causal curves, and that its level sets are smooth spacelike hypersurfaces.

---

p. 37: "The long-standing question of its positivity was resolved by Schoen and Yau [336] in dimension three, and is now known as the Positive Mass Theorem ... The result was generalized in [338,339] (compare [334]) to asymptotically flat initial data sets  $(M, h, K, F)$  satisfying the [dominant energy condition](#) (5.15)."

[Ref. 2] Piotr T. Chrusciel, Mass and angular-momentum inequalities for axi-symmetric initial data sets I. Positivity of mass, arXiv:0710.3680v1 [gr-qc]; <http://arxiv.org/abs/0710.3680>, p. 6.

=====

Subject: Re: [Smooth ghosts](#) in mathematical general relativity: a sampler

Date: Wed, 4 Aug 2010 13:17:53 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Piotr Chrusciel <piotr.chrusciel@univie.ac.at>  
Cc: Gregory Galloway <galloway@math.miami.edu>,  
Daniel Pollack <pollack@math.washington.edu>,  
Torsten Asselmeyer-Maluga <torsten.asselmeyer-maluga@dlr.de>,  
Carl H Brans <brans@loyno.edu>,  
Helge Rose <rose@first.fhg.de>,  
Helmut Friedrich <hef@aei.mpg.de>,  
Hermann.Nicolai@aei.mpg.de,  
Norbert Straumann <norbert.straumann@gmail.com>,  
Domenico Giulini <domenico.giulini@itp.uni-hannover.de>,  
John Stachel <john.stachel@gmail.com>,  
Claus Kiefer <kiefer@thp.uni-koeln.de>,  
Karel V Kuchar <kuchar@physics.utah.edu>,  
Charles Torre <torre@cc.usu.edu>,  
rendall@aei.mpg.de,  
Robert M Wald <rmwa@midway.uchicago.edu>,  
Jim Isenberg <isenberg@uoregon.edu>

P.S. In the second version of your essay arXiv:1004.1016v2 [gr-qc],

<http://www.god-does-not-play-dice.net/#Piotr>

you used "smooth" and "smoothness" 66 times. You declared that "the local accuracy of special relativity is built into general relativity" (p. 4), and regarding the [twice contracted](#) second [Bianchi identity](#), Eq. 2.10, you wrote (p. 5):

"This plays a fundamental role in general relativity, as, in particular, it implies (notice the poetry - D.C.), in conjunction with the Einstein equation, [local conservation of energy](#), [XXX] = 0."

If everything were so "smooth", with "local accuracy of special relativity" pre-built into GR, how come you cannot cope with [the \*wegtransformierbar\* faculty of gravity "over a point"](#) ? References at

<http://www.god-does-not-play-dice.net/#Zinkernagel2>

If you or some of your colleagues care about GR, please make an effort to reply professionally.

D.C.

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"The representation of matter by a tensor was only a fill-in to make it possible to do something temporarily, a wooden nose in a snowman."

Albert Einstein's Last Lecture, Relativity Seminar, Room 307, Palmer Physical Laboratory, Princeton University, April 14, 1954

=====

Subject: Re: Albert Einstein's last lecture, April 14, 1954  
Date: Tue, 27 Jul 2010 22:15:08 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Ted <newman@pitt.edu>  
Cc: Richard Price <Richard.Price@utb.edu>,  
Josh Goldberg <goldberg@phy.syr.edu>

Dear Ted:

- > You should allow us each to our own 'silliness' and 'errors'. If we
- > are wrong then history will bare that out and we will look silly.

Sorry, this is not a professional response. The arguments at the links below are one-click away. Please check them out. We aren't taking philosophy here.

- > But maybe there is a chance that we are correct.

But I'm not talking about your H-space nor arXiv:1007.4351v1 [gr-qc].

It's all about LIGO, which has been a dead turkey from the outset -- see ExplanatoryNote.pdf below.

Josh started all this mess, with the 1957 Chapel Hill "Conference on the Role of Gravitation in Physics", organized by Bryce De Witt with US Air Force money. See what he emailed me on 14 Jan 2009 (printed below): do you see any argument in support of the "theory" of LIGO?

Do you believe LIGO is designed to measure \*anything\* related to Bondi-Metzner-Sachs (BMS) group ? See ExplanatoryNote.pdf below.

How long will you, Josh, and Richard keep quiet ?

Please act professionally, and save hundreds of million US dollars -- taxpayers' money -- from wasting with the "advanced" LIGO and LISA.

It is **not** fair to keep quiet.

Yours,

Dimi

-----  
On Wed, 14 Jan 2009 13:53:30 -0500, Message-ID: <496E34AA.2090703@phy.syr.edu>, Joshua Goldberg <goldberg@physics.syr.edu> wrote:

- >
- > Dear Dr. Chakalov:
- >
- > I have read most of your comments and don't agree with them. I no
- > longer have the energy to detail my opinion. Apart from my own work
- > in the '50's, for me the definitive paper on gravitational waves is that
- > by Bondi et al written in 1960, but published in '62. Therefore, I make
- > no comment on your work.
- >
- > Josh Goldberg

-----  
> On Jul 27, 2010, at 8:11 AM, Dimi Chakalov wrote:

- >
- >> Dear Ted:
- >>
- >> In case you are professionally interested in GR, see
- >>
- >> [http://www.god-does-not-play-dice.net/#Zinkernagel\\_note](http://www.god-does-not-play-dice.net/#Zinkernagel_note)
- >>
- >> I trust you and Richard Price know that LIGO is for the birds:
- >>
- >> <http://www.god-does-not-play-dice.net/ExplanatoryNote.pdf>
- >>

>> When are you going to respond professionally? Time is running out!

>>

>> Dimi

>

>

=====

Subject: Does the Universe Have a Handedness?

Date: Mon, 3 May 2010 06:24:01 +0300

From: Dimi Chakalov <dchakalov@gmail.com>

To: Michael J Longo <mlongo@umich.edu>

Cc: [Craig J Copi](mailto:cjc5@po.cwru.edu) <cjc5@po.cwru.edu> ,

Glenn D Starkman <glenn.starkman@case.edu> ,

Dominik Schwarz <dschwarz@physik.uni-bielefeld.de> ,

Dragan Huterer <huterer@umich.edu>

Dear Dr. Longo,

Regarding your [arXiv:astro-ph/0703325v3](http://arxiv.org/abs/astro-ph/0703325v3), I think the answer to the question in the subject line could be YAIN, due to the totally different physics one can expect from the two modes of spacetime,

<http://www.god-does-not-play-dice.net/#Bahn>

In other words, you can have your cake and eat it. But you'd have to "challenge the model", as your colleagues put it.

Kindest regards,

Dimi Chakalov

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Craig J. Copi et al., Large angle anomalies in the CMB, arXiv:1004.5602v1 [astro-ph.CO],

<http://arxiv.org/abs/1004.5602>

"Even so, the cosmological model we arrive at is baroque, requiring the introduction at different scales and epochs of three sources of energy density that are only detected gravitationally -- dark matter, dark energy and the inflaton. This alone should encourage us to continuously [challenge the model](#) ... "

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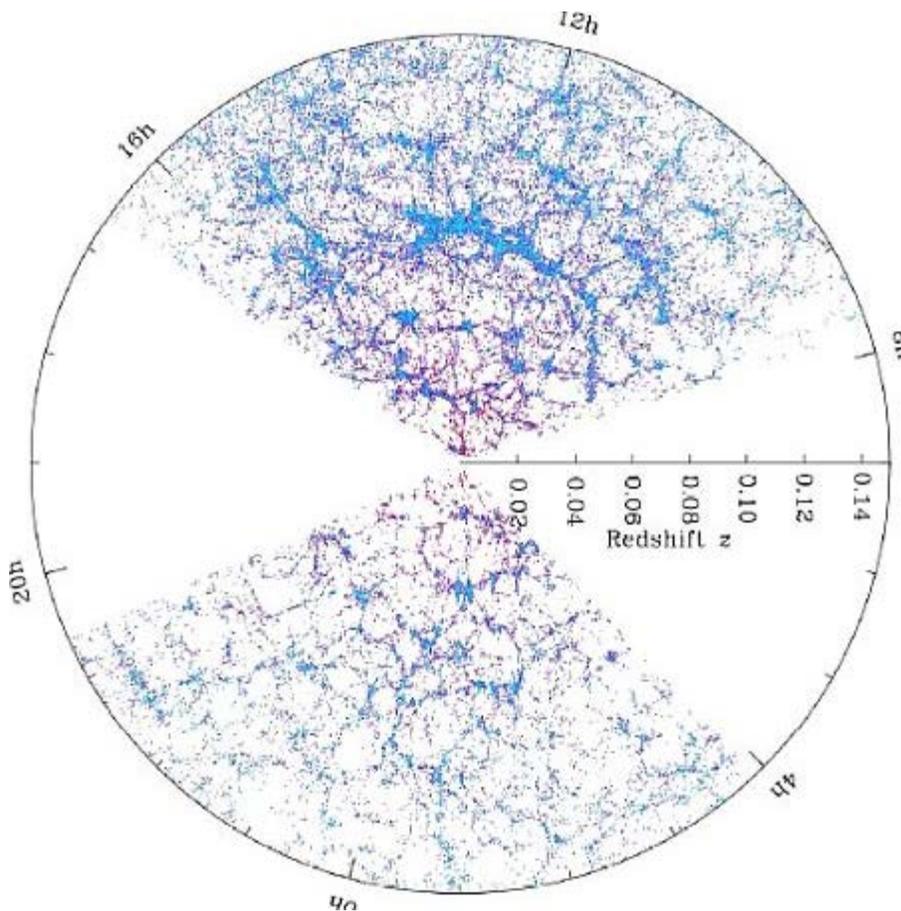
**Note:** I won't pester the readers with any detailed speculations (D. Schwarz hasn't replied to my email sent in [May 2003](#)), and will only highlight the main puzzle:

Dragan Huterer (24 November 2005), Mysteries at Universe's Largest Observable Scales,

[http://cfcp.uchicago.edu/research/highlights/highlight\\_2005-11-24.html](http://cfcp.uchicago.edu/research/highlights/highlight_2005-11-24.html)

"Copi, Huterer and Starkman, together with Dominik Schwarz from Bielefeld University in Germany, found statistically significant and completely unexpected correlations of the CMB quadrupole and octopole with the ecliptic plane. In particular, planes defined by the quadrupole and octopole are perpendicular to the ecliptic plane."

That's what we observe:



As to the "[cosmic equator](#)", perhaps we'll have a better picture from the [Planck mission](#) (exposing the elusive "[B-modes](#)", which are believed to be determined by the density of primordial GWs), once the *angular power spectrum* is revealed in 2012; animation [here](#).

But instead of modifying gravity by introducing a "dynamical Aether (or time-like vector field) with non-canonical kinetic terms" (Glenn D. Starkman *et al.*, [arXiv:astro-ph/0607411v4](#)), I suggest to replace the Aether with the so-called global mode of spacetime (cf. Fig. 2 [above](#)), and offer [relative scale principle](#), pertaining to hypothetical symmetry presentations or "views" on objects in space. Then the "[handedness](#)" of *spacetime arrow* will cast its blueprints on the distribution of matter in 3-D space, since the space itself has become dynamical, endowing the whole universe with a ([global](#)) time. As to the "spin handedness" and [torsion effects](#), recall that reference frames associated with 'spin' are different from those associated with motion along a line, as noticed by Ernst Mach many years ago. If you imagine an absolute or "meta" observer placed in the frame of "fixed stars" (called here '[global mode](#) of spacetime'), she should be able to "see" the input from the global mode, cast on the local mode in terms of some "geometric force", but a physical observer will see these effects as "dark".

To explain such "dark geometric force", in the framework of 'the universe modeled as a [brain](#)', consider the text below:

Accordng to a rscheearch at Cmabrigde Uinervtisy, it deosn't mttar in waht oredr the ltteers in a wrod are, the olny iprmoetnt tihng is taht the frist and lsat ltteer be at the rghit pclae. The rset can be a total mses and you can sitll raed it wouthit a porbelm. Tihs is bcuseae the huamn biran deos not raed ervey ltteter by istlef, but the wrod as a wlohe. Pritie amzanig huh?

Your brain operates with 'potential reality' (recall the main demonstration [above](#)), and can "shuffle" the letters and re-construct the text, even ignoring the typo in the last sentence. If the universe also works as a [brain](#), it can exert the asymmetry or "[handedness](#)" of *spacetime arrow* on the distribution

of matter, and re-organize it along the pattern observed in CBM above, but an observer in the [local mode](#) of spacetime will interpret these *geometrical* effects as "dark".

I've acknowledged, on many occasions, that the mathematical presentation of these ideas is unknown to me. Tomorrow I will write to Prof. [Amos Altshuler](#), regarding his paper on the [topology of space](#), and will ask for advice. I can only hope he won't reply like Prof. [Chris Isham](#).

D. Chakalov

May 3, 2010

Last update: July 9, 2010

=====

Subject: Machian gravity and the Bootstrap Principle

Date: Wed, 5 May 2010 03:31:33 +0300

From: Dimi Chakalov <dchakalov@gmail.com>

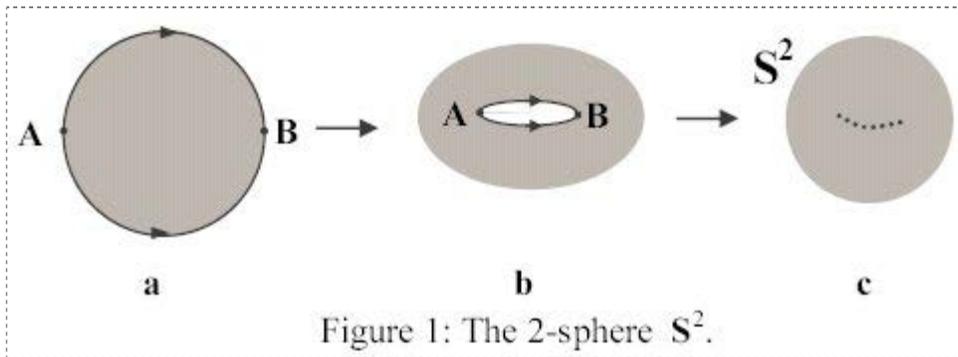
To: Amos Altshuler <alt@math.bgu.ac.il>, Amos Altshuler <amosalt@bezeqint.net>

Dear Professor Altshuler,

I very much like the statement by Einstein (Albert Einstein über Kepler, Frankfurter Zeitung, [9 November 1930](#)): "Es scheint, dass die menschliche Vernunft die Formen erst selbständig konstruieren muss, ehe wir sie in den Dingen nachweisen können." (It seems that the human mind has first to construct forms independently, before we can find them in things.)

I have an immodest request for information and advice, prompted by your latest paper, entitled: "On Space's Topology", [arXiv:1004.1831v1 \[gr-qc\]](#). I am trying to find papers or just ideas regarding some new 3-D manifold, which could supply the mathematical basis for Machian gravity and the Bootstrap Principle of Geoffrey Chew.

Regarding Fig. 1 from your paper: I imagine the 2-sphere, as shown in Fig. 1c, as a spherical balloon, which can be inflated by some "dark energy".



Is it possible to conjecture that any given point from the 2-sphere (balloon) surface can be \*somehow\* (I'm speechless here) produced by "gluing" all (infinitely many) points from the disk depicted in Fig. 1a? What I mean is the following: if some Flatlander living on the 2-sphere (balloon) surface decides to zoom on the "infinitesimal" from her balloon surface, she will find out that it actually has an inner geometrical structure -- not a dimensionless point but a 2-D disk that has shrunk to its infinitesimal "size". Also, if \*the same\* disk has been multiplied into infinitely many "points" from the 2-sphere (balloon) surface, the Flatlanders have to consider two types of connections on their (base) manifold: a "local" one, by ignoring the initial "mother" disk, and a "non-local" connection, which goes **through** \*the same mother disk\*, bootstrapping all points on the 2-sphere (balloon) surface. Thus, all interactions on the 2-sphere (balloon) surface will be inherently *quasi-local* from the outset.

Now, let's move up by one dimension. Can you think of some 3-D manifold, which can possess similar

inner geometrical structure of its infinitesimal "points"? Namely, each and every "point" would be produced by shrinking \*the same\* 3-D "mother sphere", and again two types of connections will occur on the 3-D manifold, enabling quasi-local interactions.

Thank you for your time and consideration. I am aware that my efforts are not related to your latest paper, but hope you will be so kind as to advise me on these issues.

Kindest regards,

Dimi Chakalov  
[snip]

-----

**Note:** If you wish to construct a physical space out of this new 3-D manifold, make sure that its topology has been *dynamically* fixed as "[asymptotically flat](#)", so we could "look around, and see as far as we can" ([Lee Smolin](#)). Good luck.

D.C.  
May 5, 2010

=====

Subject: Re: Machian gravity and the Bootstrap Principle  
Date: Sun, 16 May 2010 13:46:09 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Amos Altshuler <amosalt@bezeqint.net>  
Cc: Robert Geroch <geroch@uchicago.edu>,  
Laszlo Szabados <lbszab@rmki.kfki.hu>,  
Chris Isham <c.isham@imperial.ac.uk>,  
Sergio Doplicher <dopliche@mat.uniroma1.it>,  
Anthony Zee <zee@kitp.ucsb.edu>

Dear Amos,

Thank you for your reply from Sun, 16 May 2010 08:05:43 +0200.

> Sorry, but I don't know the answer to your question. I am also not sure  
> that I understood the situation you described.

I suppose you've seen the collective behavior of a [shoal of fish](#). Suppose every fish follows the rule 'think globally, act locally', such that every \*point\* from the trajectories of each and every fish is pre-correlated (Leibnizian pre-established harmony) with 'the rest of fish' from the shoal. The ongoing correlation "takes place" in a putative 'global mode of spacetime', and the dynamics of every fish

becomes \*quasi-local\*, in the sense that the "[bi-directional](#)" negotiation of every \*next\* point from the trajectories of all fish is being \*already-completed\* at the instant at which every fish makes the infinitesimal displacement  $x \rightarrow x + ds$  : please see my email to Robert Geroch at

<http://www.god-does-not-play-dice.net/#Geroch>

In the quantum-mechanical version of the story above, replace the fish with dice. Think of four dice, which have to be correlated "[in the air](#)" (global mode of spacetime), in such a way that the sum of their readings must be confined in the interval [10, 20] , at the instant they are fixed/dropped on the table. You can see only the dice on the table, where they exist as 'facts' (local mode of spacetime).

So, suppose you observe consecutive sets of readings like (3, 5, 1, 6), (4, 4, 3, 5), (5, 6, 2, 5), (1, 3, 5, 1), etc., all of which are correlated by the requirement [10, 20] . The trajectories of all dice are composed of these quasi-local states 'on the table', and all dice will be pre-correlated like a shoal of fish. They will be pre-bootstrapped 'on the table', and will display a "quantum wave", without any

localized source of such "wave", as we know from QM textbooks,

<http://www.god-does-not-play-dice.net/#Zee>

Only the math is unknown.

With all good wishes,

Dimi

=====



How do they do it?

"[This] question occurs naturally to anyone watching a school of silversides moving slowly over a reef in clear tropical waters. Hundreds of small silver fish glide in unison, more like a single organism than a collection of individuals. The school idles along on a straight course, then wheels suddenly; not a single fish is lost from the group. A barracuda darts from behind an outcropping of coral and the members of the school flash outward in an expanding sphere. The flash expansion dissolves the school in a fraction of a second, yet none of the fish collide. Moments later the scattered individuals collect in small groups; ultimately the school re-forms and continues to feed, lacking perhaps a member or two."

Brian L. Partridge, Structure and function of fish schools, *Scientific American* 246 (1982) 114-123; cf. [p. 119](#).

See also [Birds flock with scale invariance](#): "a change in direction of **one** bird can affect the behavior of all its companions -- regardless of the size of the flock. (...) This means that information about the change of direction of **any** individual is quickly shared throughout the entire flock (the [UNdecidable potential state](#) -- D.C.), and its transmission is not limited by a fundamental distance scale."

See also 'Neurophysiology 101 For Quantum Physicists' [here](#). If neuroscientists were following the "logic" of their colleagues from the established theoretical physics community, they would have to postulate some totally invisible, hence "dark", computer in the human brain, which could correlate some 100 billion neurons and [60 trillion synapses](#). Such "dark" computer would also have to remain unchanged during the life of all people, and would be the [human self](#).

In our case, the "dark" bootstrapping mechanism, which correlates every "fish" from the *local mode* of spacetime (cf. Fig. 1 [above](#)), is sought in the mechanism that fixes only one "charge" of mass, by cancellation of two gravitational "waves" in the *global mode*, as depicted in [Escher's hands](#). The two tug-of-war effects of the bootstrapping mechanism ([CDM & DDE](#)), which produce '[asymptotically flat](#) spacetime', do **not** originate from some physical stuff with [positive energy density](#), nor from some

stuff with negative energy density. The end result is perfectly embedded in the positive-mass "fish", and makes its trajectory quasi-local (cf. [Brown and York](#) and Cooperstock and Dupre [below](#)).

All this "happens" in the global mode (cf. Fig. 2 [above](#)), just like the invisible cat Macavity, which shows up "[only when no one is looking at it](#)".

That is, Macavity lives in the [non-Archimedean, global mode of time](#), which is needed to define a [finite bounded](#) region of 3-D space (local mode) endowed with *differentiable* structure (cf. [Brown and York](#)). The 'time rate of change' is in turn defined by 'the arrow of space' ([AOS](#)) on a [perfect continuum](#) (local mode).

That's the meaning of 'quasi-local', be it a [fish](#) or [quantum observable](#) or "any observable of the gravitational field" ([Laszlo Szabados](#)).

Have a nice summer.

"[just another crank](#)" D.C.

May 20, 2010

Last update: July 14, 2010

J. D. Brown and J. W. York, Quasilocal energy and conserved charges derived from the gravitational action, Phys. Rev. D 47, [1407](#) (1993)

"In nonrelativistic mechanics, the time interval  $T$  between initial and final configurations enters the action as [fixed endpoint data](#). The classical action  $S_{cl}$ , the action functional evaluated on a history that solves the classical equations of motion, is an ordinary function of the time interval and is identified as Hamilton's principal function. Therefore  $S_{cl}$  satisfies the Hamilton-Jacobi equation  $H = -dS_{cl}/dT$ , which expresses the energy (Hamiltonian)  $H$  of the classical solution as minus [the time rate of change](#) of its action.

"By a similar analysis, we shall define the quasilocal energy for gravitational and matter fields in a [spatially bounded region](#) as minus the time rate of change of the classical action."

F.I. Cooperstock, M.J. Dupre, Covariant energy-momentum and an uncertainty principle for general relativity, [arXiv:0904.0469v2 \[gr-qc\]](#)

"The Positive Energy Theorem itself has been a major factor in the acceptance of the quasi-local approach, but it must be noted that it depends on the assumption of the dominant energy condition. However, recently, all the energy conditions of general relativity have come into question [10]."

---

[10] C. Barcelo and M. Visser, [gr-qc/0205066v1](#).

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Subject: Re: Request for advice  
Date: Wed, 11 Aug 2010 11:47:10 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Mark Burgin <mburgin@math.ucla.edu>

Dear Mark:

Thank you for your feedback.

> What do mean writing "construct a trajectory of  
> such [\\_already-correlated\\_ n-states](#) "?

RE [\\_already-correlated\\_](#) : if we look at a school of fish,

<http://www.god-does-not-play-dice.net/#shoal>

we can't notice the non-linear negotiation (modeled with the [10, 20] requirement below) b/w every fish and 'the rest of fish'. Perhaps the four dice will show a pre-correlated, *wave-like rays*.

If I knew how to calculate these correlations "in the air", I could perhaps make an animation, and model the emergence of a quantum wave, without any localizable source of such wave.

All the best,

Dimi

> Dimi Chakalov wrote:

>>

>> Dear Dr. Burgin,

>>

>> I read with great interest your latest "Interpretations of Negative

>> Probabilities", [arXiv:1008.1287v1 \[quant-ph\]](http://arxiv.org/abs/1008.1287v1), and wonder if you could

>> advise me how to formalize a Gedankenexperiment with four dice at

>>

>> <http://www.god-does-not-play-dice.net/#bootstrap>

>>

>> Think of four dice, which have to be correlated "in the air", in such

>> a way that the sum of their readings on the table must be confined in

>> the interval [10, 20], at the instant they are fixed/dropped on the

>> table. You can observe only the dice on the table, where they exist as

>> 'facts'.

>>

>> So, suppose you observe consecutive sets of readings like **n\_1**: (3, 5,

>> 1, 6), **n\_2**: (4, 4, 3, 5), **n\_3**: (5, 6, 2, 5), **n\_4**: (1, 3, 5, 1), etc.,

>> all of which are correlated by the requirement [10, 20] . How can we

>> construct a trajectory of such already-correlated **n**-states ?

>>

>> Hope you can help. I extend my immodest request to Dr. Hájek as well.

>>

>> Kindest regards,

>>

>> Dimi Chakalov

=====

Subject: Machian quantum gravity

Date: Tue, 17 Aug 2010 02:02:37 +0300

From: Dimi Chakalov <dchakalov@gmail.com>

To: Mario Novello <novello@cbpf.br>

Cc: Luca Fabbri <luca.fabbri@bo.infn.it>

Re: M. Novello, Mach or Higgs? The mechanisms to generate mass, arXiv:1008.2371v1,

<http://arxiv.org/abs/1008.2371v1>

Hi Mario,

May I offer two suggestions. In your recent paper, you posed the following question (p. 9):

"We start by considering Mach principle as the statement according to which the inertial properties of

a body A are determined by the energy-momentum throughout all space. How could we describe such universal state that takes into account the whole contribution of the rest-of-the-universe onto A ?"

My suggestion: include the contribution of A onto the rest-of-the-universe. It's a [bi-directional "talk"](#).

You also wrote: "There is no simpler way than consider this state as the most homogeneous one and relate it to what Einstein attributed to the cosmological constant or, in modern language, the vacuum of all remaining bodies."

There is a simpler way to find this "universal state": solve the main problems of QM

<http://www.god-does-not-play-dice.net/#KS>

and GR,

[http://www.god-does-not-play-dice.net/#Levi\\_Civita](http://www.god-does-not-play-dice.net/#Levi_Civita)

First things first.

Take care,

Dimi

=====

Subject: The scale factor  $R(t)$ : Why would "distance" change with time, and if so, in what "time" ?  
Date: Sat, 22 May 2010 04:16:48 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Alain Blanchard <alain.blanchard@ast.obs-mip.fr>  
Cc: Elemér Rosinger <eerosinger@hotmail.com>

Dear Dr. Blanchard,

Regarding your comment on Newton theory of gravity and the "unexpected new element in modern physics" [[Ref. 1](#), p. 39]: it seems that the definition of the scale factor  $R(t)$  and the Hamiltonian formulation of GR may be wrong.

Instead of adding time "as the fourth coordinate" [[ibid.](#), p. 3] and speculate about "distance changes with time" [[ibid.](#), p. 7], we may introduce a global, Heraclitean, and non-Archimedean [[Ref. 2](#)] time, as depicted in Fig 2 at

<http://www.god-does-not-play-dice.net/#Bahn>

Specific considerations at

<http://www.god-does-not-play-dice.net/#bootstrap>

Kindest regards,

Dimi Chakalov

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[[Ref. 1](#)] Alain Blanchard, Evidence for the Fifth Element: Astrophysical status of Dark Energy, arXiv:1005.3765v1 [astro-ph.CO], <http://arxiv.org/abs/1005.3765v1>

Footnote 1: "Newton theory of gravity is wrong, but nevertheless it remains a high quality scientific theory because of its past (and present) successes. It is in this sense that modern cosmology should

be regarded as successful, and this will remain in the future, even if it might be regarded as being "wrong"..."

....

p. 3: "R is a characteristic size (in the spherical case, that is the radius of the 3D-sphere embedded in a 4D space). We then add the time as the fourth coordinate ... "

....

p. 7: "2.6 The proper distance

"In GR, space changes with time, and there is no proper time, so that the "intuitive" notion of distance between two points is not a well defined quantity. (...) The fact that this distance changes with time is the direct consequence of the expansion of the Universe.

....

p. 25-26: "5.2 Einstein Cosmological constant or Vacuum contribution

"The most direct explanation one can provide to the cosmic acceleration is that it is due to a true cosmological constant appearing in the geometrical part of Einstein's equation, i.e. the left hand side of eq. 4. However, it is much more common to believe that this term arises from some contribution to the energy-momentum tensor on the right hand side. As we have seen, from a classical point of view the vacuum might have a non zero density and behaves identically to a cosmological constant. In addition, quantum mechanics provides an intriguing hint in this direction. (...) This non-zero value is often noticed in standard text book of quantum mechanics, but, because observable quantities correspond to transitions from one state to another one, is not regarded as being problematic. However, as soon as gravitational interaction has to be added, one cannot avoid to take the absolute energy into account. (...) For all energy scales in physics does  $p \cdot v$  end up with an unacceptable large value, which looks like a fundamental problem (footnote 9).

----

Footnote 9: "It has been suggested that the zero-point fields should not be regarded as real, despite the fact that they are at the basis of the calculation of the Casimir effect (167)."

[167] Michel, F. C., Comment on Zero-Point Fluctuations and the Cosmological Constant, ApJ, 466, 660 (1996)

.....

p. 39: "... the actual origin of dark energy remains totally unknown and the presence of dark energy in the present day universe represents probably the most fundamental and unexpected new element in modern physics."

[Ref. 2] Elemer E Rosinger, Special Relativity in Reduced Power Algebras, arXiv:0903.0296v2, <http://arxiv.org/abs/0903.0296>

"3.1. Why Hold to the Archimedean Axiom ?

"It is seldom realized, especially among physicists, that ever since ancient Egypt and the axiomatization of Geometry by Euclid, we keep holding to the Archimedean Axiom. This axiom, in simplest terms, such as of a partially ordered group G, for instance, means the following property

(3.1.1) [XXX]

"or in other words, there exists a "path length"  $u$ , so that every element  $x$  in the group can be "overtaken" by a finite number  $n$  of "steps" of "length"  $u$ ."

-----

**Note:** Regarding the notion of a global, Heraclitean, and non-Archimedean time, recall the proposal of William G. Unruh, from 1988, about a Heraclitean time -- an "explicit (but unmeasurable) time", also called "nondynamical time". To explain the core idea of "explicit (but unmeasurable) time", I'll use a simple metaphor of a flat 2-D section of 3-D sphere: the Flatlanders will notice that their dynamics involves an "explicit but unmeasurable" time *and* space, in the sense that all points from

their 2-D world are also points from the 3-D sphere, yet the intrinsic dynamics of the 3-D world will be "unmeasurable". Again, this is just a metaphor in Euclidean space; the real case may be far more complicated -- check out Fig. 2 [above](#), and notice that *the* infinitesimal displacement in spacetime (compare it with [ADM presentation](#)) is *completely* sealed off by the so-called [speed of light](#), rendering the *local mode* of spacetime a *perfect continuum*. Thus, the *global mode* of spacetime is totally "dark" from the outset. Hence the [confusion in GR](#).

Now, let's see if we can unscramble some 'explicit but unmeasurable time *and* space' in our 3-D world made of [finite](#) things obeying the [Archimedean Axiom](#).

If you ponder on the *operational* definition of '[second](#)', you will notice that it is an unverifiable Gedankenexperiment: it is being "defined" as the sum of durations of 9,192,631,770 transitions between the two hyperfine levels of the ground state of the cesium 133 atom, provided the cesium atom is "at rest at a temperature of OK, such that the ground state is defined at zero magnetic field" [[Ref. 3](#)].

Here's how we are conditioned to think about such [Archimedean](#) second: imagine that every two neighboring dots from the closed interval of 'one second' below refer to one transition between the two levels of the ground state of the cesium-133 atom, and that the number of dots below is *exactly* 9,192,631,768:

[.....]

Surely your [wristwatch](#) does [somehow](#) read this [finite](#) interval, but you can't claim that 'time in GR' is a *relativistic observable* **if** the determinant of the metric *itself* (cf. Einstein's talk from April 1919 [below](#)) is a variable determined in turn by the **global** Expansion of Space (EoS) -- read Michal Chodorowski [[Ref. 4](#)].

To cut the long story short: the principles of GR explicitly ban the *global mode* of space (see Fig. 2 [above](#)) from *direct* observation. We cannot *directly* observe any 'absolute space' or 'aether', just as we cannot *directly* observe the [UNdecidable KS state](#). The "bare points" (cf. '[bare finger nails](#)' and 'absolute structures', [James L. Anderson](#)) can exist only in the *global mode* of spacetime. Once the singularity is resolved, a vast new region of 'the universe as ONE' appears (compare with A. Ashtekar, [p. 15](#)). It provides a global, Heraclitean, and non-Archimedean **matrix** for [finite things](#) in the local mode of spacetime, such as 'one second' or 'one meter'.

Without the *global mode* of spacetime, the existence of **finite** things like 'one second' and 'one meter' will be a miracle, since no physical phenomenon alone (local mode of spacetime) can reproduce them as comprised from *finite* number of *finite* things -- see the dots above.

**NB:** The duration of the transition between the two levels of the ground state of the cesium-133 atom -- the distance between two neighboring dots above -- is an Archimedean entity, a [finite "path length" u](#). Were the *emergence* of "more and more space" [[Ref. 4](#)] an Archimedean phenomenon, the Hubble Law would correspond to **actual** velocities of distant bodies, as inferred and calculated from their red-shifted light, and we would **directly** observe an effect of 'absolute space', endowed with "an additional attribute: expansion." [[Ref. 4](#)] But notice that you can inject **any** "number" of infinitesimal "points" into the global, Heraclitean, and non-Archimedean space, and it won't "expand" a bit. **Not at all.**

The explanation is with the famous song "[Aleph-null bottles of beer on the wall](#)", only here the "expansion" of space is produced by *adding* 'bottles of beer' -- "more and more space" [[Ref. 4](#)] *emerges* along the arrow of spacetime denoted with **w** in Fig. 2 [above](#). Notice also that, in present-day GR, the "horizontal" cross-sections of the arrow of spacetime (the *local mode* of spacetime, like [Photoshop layers](#)) are "flattened", and the *local mode* of spacetime becomes a **perfect** continuum -- [no "dark gaps"](#) from the global mode of spacetime are present in the local mode -- so it is impossible to get a glimpse at the global Expansion of Space (EoS) pertaining to the 'absolute space' and 'reference fluid'.

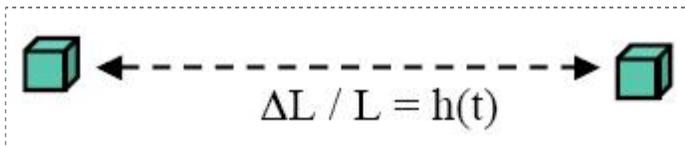
Stated differently, we may talk about a '*real actual* expansion of space' only to the extent to which we can talk about any other 3-D blueprint from the global (Heraclitean, and non-Archimedean) mode of spacetime. Example: the global position of Earth in the "absolute" reference frame of [the cosmic](#)

equator -- the "handedness" of the universe, produced by the *arrow* of spacetime, can show up only *through* the cosmic substratum [[Ref. 4](#)], yet its source and "force" will never be directly observable or traceable (try an experiment with your brain [above](#)).

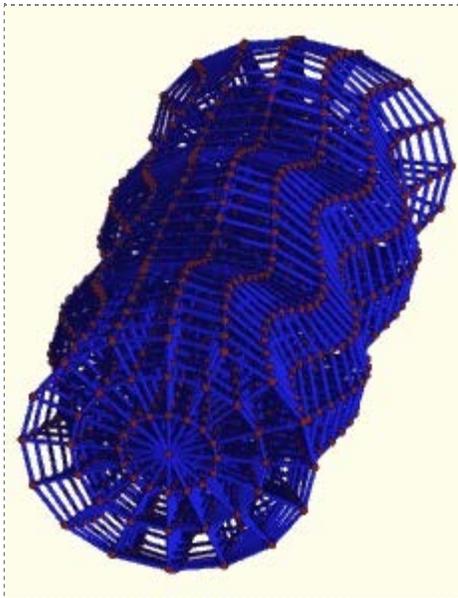
Even if 'one meter' can "expand" due to the *emergence* of "more and more space" [[Ref. 4](#)], the underlying 'body of reference' -- the global Expansion of Space (EoS) -- will **not** be physically observable. It is GR itself that makes it "dark". You can trust the present-day 'GR without DDE' only for adjusting the GPS system.

Needless to say, you cannot capture 'the entire space' with some conformal recipe either, being confined *within* the Archimedean local mode of *finite* things. Sorry for repeating this all over again; the crux of the argument is known after Lucretius. He didn't use math, but neither did Karel Kuchar some 2060 years later, regarding the "hidden unmoved mover".

The implications for "GW astronomy" are obvious: LIGO, Virgo, GEO, LCGT, LISA, *etc.*, are supposed to detect the "ripples" of metric, as visualized below, in line with Kip's mantra:



Notice that one space dimension is omitted in the animation below: it shows a 2-D plane (not 3-D space), which is being modulated by a passing GW, propagating along an axis **orthogonal** to that flat plane, yet the *very same* axis of GW propagation is supposed to match the "direction" of GW scattering in 3-D space **as well**. Which is why Kip Thorne and his colleagues suggested an L-shaped (x/y) "antenna" to catch the signal coming from the orthogonal (to that plane) **z** direction. [Do you smell a rat?](#)



Markus Pössel, "The wave nature of simple gravitational waves",  
Einstein Online, Vol. 2 (2006), [1008](#)

Take a look at the non-relativistic picture from NASA [above](#), and notice that the very same "direction" of GW propagation, used to make the GW animation, has been employed to display an accelerated "expansion" of space -- again by omitting one space dimension. Now, if we were 2-D Flatlanders, we'd introduce a "temporal" dimension to model our 2+1-D universe, but we would **not** like that "temporal" dimension to pertain to 'the whole 2-D Flatland *en bloc*', because it will point to some anti-relativistic aether, and any force from it will be totally "dark". Not surprisingly, Michal Chodorowski doesn't like some global Expansion of Space either [[Ref. 4](#)], yet the **global** "direction"

of GW propagation, orthogonal to the 3-D space *en bloc*, is perfectly fine for LIGO Scientific Collaboration: they simply use an L-shaped (x/y) "antenna" and wait, patiently, for the GW strain to come from the orthogonal (to that plane) z direction. Isn't this [GW parapsychology](#)?

To make the case decipherable, recall the (utterly misleading) picture of "GW lake", in which the **two** spatial dimensions of the expanding/contracting plane in the animation above are omitted: you can imagine the GW lake below only by compactifying all "stretching 'n squeezing distances" on the 2-D plane into **one point** from the 1-D "radius" of the GW lake *below*. Notice that the 1-D "radius" is the alleged "longitudinal direction" of GW propagation (cf. [Jose G. Pereira et al.](#)).

You also need another "axis" [[Ref. 4](#)] for the **dimensionless** wave amplitude, and yet another axis to picture the GW lake in 3-D (to impress your taxpayers), which makes the picture below an utterly misleading muddle.



LIGO is supposed to be located "near the shore", where the lake is "[effectively flat](#)", so you can think of LIGO as some **point-like** fishing rod float waiting, patiently, for the ([initially strong](#)) GW from the lake center to wiggle it, **transverse** to the 1-D "radius" of the GW lake. But in order to picture the **transverse** (to the 1-D "radius") directions of GW strain, you need to endow the **point-like** fishing rod float (LIGO) with two **spatial** dimensions, hence recover the 2-D plane in the animation above.

Total mess. For if you "upgrade" the **point-like** fishing rod float to 3-D space, where would the "longitudinal direction" point to? To "[the center of the Galaxy](#)"?

Let me quote Ray Weiss, from a video clip "[Gravity: Making Waves](#)", intended to the taxpayers who pay for all this mess (video transcript, American Museum of Natural History, November 2004).

Ray Weiss in lab, stretching and collapsing a mesh wine bottle protector:

"The waves can be represented by this object I found on a wine bottle. And it's a mesh that you can see. And the waves cause transverse to the direction in which they're moving. They're moving forward, and transverse to that the space gets **tugged** like this, and **collapses** like that. Tugged like this. And if you look carefully at this, and I'll do this a few times, you'll notice that the little squares in this, how they're exercising a motion where along one direction, it's obvious which direction -- I mean, the direction I'm pulling in -- space is getting **expanded**. But transverse to that, up and down, space is getting **contracted**. And that's the key to the whole thing."

That's the key to the whole thing: you can't monitor some "expanding" [[Ref. 4](#)] or "collapsing" space if you are confined inside that same space: measurements "across" space are unphysical ([B. Schutz](#), Fig. 24.3, p. 349).

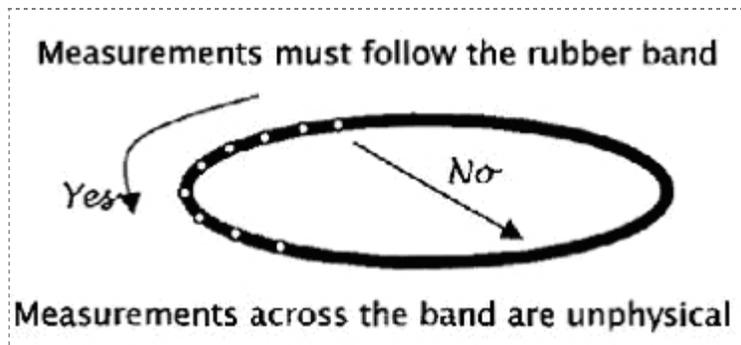


Fig. 24.3

However, B. Schutz and his colleagues from LIGO Scientific Collaboration (LSC) need exactly such measurements "across" 3-D space to determine the amplitude of the "passing" -- with respect to some absolute space [Ref. 4] -- GWs, and also "see" the animation above as [ripples of the 3-D metric itself](#).

No **background** (regardless of being "undisturbed" or "disturbed") can exist for (i) "expansion" of 3-D space [Ref. 4] *nor* for (ii) GW propagation, yet [Bernard Schutz](#) and his LSC colleagues managed to "obtain" it for case (ii), with their [spherical cow approximation](#).

There is also a tantalizing story by B. Schutz, regarding the "time parameter" of the propagation of GWs, depicted with the horizontal line in Fig. 22.1 below, from his book "GRAVITY from the Ground Up" (Cambridge University Press, Cambridge, 2003), p. 312. Notice also that the small vertical line refers to "something that is dimensionless" (exact quote from Kip Thorne's [Physics 237-2002 Course](#)).

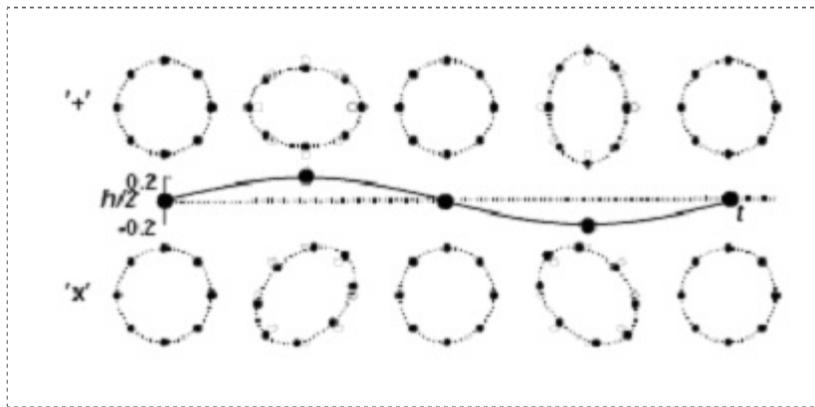


Fig. 22.1

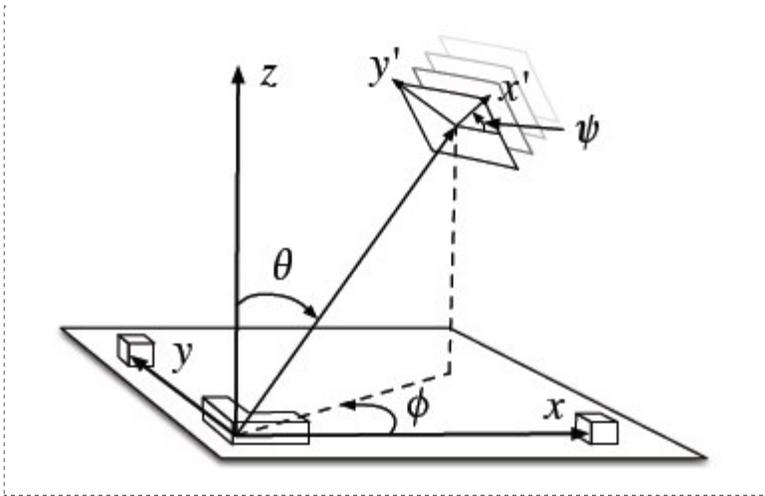
B. Schutz argues that "the force of the Moon comes from the curvature of time" (*ibid.*, p. 310), and "the deformation produced by the Moon is partly directed towards the Moon (the longitudinal direction), whereas gravitational waves are transverse" (*ibid.*, p. 311).

Therefore, LSC members have to separate two crucially distinct cases: curvature of time, as in the example with the tidal effect on Earth caused by the Moon (no GWs in principle), from curvature of space, as in the case of time-dependent spatial curvature (lots of GWs waiting for the "advanced" LIGO and LISA), depicted with the horizontal line in Fig. 22.1 above, and denoted with **t** as well.

To elucidate the situation, let me quote further from B. Schutz: "The fact (there are no "facts" here - D.C.) that gravitational waves are transverse and do not act like the Moon does on Earth implies that they are not part of the curvature of time, since that is where the Newtonian forces originate. They are purely a part of the curvature of space (emphasis mine - D.C.). When gravitational waves move through a region they do not induce difference between the rates of nearby clocks. Instead, they deform proper distances according to the pattern in Fig. 22.1" (*ibid.*, p. 312). More from Bernard Schutz [here](#).

Perhaps LSC members will try to separate (safely) the curvature of time from the curvature of space at [GR19](#). I wish them best of luck with the [SBG argument](#) too.

In my "[just-another-crank](#)" opinion, the *splitting* of 3-D space into some **x/y plane** and an orthogonal "transverse direction" of GW scattering, denoted usually with **z**, is sheer parapsychology. Check out the precise recipe for detecting "**local** perturbations in the space-time metric from astrophysical sources", by LIGO Scientific Collaboration (540 people), [arXiv:1007.3973v1 \[gr-qc\]](#), p. 11:



**NB:** If someone tells you that the **ongoing** "expansion" of spacetime metric, driven by [\[we-do-not-know-it\]](#), is along a straight line **in space** (say, 'from the center of the Galaxy toward Earth'; cf. my email to Gabriela González from [8 June 2005](#)), would you believe it? Of course not. Then how come people believe in the drawing above? Can you separate the "expanding" metric in the two cases?

Notice also the [dimensionless](#) GW amplitude and the analogy with the EM waves in 3-D space, suggested by [Bernard Schutz](#): you can prove that light is a transverse wave by using Polaroid, hence a simple Gedankenexperiment with GW "amplitude" will require that it will inevitably acquire dimensionality, upon projecting the "amplitude" on the [transverse x/y plane](#).

The proper GW detectors should be endowed with the faculty of self-acting (resembling the [human brain](#)), in order to be triggered by GWs. But this is a different thread.

Notice the crucial **global** "direction" of GW propagation, orthogonal to the whole 3-D space *en bloc*, in Fig. 2 [above](#), and its holistic effect in the shoal of fish [here](#); more from Anthony Zee [above](#). Just as there is no source that is "waving" to produce quantum waves, there is no **material** source that is "waving" to produce GWs propagating from [one location in 3-D space to another location](#). It would be tantamount to claiming that some *material* source, located somewhere in 3-D space, can produce a **finite** period of cosmological time (say, [8 min](#)). If we use such [Archimedean geometry](#) for 'the source of DDE' [[Ref. 4](#)], the task for understanding the cosmological "beginning" and "end", as well as the problems with singularities and 'boundary of space' will be insurmountable. There is a lot to be done for revealing Einstein's "total field of as yet [unknown structure](#)."

Here comes a difficult (to my teenage daughter) exercise: try to recover the [ripples of the 3-D metric](#) following the 1-D case (see the GW lake) and 2-D case (the Flatland animation above).

If you endow the "stretching 'n squeezing" 2-D plane (Ray Weiss' mesh) with a third space dimension, the "direction" of GW propagation will be **omnipresent** in 3-D space, similar to the 2-D case in which it was "acting" on the whole 2-D plane *en bloc*. To explain 'omnipresent', imagine a brand new axis in 3-D space, along which you can discriminate between Small and Large. The [spherically symmetrical](#) 3-D "breathing" of the metric is along this new T-invariant axis, so if you dare to talk about the dynamics of the [metric-filed "breathing"](#), you have to use different signs for **t**, say, **+t** for the "inhaling" mode and **-t** for the "exhaling" mode. Then the arrow of spacetime will require **another** axis, denoted with **w** in Fig. 2 [above](#), which is **orthogonal** to the *omnipresent* axis of the Small viz Large in [our good old 3-D space](#).

Thus, the cosmological arrow [[Ref. 4](#)], as well as the dynamics of GW scattering in 3-D space, can only be defined w.r.t. the unobservable, global, Heraclitean, and non-Archimedean time (see [above](#)): once we "look" at 3-D space from the *global mode*, the very **nature** of time changes accordingly. As explained in [Wiki](#), we would see "all points in 3-dimensional space **simultaneously**, including the inner structure of solid objects and things obscured from our three-dimensional viewpoint". However, our (inanimate) wristwatch can read only *one* instant from this *global mode* of time. It can't read **+t** ("inhaling" mode) and **-t** ("exhaling" mode) *simultaneously*, hence it will report the global mode of time as [atemporal](#) and "frozen" (recall the problem of time in [canonical](#) quantum gravity).

I bet nobody at [GR19](#) will make the slightest effort to mention the unobservable, global, Heraclitean, and non-Archimedean time, pertaining to GWs *and* the global expansion of space. Eight years ago, [B. Schutz](#) explained only a fraction of the problems, and didn't even mention the problems of GW dynamics stemming from the global expansion of space: you **cannot** detect GWs along the time read by your wristwatch, as Kip Thorne speculated [above](#), just as you cannot take the stand of some meta-observer to monitor the global GW dynamics 'on the whole spacetime *en bloc*', or count to infinity, like [Chuck Norris](#).

The usual excuse of LIGO Scientific Collaboration is that they use a linearized approximation of GR, only this '[spherical cow](#)' is "**a shadow without power**" -- check out [Hermann Weyl](#).

Yet LSC persistently ignore all arguments against the "theory" of GW detection with LIGO and the like. Okay, I used *their* linearized approximation of GR to derive the conditions under which LIGO Scientific Collaboration ([700+ people](#)) might succeed: LIGO needs a *schizophrenic behavior of gravity*, as explained [here](#). But of course nobody at [GR19](#) will mention [Hermann Weyl](#) nor the [SBG argument](#).

LIGO Scientific Collaboration stubbornly refuse to acknowledge that there are no bans on the [dipole radiation](#) anymore, simply because the alleged [conservation of gravitational mass-energy](#) and momentum, in a world dominated by an *evolving* cosmological "constant", is a wishful thinking: [all the energy conditions of GR](#) have come into question.

In [October last year](#), I asked [75 physicists](#) to endorse the submission of my manuscript "Taxpayer's perspective on GW astronomy" to ArXiv.org server. Two of them refused ([Jonathan Thornburg](#) and [Stanley Deser](#)), while the rest didn't even bother to respond to my email. Surely GWs exist, but we may have to construct brand new detectors for the [dipole radiation](#), and even re-examine [the crux of GR](#) [[Ref. 5](#)]: the [quasi-local](#) energy density of the gravitational field and the "boundary conditions" [[Ref. 6](#)] fixed in the global non-Archimedean spacetime. In simple words, the *wegtransformierbar* quality of gravity "over a point" (Afriat and Caccese, [p. 27](#)) indicates its *specific quantum origin*; details [above](#).

Nobody from [GR19](#) has so far responded to my email. I cannot argue with silent [spherical cows](#) either, once they have collected all the money -- [taxpayers' money](#) -- to play with [Einstein's GR](#).

There is no sense to "enhance" the sensitivity of LIGO, for it has been a [dead turkey](#) from the outset. I suggested in [March 2006](#) that LIGO tunnels should be converted to wine cellars, but what can be done with [LISA](#)? How much will cost that space junk?

[When is enough, enough?](#)

"[just another crank](#)" D.C.

June 1, 2010

Last update: July 29, 2010

[Ref. 3] Orfeu Bertolami, The mystical formula and the mystery of Khronos, arXiv:0801.3994v3 [gr-qc], <http://arxiv.org/abs/0801.3994>

"In practical terms, one defines the second, the fundamental unit of time, as 1/86400 of the duration of the average solar day, or 9,192,631,770 **periods** of transition the radiation corresponding to the transition between the two hyperfine levels of the ground state of the cesium-133 atom. (4)

...

Footnote 4: "This definition concerns a cesium atom at rest at a temperature of 0K, such that the ground state is defined at zero magnetic field.

....

"Another interesting idea is the so-called "Heraclitean time proposal" [63, 64]. This is based on a suggestion by Einstein [65] according to which the determinant of the metric might not be a dynamical quantity."

--

[65]

**Spielen Gravitationsfelder im Aufbau der materiellen Elementarteilchen eine wesentliche Rolle?, *Sitz.ber. Preuss. Akad. Wiss. (Berlin)*, pp. 349-356 (presented at the meeting of 10 April 1919); reprinted in *Das Relativitätsprinzip*, third edition, 1920. English translation: Do gravitational fields play an essential part in the structure of the elementary particles?, in *The Principle of Relativity, L.c.*, pp. 189-198.**

[Ref. 4] Michal Chodorowski, A direct consequence of the expansion of space? arXiv:astro-ph/0610590v3, <http://arxiv.org/abs/astro-ph/0610590v3>

"We argue that, unlike the expansion of the cosmic substratum, the expansion of space is unobservable."

"To 'explain' these and other GR effects in cosmology, the idea of the Expansion of Space (EoS) is evoked.

...

" • On a philosophical level, it suggests that the expansion of the universe can be detached from the matter that is participating in the expansion. However, we know that, as he was constructing GR, Einstein was greatly influenced by the thoughts of German physicist and philosopher Ernst Mach. In the words of Rindler (1977), for Mach "space is not a 'thing' in its own right; it is merely an abstraction from the totality of instance-relations between matter". Therefore, the idea of expanding space 'in its own right' is very much contrary to the spirit of GR.

"• On a physical level, it suggests that the EoS is a geometric effect, so space itself is absolute. Then, though abolished in SR, in cosmology absolute space reenters triumphally the cosmic arena, endowed with an additional attribute: expansion.

"• Again on a physical level, it suggests the existence of a new mysterious force. If so, one can expect non-standard effects also on small scales. For example, one might expect particles to be dragged along by the EoS.

...

"Still, isn't space expanding from a global point of view? Spatial sections of a closed FL model are three-spheres, whose radius of curvature increases as  $a(\tau)$ . Here,  $a(\tau)$  is the so-called [scale-factor](#), a universal function of cosmic time which describes how the distances between all elements of the cosmic substratum (or, fluid) grow with time. Therefore, the proper volume of a closed FL universe increases as  $[a(\tau)]^3$ ; [more and more space thus appears](#)."

[Ref. 5] Bahram Mashhoon, Necessity of Acceleration-Induced Nonlocality, [arXiv:1006.4150v1](https://arxiv.org/abs/1006.4150v1) [[gr-qc](#)]

"Ideal inertial (non-Archimedean - D.C.) observers are imaginary and do not really exist (yes they do exist: check out the UNdecidable KS state [above](#) - D.C.).

....

"The locality postulate states that an accelerated observer is at each instant physically equivalent to an otherwise identical momentarily comoving inertial observer. The latter follows the straight world line that is tangent to the world line of the accelerated observer at that instant. Thus an accelerated observer may be replaced in effect by an infinite sequence of hypothetical momentarily comoving inertial observers; mathematically, the world line of the accelerated observer is the envelope of the straight world lines of the corresponding hypothetical inertial observers (for reality check, see [Alan Rendall](#) - D.C.).

"This locality assumption originates from Newtonian mechanics, where the state of a point particle is determined at each instant by its position and velocity. The (hypothetical - D.C.) [point particle](#) and the hypothetical comoving inertial particle of the same mass share the same state (only in Newtonian mechanics - D.C.) and are thus physically equivalent."

[Ref. 6] Emil Mottola, The Trace Anomaly and Dynamical Vacuum Energy in Cosmology, [arXiv:1006.3567v1 \[gr-qc\]](https://arxiv.org/abs/1006.3567v1), Sec. 1.

"Hence  $[\lambda]$  may take on [any value whatsoever](#) with no difficulty (and with no explanation) in classical General Relativity.

.....

"This is a clear indication, confirmed by experiment, that the measurable effects associated with vacuum fluctuations are infrared phenomena, dependent upon *macroscopic boundary conditions*, which have little or nothing to do with the extreme ultraviolet modes or cutoff of the integral in (1.4).

.....

"In calculations of the Casimir force between conductors, one subtracts the zero point energy of the electromagnetic field in an infinitely extended vacuum (with the conductors absent) from the modified zero point energies in the presence of the conductors. It is this subtracted zero point energy of the electromagnetic vacuum, depending upon the boundary conditions imposed by the conducting surfaces, which leads to experimentally well verified results for the force between the conductors.

.....

"In the case of the Casimir effect, a constant zero point energy of the vacuum, no matter how large, does not affect the force between the plates. In the case of cosmology it is usually taken for granted that any effects of [boundary conditions](#) can be neglected ([can't and shouldn't](#) - D.C.).

"It is not obvious then what should play the role of the conducting plates in determining the magnitude of  $\rho_V$  in the universe, and the magnitude of any effect of quantum zero point energy on the curvature of space has remained unclear from Pauli's original estimate down to the present.

.....

**NB**, p. 4: "A vacuum energy with  $p > 0$  and  $w = p_V/\rho_V = -1$  leads to an accelerated expansion, a kind of "repulsive" gravity in which the relativistic effects of a negative pressure can **overcome** a positive energy density in (1.6). Taken at face value, the observations imply that some 74% of the energy in the universe is of this hitherto undetected  $w = -1$  dark variety [3, 4]. This leads to a non-zero *inferred* cosmological term in Einstein's equations ... (Eq. 1.7).

.....

"A naturalness problem arises only when the effects of quantum zero point energy on the large scale curvature of spacetime are considered. This is a problem of the gravitational energy of the quantum vacuum or ground state of the system at *macroscopic* distance scales ... "

=====

Subject: Quantum mechanics needs no consciousness (and the other way around)

Date: Mon, 27 Sep 2010 17:51:05 +0300

From: Dimi Chakalov <dchakalov@gmail.com>

To: Shan Yu <yushan.mail@gmail.com> ,

Danko Nikolic <danko.nikolic@googlemail.com>

Cc: Thomas Metzinger <metzinger@uni-mainz.de> ,

Philip Pearle <ppearle@hamilton.edu> ,

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Horst Stöcker <stoecker@uni-frankfurt.de> ,

Karlheinz Langanke <k.langanke@gsi.de>

Dear Dr. Yu,

May I comment on your latest [arXiv:1009.2404v2](http://arxiv.org/abs/1009.2404v2), "Quantum mechanics needs no consciousness (and the other way around)".

I fully agree with you and Dr. Nikolic that (pp. 5-6) "quantum mechanics may have not left any space for the observer's consciousness to manipulate the experimental results". There is no need for any "observer" in QM, provided we can formulate the latter in accordance with 'no observer' requirement from quantum cosmology -- please see Sec. Summary, pp. 35-36, at

<http://www.god-does-not-play-dice.net/ExplanatoryNote.pdf>

Instead, the whole universe should act as "observer" (or rather "[chooser](#)", Philip Pearle), in line with 'the universe modeled as a brain',

<http://www.god-does-not-play-dice.net/#history>

<http://www.god-does-not-play-dice.net/#KS>

Please notice that I strictly follow W. Pauli's proposal for solving the mind-brain problem (H. Atmanspracher and H. Primas (1997), The Hidden Side of Wolfgang Pauli, Journal of Scientific Exploration 11(3) 369-386; cf. Sec. VI, Matter and Psyche as Two Aspects of One Reality, p. 381).

I will appreciate your professional comments. I trust your German colleagues have received my previous email (Mon, 20 Sep 2010 08:19:34 +0300), regarding the physics of [binding phenomenon](#). It's all about the brain, again.

Kindest regards,

Dimi Chakalov

=====

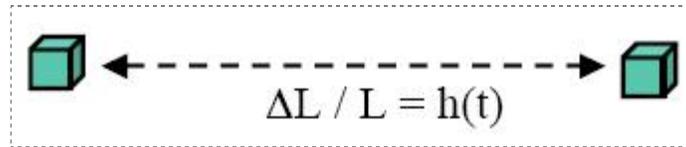


Excerpt from "ripples on space-time,"  
<http://www.ligo.org/science/GW-GW2.php>

"For physicists, a strong gravitational wave will produce displacements on the order of  $10^{-18}$  meters - this is 1000 times smaller than the diameter of a proton."

It is a **dimensionless ghost** that would show up *only* with ... "[2.3 × 10<sup>-26</sup>](#)". It is also supposed to "cause a **periodic** strain (i.e., stretching and contraction) of the [proper distance between points](#) (altered by the "dark energy" - D.C.) in spacetime" ([G. Jones](#), p. 182).

What is the *dimensionality* of GW amplitude, **h** , in Kip's mantra?



The very entity that fixes the "proper distance" of [[one meter](#)] cannot be presented with what is *produces* -- '[one meter](#)'. It is indeed dimensionless, just like the "amplitude" of quantum waves. Can you display at macroscopic scale the ongoing dynamics of quantum-gravitational waves at distances of "[2.3×10<sup>-26</sup>](#)" without a proper theory of quantum gravity?

How can you detect, with some "advanced" LIGO or LISA, the very "dark energy" which "expands" space by altering the **proper** distance between "points" ?

Nobody cares. **Nobody.**

D.C., 11 April 2011

*Ceterum autem censeo, LIGO esse delendam*

=====

Subject: Re: "yes, I do understand GR, but cannot discuss that now."

Date: Wed, 6 Apr 2011 00:35:59 +0300

Message-ID: <BANLkTikHX9GK8L1c8CzgshEANVFLubEcXw@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

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Cc: LSC Spokesperson <reitze@phys.ufl.edu> ,

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Stanley:

Five years ago, on 31 March 2006, you claimed that you "do understand GR, but cannot discuss that now."

Regrettably, neither you nor any of your colleagues agreed to endorse the submission of my manuscript, entitled: "A Taxpayer's Perspective on GW Astronomy." An outline can be read at

<http://www.god-does-not-play-dice.net/#LIGO>

General considerations at

<http://www.god-does-not-play-dice.net/#Ruben>

Any comments?

Dimi

-----  
Subject: Re: "yes, I do understand GR, but cannot discuss that now."  
Date: Wed, 21 Oct 2009 01:32:35 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Stanley Deser <deser@brandeis.edu>  
Cc: Joel Franklin <jfrankli@reed.edu>,  
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Andrew Waldron <wally@math.ucdavis.edu>,  
Steven Carlip <carlip@physics.ucdavis.edu>,  
John Baez <baez@math.ucr.edu>,  
John W Barrett <john.barrett@nottingham.ac.uk>

On Wed, Oct 21, 2009 at 1:14 AM, Stanley Deser <deser@brandeis.edu> wrote:  
>  
> Dear Sir,  
> I cannot spare the time for your proposals; why not submit to a journal &  
> see what happens? sd

Gladly.

Would you, or any of your colleagues, endorse the submission of my manuscript

<http://arxiv.org/help/endorsement> ?

The basic arguments are at

<http://www.god-does-not-play-dice.net/Szabados.html#SBG>

I will be happy to send you, or any of your colleagues, my manuscript, entitled: "A Taxpayer's Perspective On GW Astronomy".

Regards,

Dimi

=====

Subject: The wine cellars of LIGO  
Date: Mon, 18 Apr 2011 14:29:57 +0300  
Message-ID: <BANLkTik6NZehtJyA7MauFWbEoeTKsbERPw@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Sanjeev Dhurandhar <sanjeev@iucaa.ernet.in>  
Cc: Jorge Pullin <pullin@lsu.edu>,  
Gabriela González <gonzalez@lsu.edu>,  
Curt Cutler <Curt.J.Cutler@jpl.nasa.gov>,  
Bernard Schutz <Bernard.Schutz@aei.mpg.de>,  
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Valerio <vfaraoni@ubishops.ca>,

Warren <johnson@ligo.phys.lsu.edu>,  
lsfinn@psu.edu,  
Joan.Centrella@nasa.gov

Dear Dr. Dhurandhar,

Five years ago (Wed, 01 Mar 2006 04:59:31 +0200), I suggested to Jorge Pullin to convert the dark, air-conditioned tunnels of LIGO to wine cellars (it is important to keep the temperature at 13°C - 15°C).

I wonder what can you do with your "interferometric detectors", [arXiv:1104.2968v1 \[gr-qc\]](https://arxiv.org/abs/1104.2968v1),

<http://www.god-does-not-play-dice.net/#LIGO>

[http://www.god-does-not-play-dice.net/#LIGO\\_LISA](http://www.god-does-not-play-dice.net/#LIGO_LISA)

The suggestions from your colleagues will be greatly appreciated, too.

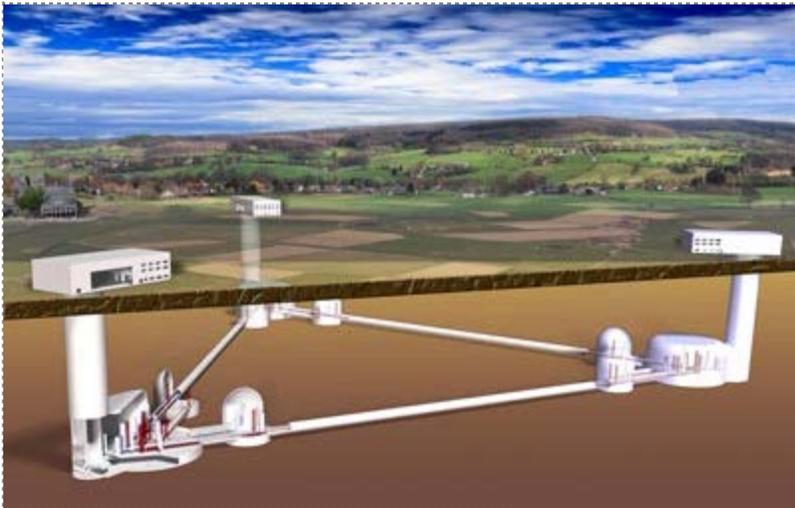
Sincerely,

D. Chakalov

-----

Overfunded research is like heroin: It makes one addicted, weakens the mind and furthers prostitution.

[Johann A. Makowsky](#), *The Jerusalem Post*, 19 April 1985



The next wine cellar (pictured above) will cost at least \$1,280,000,000 (€790M). It will be built underground at a depth of about 100–200 m and will consist of three large wine cellars, each linked by two 10 km long wine shelves. Cheers!

D. Chakalov  
May 19, 2011

=====

Subject: Re: [The wine cellars of LIGO](#)  
Date: Tue, 20 Sep 2011 17:56:28 +0300  
Message-ID:  
<CAM7EkxnvwukGbCF823KX7sjHY4pZxD1hby6iQV5-o8qCcvrwoQ@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Joan Centrella <Joan.Centrella@nasa.gov>

Cc: Vivian Drew <vdrew@stanford.edu>,  
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frank.steier@aei.mpg.de,  
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Stefan.Krueckeberg@dfg.de,  
Cliff <cmw@wuphys.wustl.edu>,  
LSC Spokesperson <reitze@phys.ufl.edu>

Hello Joan:

As a civil servant employee of NASA, you should be *very* careful to avoid elementary errors, which could undermine the reputation of NASA.

Yet in your latest essay [arXiv:1109.3492v1 \[astro-ph.HE\]](https://arxiv.org/abs/1109.3492v1), you wrote:

"Far from their source, these ripples are small perturbations (xxx) on a flat background spacetime."

No they aren't:

<http://www.god-does-not-play-dice.net/#LRR>

STOP wasting taxpayers' money for your fantasies.

When you and LIGO "scientific" collaboration ultimately fail, people all over the world will not laugh at your wishful thinking.

**They will laugh at NASA.**

*Capiche?*

D. Chakalov

-----  
Subject: The wine cellars of LIGO  
Date: Mon, 18 Apr 2011 14:29:57 +0300  
Message-ID: <BANLkTik6NZehtJyA7MauFWbEoeTKsbERPw@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Sanjeev Dhurandhar <sanjeev@iucaa.ernet.in>  
Cc: Jorge Pullin <pullin@lsu.edu>,  
Gabriela González <gonzalez@lsu.edu>,  
Curt Cutler <Curt.J.Cutler@jpl.nasa.gov>,  
Bernard Schutz <Bernard.Schutz@aei.mpg.de>,  
LSC Spokesperson <reitze@phys.ufl.edu>,  
Kip <kip@tapir.caltech.edu>,  
Karsten <karsten.danzmann@aei.mpg.de>,  
David <garfinkl@oakland.edu>,  
Valerio <vfaraoni@ubishops.ca>,  
Warren <johnson@ligo.phys.lsu.edu>,  
lsfinn@psu.edu,  
Joan.Centrella@nasa.gov

Dear Dr. Dhurandhar,

Five years ago (Wed, 01 Mar 2006 04:59:31 +0200), I suggested to Jorge Pullin to convert the dark, air-conditioned tunnels of LIGO to wine cellars (it is important to keep the temperature at 13°C - 15°C).

[snip]

-----  
**Note:** You cannot, *not even in principle*, derive the so-called "[weak limit](#)."

You cannot estimate the **quasi-local** "loss" or "gain" of energy due to gravity either [[Ref. 1](#)]. All you could do is to admit the consequences from the so-called "dark energy" ([Sean Carroll](#)), get yourself a blank notebook and sharp pencils, and [start from scratch](#).

D. Chakalov  
September 21, 2011

[Ref. 1] Carl Hofer, [Energy Conservation in GTR](#), *Stud. Hist. Phil. Mod. Phys.* 31(2), 187 (2000); see pp. 193-195, pdf file available from [here](#).

p. 191: "Intuitively, if energy-momentum is *really* being conserved locally, then when one integrates up it should be conserved over regions as well. Since this fails, we have to fall back on a different understanding of what (1) represents.

...

p. 193: "It is called the gravitational stress-energy *pseudo-tensor*, and its non-tensorial nature means that there is no well-defined, intrinsic 'amount of stuff' present [at any given point](#)."

Regarding [GWs](#), see p. 196: "If energy is not conserved quite generally, there is no need to make up a story about [where it has gone](#) when a system loses it."

See also footnote 11, p. 195.

=====



Subject: Re: [The wine cellars of LIGO](#)  
Date: Mon, 30 Jan 2012 14:44:12 +0200  
Message-ID:  
<CAM7EkxmbWB\_2nTzZWDuSWdpVT2TU+62ZNtsAWc\_DoEoK3jQL8g@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: James Ira Thorpe <James.I.Thorpe@nasa.gov>, john.g.baker@nasa.gov  
Cc: Joan Centrella <Joan.Centrella@nasa.gov>, stmcwill@princeton.edu, markodh@googlemail.com, robin.t.stebbins@nasa.gov, Karen.m.Smale@nasa.gov, Catherine.m.Corlan@nasa.gov, notoya.r.russell@nasa.gov, mor.vimmer@nasa.gov, johnson@ligo.phys.lsu.edu, stephen.m.merkowitz@nasa.gov, meredith.gibb@nasa.gov, Bernard Schutz <Bernard.Schutz@aei.mpg.de>, LSC Spokesperson <reitze@phys.ufl.edu>, Kip <kip@tapir.caltech.edu>, Karsten <karsten.danzmann@aei.mpg.de>, David <garfinkl@oakland.edu>

Hello Dr. Thorpe,

In your latest [arXiv:1201.5656v1 \[gr-qc\]](#), you and you co-author wrote: "LISA was identified as a priority in the most recent decadal survey of astronomy and astrophysics[10] but has yet to be implemented due to funding constraints."

LISA will never fly, not because of "funding constraints", but because your hypotheses are wrong:

[http://www.god-does-not-play-dice.net/#LIGO\\_Prague](http://www.god-does-not-play-dice.net/#LIGO_Prague)

I explained the facts to Mrs. Centrella (Tue, 20 Sep 2011 17:56:28 +0300), but she refused to reply.

Again, once you and LIGO "scientific" collaboration fail with the "advanced" LIGO, people all over the world will *not* laugh at your wishful thinking.

**They will laugh at NASA.**

D. Chakalov  
-----

**Note:** "People sometimes make errors," said Edward Weiler, NASA's Associate Administrator for Space Science, on September 30, 1999, after the crash of [Mars Polar Lander](#) spacecraft. One of the teams used English units (e.g., inches, feet and pounds), while the other used metric units.

It happens. But the case here is totally different: [science](#) has been contaminated with money. I believe both NASA and [NSF](#) are **fully aware** of the game, but keep quiet.

In my not-so-humble opinion, the linearized approximation of GR is applicable to specific task such as adjusting the [GPS system](#), but **not** for the transport of energy by GWs, which is "a fundamentally nonlinear phenomenon":

Sir Hermann Bondi (*Gravitational Waves in General Relativity*, [February 1, 1990](#)): "From the beginning I was very suspicious of the value of linearized treatments of the topic. Not only is general relativity by its nature a [nonlinear theory](#), but the question of the "reality" of the waves essentially concerned whether they transported energy. Such transport is a fundamentally nonlinear phenomenon."

To quote from M. Maggiore's "Gravitational Waves" (Oxford University Press, 2007, [p. 32](#)): "In [special cases](#) (English translation: spherical cow approximations; cf. [[Ref. 1](#)] - D.C.) one can find exact wave-like solutions of the full nonlinear Einstein equations, see, e.g. Misner, Thorne and Wheeler (1973), [Section 35.9](#), and then there is **no need** (Sic! - D.C.) to perform a [separation](#) between the background and the waves. However, it would be **hopeless** to look for exact solutions for the gravitational waves emitted by realistic astrophysical sources."

*Voilà*, straight from the horse's mouth. You'll need the [medieval magic](#) of the "linearized approximation" to "eliminate" by hand the **insurmountable** problems of detecting GWs [[Ref. 2](#)], plus **billions** of USD to perform "a [separation](#) between the background and the waves" and endow GWs with "an energy-momentum tensor" (Michele Maggiore, [p. 34](#); see also [[Ref. 1](#)]).

Or just the cash, which is *much* easier.

As [Johann Makowsky](#) put it (*The Jerusalem Post*, 19.4.1985), "Overfunded research is like heroin: It makes one addicted, weakens the mind and furthers prostitution."

D.C.

January 31, 2012

Last updated: February 4, 2012, 14:35 GMT

[Ref. 1] [MTW](#), p. 968:

All nonlinear interactions of the wave with itself are neglected in this first-order propagation equation. Absent is the mechanism for waves to scatter off each other and off the background curvature that they themselves produce. Also absent are any hints of a change in shape of pulse due to self-interaction as a pulse of waves propagates. There are no signs of the gravitational collapse that one knows must occur when a mass-energy  $m$  of gravitational waves gets compressed into a region of size  $\lesssim m$ . To see all these effects, one must turn to corrections of second order in  $\mathcal{L}$  and higher [e.g., equations (35.59c) and (35.60)].

(Comment: By the same token, suppose I decide to "cope with the complexities" ([MTW](#), § 35.9) of Quantum Mechanics (QM) by suggesting an [approximation](#) of QM based on classical statistical theory, to achieve "a compromise between realism and complexity" (*ibid.*), and claim that one can measure simultaneously non-commuting QM observables with arbitrary precision, provided we 'enhance the sensitivity' of our macroscopic measuring devices, for which I need just a couple of billion USD and EUR.

Catch my drift? - D.C.)

p. 970:

(A gentle suggestion to those who [deeply believe](#) that LIGO "scientific" collaboration has some theory somehow related to [General Relativity](#): Once you introduce "stress-energy tensor for gravitational waves" and explain the energy exchange of "mass-energy **m** of gravitational waves" with LIGO's arms -- locally, 'at a point' -- please proceed to the puzzle of 'gravitational energy **density** at a **point**' (MTW, [p. 467](#)) and all [quasi-local](#) features of gravity - D.C.)

Figure 35.3, p. 959: "an exact **plane-wave** solution to Einstein's **vacuum field** equations."

### §35.9. AN EXACT PLANE-WAVE SOLUTION

Any exact gravitational-wave solution that can be given in closed mathematical form must be highly idealized; otherwise it could not begin to cope with the complexities outlined above. Consequently, mathematically exact solutions are useful for pedagogical purposes only. However, pedagogy should not be condemned: it is needed not only by students, but also by veteran workers in the field of relativity, who even today are only beginning to develop intuition into the nonlinear regime of geometrodynamics!

From the extensive literature on exact solutions, we have chosen, as a compromise between realism and complexity, the following plane wave [Bondi *et. al.* (1959), Ehlers and Kundt (1962)]:

[Ref. 2] L.P. Grishchuk, Update on gravitational-wave research, [arXiv:gr-qc/0305051v2](#)

"It is often stated that "gravitational waves are oscillations of space-time itself". The next phrase seems to be logically unavoidable: "gravitational waves act [tidally](#), stretching and squeezing any object that they pass through".

"If this phrase were correct, we would never be able to notice gravitational waves. The device measuring, say, the displacements of free mirrors in an interferometer would be "stretched and squeezed" **as well**. In this situation, we can probably find comfort in the wise observation [67]: "I agree that much of what one reads in the literature is absurd. Often it is a result of bad writing, rather than bad physics. I often find that people who say silly things actually do correct calculations, but are careless in what they say about them.

----

"[67] I am grateful to S. Weinberg for the permission to quote his e-mail message of 25 Feb 2003."

L. P. Grishchuk and A. G. Polnarev, Gravitational Waves and Their Interaction with Matter and Fields, in *General Relativity and Gravitation*, ed. by A. Held, Vol. 2, Ch. 10, Plenum, New York, 1980, [p. 427](#):

"Due to the nonlinearity of gravitation a weak gravitational wave can **interact** with a smooth background gravitational field. This interaction may result in dispersion of the gravitational waves, their amplification, etc."

## Addendum

An excerpt from *Lectures on Mathematical Cosmology* by H.-J. Schmidt, [gr-qc/0407095](#), Sec. 4.2, p. 35, *Why do all the curvature invariants of a gravitational wave vanish?*

"The energy of the gravitational field, especially of gravitational waves, within General Relativity was subject of controversies from the very beginning, see Einstein [66]. Global considerations - e.g. by considering [the far-field of asymptotically flat spacetimes](#) - soon led to satisfactory answers. Local considerations became fruitful if a system of reference is prescribed e.g. by choosing a timelike vector field.

"If, however, no system of reference is preferred then it is not a priori clear whether one can constructively distinguish flat spacetime from a gravitational wave. This is connected with the generally known fact, that for a **pp-wave**, see e.g. Stephani [250] especially section 15.3. and [65] all curvature invariants vanish, cf. Hawking and Ellis [107] and Jordan et al. [123], but on the other hand: in the absence of matter or reference systems - only curvature invariants are locally constructively measurable.

....

"At page 97 of [123] it is mentioned that for a pp-wave all curvature invariants constructed from

$$R_{ijkl;i_1\dots i_r} \quad (4.18)$$

by products and traces do vanish."

--

[66] Einstein, A.:

1914, Sitzungsber. Akad. d. Wiss. Berlin, 1030.

1916, Sitzungsber. Akad. d. Wiss. Berlin, 688.

1918, Sitzungsber. Akad. d. Wiss. Berlin, 154.

1921, Sitzungsber. Akad. d. Wiss. Berlin, 261. 35, 145

[65] Ehlers, J., Kundt, W.: 1962, in: Witten, E., ed., *Gravitation, an introduction to current research*, Wiley New York, 49. 36

[107] Hawking, S., Ellis, G.: 1973, *The large scale structure of space-time*, Cambridge University Press. 36

[123] Jordan, P., Ehlers, J., Kundt, W.: 1960, Abh. Akad. Wiss. Mainz, Math./Nat. Kl. 2, 21. 36

[250] Stephani, H.: 1982, *General Relativity*, Cambridge University Press. 7, 36, 164; section 15.3.

-----

Prof. Hans-Jürgen Schmidt hasn't yet replied to my email of Thu, 20 Feb 2003 12:05:02 +0200:

"Isn't it true that the \*necessary\* condition for detecting gravitational waves is that the distribution of energy-momentum of a physical system [in the gravitational field](#) must be [uniquely defined on a continual trajectory](#), not just in one instant of measurement?"

Again, all those who [deeply believe](#) that LIGO "scientific" collaboration has some theory somehow related to [General Relativity](#) should try the following simple exercise:

Once you introduce "stress-energy tensor for gravitational waves" and explain the energy exchange of "mass-energy **m** of gravitational waves" with LIGO's arms -- locally, 'at a point' -- please proceed to the puzzle of 'gravitational energy **density** at a **point**' (MTW, [p. 467](#)) and all [quasi-local](#) features of gravity.

D. Chakalov  
February 2, 2012

=====

Subject: Re: [NSF OIG has received your submission. Thank you.](#)  
Date: Tue, 31 Jan 2012 02:30:50 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: OIG <oig@nsf.gov>

On Mon, 30 Jan 2012 19:14:59 -0500,  
Message-ID: <2D1C5457CACAB04F9325751A96F342D904BC4966@NSF-BE-03.ad.nsf.gov> ,  
OIG <oig@nsf.gov> wrote:  
>  
> Re: NSF OIG has received your submission. Thank you.

Thank you for confirming the receipt of my warning message.

I stand ready to provide all information you may deem necessary for your investigation.

Yours sincerely,

Dimitar G. Chakalov  
[snip]

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**Note:** I hope that the Office of Inspector General ([OIG](#)) at NSF does provide independent oversight of the NSF's programs and operations, "preventing and detecting fraud, waste, and abuse". Here, the key word is **waste**: hundreds of million USD and EUR have been already wasted, and even more is scheduled to be wasted with the "advanced" LIGO and LISA.

I also wrote to NASA Science (cf. my ref # below) and to the Inspector General at NASA <[HQ-OIG-Counsel@mail.nasa.gov](mailto:HQ-OIG-Counsel@mail.nasa.gov)> , and will offer my manuscript, entitled: "A Taxpayer's Perspective on GW Astronomy". In October 2009, I asked [seventy-five](#) theoretical physicists whether they would endorse the submission of this manuscript to [gr-qc] -- two of them flatly denied (S. Deser and J. Thornburg), the rest didn't even bother to acknowledge my email.

D.C.  
January 31, 2012

**THANKS**  
**YOUR FEEDBACK HAS BEEN SUBMITTED, REFERENCE NUMBER: 6786**

=====

Subject: Re: [The wine cellars of LIGO](#)  
Date: Tue, 31 Jan 2012 11:36:00 +0200  
Message-ID: <CAM7EkxkqR2MbZ8AnMxwwZTUcv69LRnuLdOvrPHJa7Cw6Wj7+EQ@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>

To: Warren Johnson <johnson@ligo.phys.lsu.edu>  
Cc: James Ira Thorpe <James.I.Thorpe@nasa.gov>,  
john.g.baker@nasa.gov,  
Joan Centrella <Joan.Centrella@nasa.gov>,  
stmckill@princeton.edu,  
markodh@googlemail.com,  
robin.t.stebbins@nasa.gov,  
Karen.m.Smale@nasa.gov,  
Catherine.m.Corlan@nasa.gov,  
notoya.r.russell@nasa.gov,  
mor.vimmer@nasa.gov,  
stephen.m.merkowitz@nasa.gov,  
meredith.gibb@nasa.gov,  
Bernard Schutz <Bernard.Schutz@aei.mpg.de>,  
LSC Spokesperson <reitze@phys.ufl.edu>,  
Kip <kip@tapir.caltech.edu>,  
Karsten <karsten.danzmann@aei.mpg.de>,  
David <garfinkl@oakland.edu>,  
Beverly Berger <bberger@nsf.gov>,  
Tom Carruthers <tcarruth@nsf.gov>,  
Denise S Henry <dshenry@nsf.gov>,  
Ramona Winkelbauer <rwinkelb@nsf.gov>,  
Peggy Fischer <pfischer@nsf.gov>,  
OIG <oig@nsf.gov>,  
Clifford Will <cmw@wuphys.wustl.edu>

Dear Mr. Johnson,

On Tue, 31 Jan 2012 01:12:18 -0600,  
Message-Id: <C37B47CC-49F9-436E-B3A0-D8923CDB9B2B@ligo.phys.lsu.edu> ,  
you wrote:

- > For years you have accumulated taunts and insults on your
- > website <http://www.god-does-not-play-dice.net>. Your targets have included
- > all the scientists who have worked on gravitational wave physics and are
- > connected with the LIGO and LISA projects.

My first warning message, recorded at my web site, is from Wed, 19 Feb 2003 23:40:26 +0200.

In the past (almost) nine years, nobody has responded professionally to my objections to your absolutely ridiculous wasting of taxpayers' money -- nobody has made even a modest effort to read and study the articles published in peer reviews journals, which prove, beyond ANY reasonable doubt, that LIGO "scientific" collaboration and VIRGO collaboration do NOT have any scientific theory. Just wishful thinking based on wild guesses.

Your efforts to detect GWs is indeed based solely on wishful thinking: read carefully the text and references at

[http://www.god-does-not-play-dice.net/#LIGO\\_Prague](http://www.god-does-not-play-dice.net/#LIGO_Prague)

Yes, I will expose the dirty little secrets of LIGO "scientific" collaboration.

- > At your website you explain how these detectors are supposed to work. I
- > agree that your explanation is nonsense, so I understand how you conclude
- > that these experiments can never work. However, the fault lies in your
- > understanding, and not in the detectors themselves.

As a member of LIGO "scientific" collaboration, you demonstrate total lack of understanding the basic

basics of General Relativity: your linearized approximation is your problem. Not my web site.

Read the references and my objections, and don't try to guess what I wrote.

> We, who work on these detectors, know how the equations of general  
> relativity can be used to calculate the difference of the round-trip travel  
> times for light in the two arms of the interferometer (the instrument at the  
> heart of both detectors). In short, if no gravity wave passing by, then the  
> round-trip travel time for each arm will remain constant and the same for  
> both arms. But, during those moments when a gravity wave is passing by, one  
> round trip time will be longer than the other, and we can observe and  
> measure that time difference directly. Of course, literally tons more of  
> technical detail can be added, but it really is that simple.

Totally irrelevant. You haven't even glanced at the URL from my initial email, which I reproduced above.

The problem is not in the "round-trip travel time for each arm will remain constant and the same for both arms."

The problem is that you and your 800+ colleagues don't want to face the inherent limitations from the LINEARIZED approximation of GR.

All you want is money -- more and more taxpayers' money earned with hard labor by millions of people.

Yes, I will expose the dirty little secrets of LIGO "scientific" collaboration.

> So for the record, you can not say that your charges have gone unanswered.

For the record: You, Mr. Johnson, have not read any of the papers cited at my web site, and tried instead to guess what I might have stated. And of course you are wrong.

> More to the point, hundreds of highly skilled scientists have repeatedly  
> reviewed every technical aspect of these projects, and all of your charges  
> against them are baseless.

To begin with, read the article by Hermann Weyl from 1944. That's just for a start. More at the link above.

My advice to you and your 800+ colleagues: Get real. Don't hide your head in the sand. Read all arguments and facts about your problems. And most importantly: do not **ever** say that your efforts are related to General Relativity. As I showed at the link above, you don't have any scientific theory, but two wild guesses (cf. the two "if"-s), which have **nothing** to do with General Relativity.

Should you or any of your colleagues wishes to respond, please do your homework first. First things first.

Yes, I will expose the dirty little secrets of LIGO "scientific" collaboration.

And don't even think about LISA.

Sincerely,

Dimi Chakalov

On Tue, 31 Jan 2012 02:14:57 +0200, Dimi Chakalov <dchakalov@gmail.com> wrote:

>

- > P.S. Note added at
- > <http://www.god-does-not-play-dice.net/#ESA>
- >
- > Any comments? Please don't hesitate.
- >
- > D.C.
- >

=====

Subject: LISA: Unveiling a hidden Universe  
Date: Tue, 20 Sep 2011 18:46:07 +0300  
Message-ID:  
<CAM7Ekx=q970kBurwTnV9jr\_bPBjuB76RSCUfGuUqNA-\_HNzU8Q@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Oliver Jennrich <oliver.jennrich@esa.int>, SciTech.Editorial@esa.int

LISA assessment study report  
03 Feb 2011  
Reference: ESA/SRE(2011)3  
<http://sci.esa.int/science-e/www/object/doc.cfm?fobjectid=48363>

-----

Dear Dr. Jennrich,

LISA won't fly, ever.

Check out

<http://www.god-does-not-play-dice.net/#LRR>

[http://www.god-does-not-play-dice.net/#wine\\_cellars](http://www.god-does-not-play-dice.net/#wine_cellars)

Please confirm the receipt of this email.

Sincerely,

Dimi Chakalov

=====

Subject: Re: ... it is necessary to let [the clock](#) tick once.  
Date: Sat, 16 Apr 2011 12:48:15 +0300  
Message-ID: <BANLkTin-6DyAcGNAJHDSjswBVvZMX2\_pJA@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Louis H Kauffman <kauffman@uic.edu>  
Cc: p.rowlands@liverpool.ac.uk, info@theresonanceproject.org, adam@math.missouri.edu, [laan@aei.mpg.de](mailto:laan@aei.mpg.de)

Dear Lou,

Regarding my email from Tue, 05 Apr 2005 16:20:39 +0300, may I draw your attention to the proposal for 'potential reality' at

<http://www.god-does-not-play-dice.net/#Bedingham>

Perhaps it is relevant to "the 'rest of the universe' that the fermion sees and interacts with" and the hypothetical massless particles suggested by Peter Rowlands ([arXiv:0810.0224v1](http://arxiv.org/abs/0810.0224v1) [[physics.gen-ph](http://arxiv.org/abs/0810.0224v1)], p. 11).

Implications for GR and other crazy ideas at

<http://www.god-does-not-play-dice.net/about.html#GR>

<http://www.god-does-not-play-dice.net/about.html#China>

<http://www.god-does-not-play-dice.net/about.html#AVC>

The text at the last URL is essentially incomplete, because I haven't spelled out the hypothetical kinematics of space and its symmetry transformations,

<http://www.god-does-not-play-dice.net/#Chappell>

Will be happy to learn whether you or some of your colleagues are interested. The challenge is [strictly mathematical](#).

Regards,

Dimi

=====

Subject: Cosmic equator: Request for update  
Date: Wed, 20 Apr 2011 04:47:51 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Craig J Copi <cjc5@po.cwru.edu>, ahajian@cita.utoronto.ca, adammoss@phas.ubc.ca, dscott@phas.ubc.ca, zibin@phas.ubc.ca, i.k.wehus@fys.uio.no, mdesouza@ufs.br, lusanna@fi.infn.it, tegmark@mit.edu, mlongo@umich.edu, glenn.starkman@case.edu

Dear colleagues,

May I ask you to help me find an explanation (if any) of the 'cosmic equator' (statistically anisotropic microwave fluctuations), as shown at

<http://wmap.gsfc.nasa.gov/media/101082/index.html>

[http://wmap.gsfc.nasa.gov/media/101082/101082\\_w\\_7yr\\_WMAP\\_256.png](http://wmap.gsfc.nasa.gov/media/101082/101082_w_7yr_WMAP_256.png)

As Max Tegmark admitted eight years ago, "The octopole and quadrupole components are arranged in a straight line across the sky, along a kind of cosmic equator. That's weird. (...) We did not expect this and we cannot yet explain it."

<http://news.bbc.co.uk/2/hi/science/nature/2814947.stm>

Details from [Craig J. Copi](#) et al., astro-ph/0605135v2, p. 15: "It is difficult for us to accept the occurrence of a  $10^{-8}$  unlikely event as a scientific explanation."

Could this 'cosmic equator' be interpreted as a blueprint left from some ([global](#)) cosmological arrow driven by the "dark" energy of [[you-name-it](#)]?

Spin is a fundamental phenomenon, and if 'the whole universe' has angular momentum along some (global) cosmological arrow, the cosmic equator may be a visual manifestation (blueprint) of the "dark" energy of [[you-name-it](#)].

The cosmic equator may not break the Galilei invariance ([Luca Lusanna](#) et al., arXiv:1007.4071v1 [gr-qc]) by defining some preferred observers at rest with respect to the cosmic background radiation, who could literally watch the spinning universe "online", and time it: 13.7 Gy "after" [you-name-it]. I mean, the \*topology\* of time (and space) is still unknown, after Aristotle,

<http://plato.stanford.edu/archives/win2010/entries/time/#TopTim>

Thank you for your time and consideration.

Yours sincerely,

Dimi Chakalov

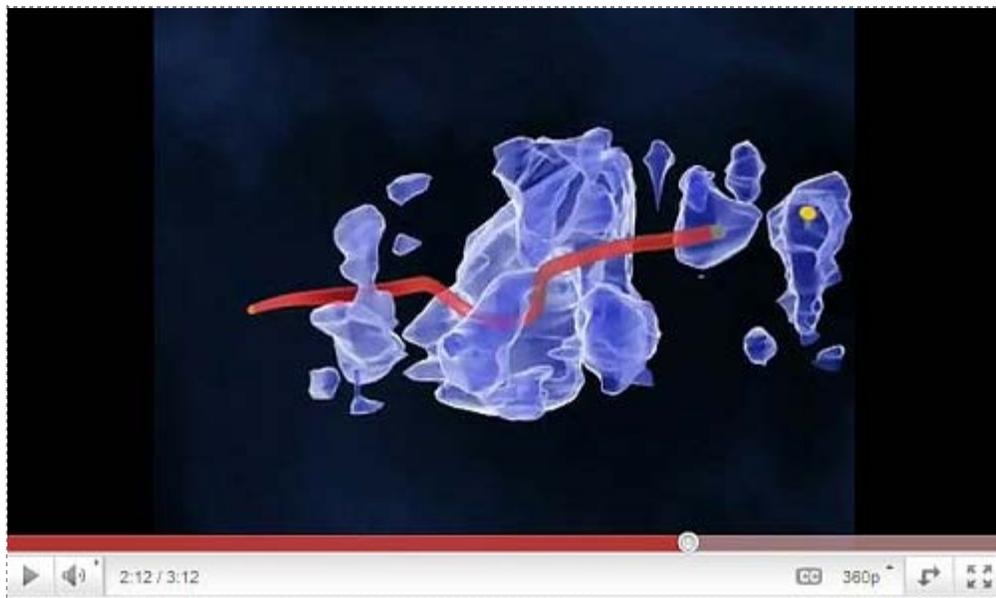
-----

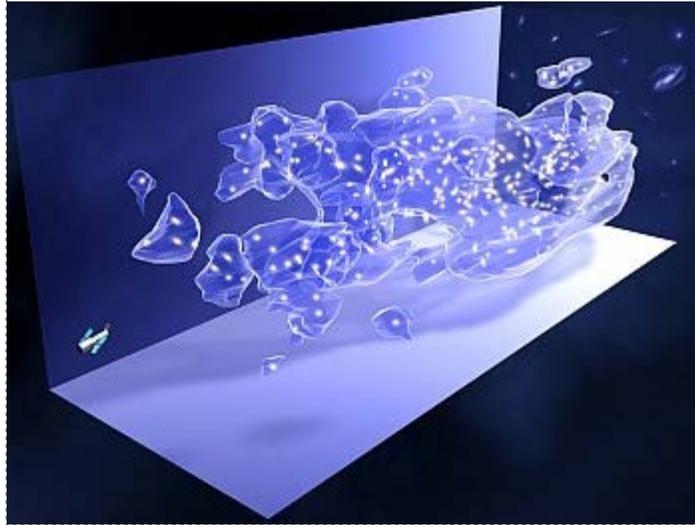
**Note:** In the case [dual age cosmology](#), the *topology* of time will be highly non-trivial, namely, time will evolve *both* along a line *and* a circle. Don't try to picture this in the [Archimedean geometry](#) of 3-D space, however.

Locally -- to be precise, [quasi-locally](#) -- the universe looks like an *unbroken ring with no circumference*, for the circumference is nowhere, and [the "center" is everywhere](#). Globally, it may possess "[spin](#)" which would cast its 3-D blueprints on all **finite** subsystems, the observable universe included.

As to the "[cosmic equator](#)" itself, perhaps we'll have a better picture from the [Planck mission](#) (exposing the elusive "[B-modes](#)", which are perhaps determined by the density of primordial GWs), once the *angular power spectrum* is revealed next year; animation [here](#).

Last but not least, notice the terribly misleading "explanation" of the so-called "dark matter" with the **read sausage** below.





Only [Chuck Norris](#) can "see" the whole space *en bloc* and verify its "[curvature](#)".

Yet some (otherwise credible) people claim that there exists "matter" that is "dark", or simply "missing" ([Leonard Susskind](#)), and have even coined a name for it: [WIMPS](#). Trouble is, what you can "see" is only the local impact from a global, tug-of-war effect of gravity, CDM&DDE.

If you think of this global tug-of-war effect of gravity as being produced **directly** by some stuff with [positive energy density](#), you'll be destined to publish papers and books until you retire.

Sorry for being frank. All I'm trying to say is that nobody knows the [global properties](#) of spacetime and the origin of inertia ([A. Einstein](#)), and the '[cosmic equator](#)' is a wonderful opportunity to gain insights into this puzzle of spacetime.

D. Chakalov  
April 20, 2011

=====

Subject: Re: [arXiv:1103.5870 v3 ?](#)  
Date: Thu, 21 Apr 2011 04:18:35 +0300  
Message-ID: <BANLkTinxoqWZJXr4SBTNJ1xUBk7-bA9Oww@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Miao Li <mli@itp.ac.cn>  
Cc: Xiao-Dong Li <renzhe@mail.ustc.edu.cn>,  
Yi Wang <>wangyi@hep.physics.mcgill.ca>,  
Yi-Fu Cai <ycai21@asu.edu>

Dear Professor Li,

After my email posted at

<http://www.god-does-not-play-dice.net/#Li>

... you assured me, in your private email, that will consider my comments on your [arXiv:1103.5870v2](#) in its next update, which is [arXiv:1103.5870 v3](#).

Look again at  
<http://www.god-does-not-play-dice.net/#error>

It explains the huge ERROR made by many people. Yet you still repeated it in [arXiv:1103.5870 v3](#) !

Unbelievable!

To quote from your arXiv:1103.5870 v3, p. 69: "Phenomenologically, cosmological experiments are typically carried out by measuring redshift and distance."

p. 85: "The most common approach to probe dark energy is through its effect on the expansion history of the universe. This effect can be detected via the luminosity distance  $d_L(z)$  and the angular diameter distance  $DA(z)$ ."

I noticed that you haven't mentioned my name even in Sec. Acknowledgments, p. 153 in [arXiv:1103.5870 v3](#) .

If you or any of your colleagues cannot understand the [ERROR](#) at the link above, please write me back with your professional questions.

Yours sincerely,

Dimi Chakalov

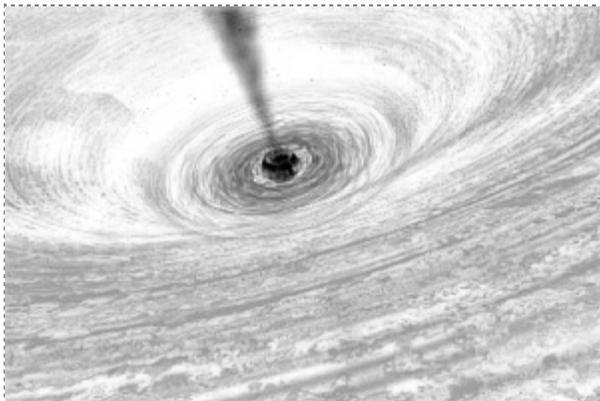
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**Note:** The review article by Miao Li *et al.* (cf. [above](#)) is one of the best I've read. Pity they ignored the arguments about the [error](#) with "luminosity distance".

You can't use *intrinsic* evaluations (i.e., "working solely within the 4-dimensional spacetime in which we find ourselves", [J. Baez](#)) when dealing with the **global** properties of spacetime. You would need some [non-Archimedean](#) "global" observer, such as [Chuck Norris](#). Which is absurd, of course. Let me elaborate.

The conventional recipe from GR textbooks is to evaluate **local** and **finite** (comprised from infinite many "[sufficiently small](#)") *deviations* from the [connection](#) (not "curvature") in a **counterfactual** manner -- something which might have happened in some fictitious flat spacetime (then the effect from the connection would have been zero), but didn't *actually* happen, hence the effect from the connection is observable. And then people say: look, the spacetime is indeed "curved" (they also measured the angles of some large size triangle), and there is a lot of "dark matter" in it, and because the standard "candles" are receding from us in line with the Hubble Law, the space is also "expanded" by its "dark energy". What a mess.

Such **counterfactual** approach presumes some "[Euclidean eyes](#)" as a *reference object* (cf. matter-free homogeneous spacetime of constant curvature as "the background reference," Naresh Dadhich, [arXiv:1105.3396v1 \[gr-qc\]](#), p. 2), and that could be *very* misleading. People tend to "explain" GR by reducing the dimensions of space, and then picture some "deformed" 2-D surface or 2-D closed domains of "dark matter" **inside** 3-D space (cf. the **red sausage** [above](#)). Ditto for "black holes", as depicted **inside** 3-D space (you may also find intelligent life there, with lots of [advanced Russian math](#)).



Such naïve "explanations" might be suitable for general audience only (e.g., [Michio Kaku](#)), provided

the TV anchor explains the inevitable deceptions. Which is by no means an easy task, because nobody has so far defined '[event horizons](#)'.

Well, such approach works for **local** effects, say, adjusting the [GPS system](#). And if you endorse some metaphysical assumptions about the homogeneity of space, you may also assume that everything you see in a domain of space with size, say, 1B light years is not different from what you *could have seen* in another domain of size 1B light years, which **can** be parallel-transported (Sic!) 10B light years away from you. You never know with metaphysics, so you could be right.

But the task for evaluating **global** properties of spacetime is totally different. You cannot possibly *presume* that you may "expand" **indefinitely** the initial size of your 1B light year domain, without reaching some **critical size limit** at which the *gravity itself* will break down. The tacit presumption that gravity will work in arbitrary large volumes of 3-D space is ridiculous, to say the least. There is **no guarantee** that the space geometry will remain [Archimedean](#) indefinitely.

Notice the insurmountable problem from assuming *exclusively* [Archimedean](#) geometry: you actually invoke some **absolute space** in which "more and more space" appears from its "dark source" (cf. [Michal Chodorowski](#)). Such "dark stuff" doesn't get *diluted* as space "expands". On the contrary: at every instant of time it appears in *greater* quantities. It is the ultimate [free lunch](#). By comparison, every [perpetual motion device](#) would look boring and terribly inefficient.

The usual claim presented in [thousands of papers](#) is that space is **globally expanding**, being driven by some "perfectly smooth" (cf. [Matt Visser](#)) fluid with '[positive energy density](#)'. Such statement requires verification, which in turn can **only** be performed by some absolute non-Archimedean "observer" who can '[count to infinity](#)', and is able to "see" the whole space *en bloc*, hence can time its "expansion" online, along her/his global wristwatch, and finally write down "the absolute equation of state" of this *absolute* and *perfectly smooth* "dark" fluid.

Summary on **the error**. Firstly, you inevitably hit "[absolute space](#)". Secondly, you can't work "intrinsically" with global properties of spacetime. And thirdly, you cannot promote yourself to an absolute non-Archimedean "observer", not even with some Gedankenexperiment.

You may seek some "upper limit" or "boundaries" on space, at which space could become *self-wrapped* ([Einstein](#)), but such task may require **non-Archimedean** geometry (global mode of spacetime) and a modified [Finite Infinity](#).

Trouble is, your diff geometry textbooks say nothing about the fine structure of 'geometrical point' in the postulated 'differentiable manifold', and even the texts about 'modern differential geometry' (e.g., [C. Isham](#)) are dead silent about how these "points" get "**connected**" in the first place. For you can't **connect** these **bare** geometrical points with any physical stuff *whatsoever* (do you speak [Mandarin](#)?). And since you can only observe the **local** effect from this truly fundamental connection (called here The Aristotelian Connection), you cannot "see" its global [holistic source](#). It will be inevitably "[dark](#)" to you, as some (otherwise credible) people have called it.

Apart from these minor objections, prompted by the usage of the adverb 'marginally' by Miao Li *et al.* (cf. [above](#)), I strongly recommend their review paper.

They repeated in [arXiv:1103.5870 v3](#), p. 5, the following claim: "In principle, before we understand the origin of the vacuum energy, the energy density can be positive, negative and zero". My suggestion: before we address the origin of the vacuum energy, we should first try to understand the [mechanism](#) by which we observe *positive* energy densities only. As I noticed [previously](#), we shouldn't have jumped into conclusion that the "dark puzzle" originates [directly](#) from some mundane stuff with positive energy density: it comes out far too much, and suspiciously well-tuned during *all* cosmological stages. It just doesn't work.

When will they update their manuscript ([arXiv:1103.5870 v4](#)?), as Miao Li hinted in a private email?

When pigs fly, of course.

[Xiao-Dong Li](#) and [Shuang Wang](#) already rejected my email below.

Maybe they didn't like my [Mandarin](#) ...? 

D. Chakalov  
April 21, 2011  
Last updated: May 20, 2011

=====

Subject: Re: arXiv:1103.5870 v3 ?  
Date: Thu, 21 Apr 2011 17:18:50 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Miao Li <mli@itp.ac.cn>,  
Xiao-Dong Li <renzhe@mail.ustc.edu.cn>,  
Yi Wang <wangyi@hep.physics.mcgill.ca>,  
Shuang Wang <swang@mail.ustc.edu.cn>  
Cc: Yi-Fu Cai <ycai21@asu.edu>,  
Lau Loi So <s0242010@gmail.com>,  
Xiao Zhang <xzhang@amss.ac.cn>

P.S. Explanatory note at  
[http://www.god-does-not-play-dice.net/#Li\\_error](http://www.god-does-not-play-dice.net/#Li_error)

Comments welcomed.

D.C.

On Thu, Apr 21, 2011 at 4:18 AM, Dimi Chakalov <dchakalov@gmail.com> wrote:  
[snip]

=====

Subject: Suggestion  
Date: Sat, 23 Apr 2011 00:32:22 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: [Adam Helfer](mailto:adam@math.missouri.edu) <adam@math.missouri.edu>

Hi Adam,

You've published a *very* important article, which I think is barely known:

Adam D. Helfer, The Kinematics of the Gravitational Field, in: Proceedings of Symposia in Pure Mathematics, ed. by R. Greene and S.-T. Yau, Vol. 54 (1993), Part 2, American Mathematical Society, 1993, pp. 297-316.

It would be great if you post it on [gr-qc] section of ArXiv.org, perhaps with a brief appendix explaining the problems of introducing the **dynamics** of that "field", after the so-called DDE,

[http://www.god-does-not-play-dice.net/#Li\\_error](http://www.god-does-not-play-dice.net/#Li_error)

You certainly don't need an [endorsement](#) from ArXiv "moderators", who deleted my paper on LIGO,

<http://www.god-does-not-play-dice.net/#LIGO>

I posted today some scattered thoughts on the kinematics of space at

[http://www.god-does-not-play-dice.net/#25\\_11\\_2015](http://www.god-does-not-play-dice.net/#25_11_2015)

Have a nice Easter.

Dimi

=====

Subject: Re: Suggestion

Date: Thu, 12 May 2011 16:38:54 +0300

Message-ID: <BANLkTikywdRT-jC667F9P7NVvfVyL0aJBg@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Adam D. Helfer <helfera@missouri.edu>

Cc: [Pankaj S Joshi](mailto:psj@tifr.res.in) <psj@tifr.res.in> ,

[Robert M Wald](mailto:rmwa@midway.uchicago.edu) <rmwa@midway.uchicago.edu> ,

[George F R Ellis](mailto:george.ellis@uct.ac.za) <george.ellis@uct.ac.za> ,

William G Unruh <unruh@physics.ubc.ca> ,

Larry Ford <ford@cosmos.phy.tufts.edu>

Hi Adam,

Pity you ignored my preceding email from Mon, [25 Apr 2011](mailto:25_Apr_2011) 18:37:39 +0300. It concerns all papers you've posted at

[http://arxiv.org/find/gr-qc/1/au:+Helfer\\_A/0/1/0/all/0/1](http://arxiv.org/find/gr-qc/1/au:+Helfer_A/0/1/0/all/0/1)

A few comments on your latest manuscript:

Adam D. Helfer, Black holes reconsidered, arXiv:1105.1980v1 [gr-qc],

<http://arxiv.org/abs/1105.1980>

The problem of teleology: a *complete* model of spacetime requires re-formulation of Ellis' [Finite Infinity](#), but in the framework of the current stipulations (p. 3, footnote 1), I'm afraid this is impossible. Once you start with what you should derive *at the end* ([Lorentzian metric](#)), you are on a wrong track. You can never define rigorously the hypotheses on the asymptotic regime (Sec. 1.2), nor understand the paradox of [naked singularity](#) (p. 6).

I also think quantum fields in curved spacetime would seem "natural and attractive" (p. 23) only to people who neglect the fact that "we do not yet have a practical understanding of how to treat the [nonlinear case](#)" (p. 44). In your words, "the usual theory of quantum fields in curved space-time is not adequate for treating black holes" (p. 40). I fully agree, but the current GR mantra (p. 3, footnote 1) is inadequate for describing "black holes" that are outside the applicable limits of this GR mantra in the first place.

You also wrote (p. 42): "I am going to describe here the results of measurements of Hawking quanta and their precursors, according to conventional quantum theory [49]."

---

49. A. D. Helfer, Phys. Lett. A329, 277–283 (2004), [gr-qc/0407055](http://arxiv.org/abs/gr-qc/0407055)

In ref. [49], you wrote: "Energy, in quantum theory, is measured by the Hamiltonian operator. Since this operator **generates** temporal evolution, energy will be conserved if the operator remains constant. (...) Again, since the stress-energy is the source for Einstein's equation, a quantum stress-energy implies a quantum gravitational field and a deeper, quantum-gravitational, treatment of the entire question is really required. Again, this is in line with the main argument here, that quantum gravity must be considered in the quantum physics of gravitational collapse."

I fully agree. Recall my [comments](#) to your essay "The Production of Time", arXiv:0812.0605v1 [gr-qc],

<http://arxiv.org/abs/0812.0605>

We need quantum gravity (cf. my preceding email from [April 25th](#)) to understand Fig. 5 and footnote 18 regarding the "dressed vacuum" (p. 45), and Sec. 5.4 regarding how quantum fields can act as sources for gravity, in your latest arXiv:1105.1980v1 [gr-qc].

You also wrote (arXiv:1105.1980v1 [gr-qc], p. 48): "For questions about the detectability of negative

energy densities, see [55]."

---

55. A. D. Helfer, *Class. Quant. Grav.* 15, 1169–83 (1998).

Ref. [55] is your arXiv:gr-qc/9709047v2,  
<http://arxiv.org/abs/gr-qc/9709047>  
<http://iopscience.iop.org/0264-9381/15/5/008>

Do you remember my email from Thu, 20 Sep 2001 21:28:18 +0200 ? I wrote about your [arXiv:gr-qc/9709047v1](http://arxiv.org/abs/gr-qc/9709047v1), from Thu, 18 Sep 1997 16:18:34 GMT (15kb), which was entitled: "Are Negative Energy Densities Detectable?" Here's your abstract of [arXiv:gr-qc/9709047v1](http://arxiv.org/abs/gr-qc/9709047v1):

"T. S. Eliot described a 'mystery cat,' Macavity, responsible for all sorts of mischief, But when the crime's discovered, Macavity's not there! I investigate the negative energy densities predicted by relativistic quantum field theories, and find they have a similar character. The energy in a region, plus the energy of a device which detects it, must be non-negative. Indeed, as far as has been checked, the total four-momentum density, of the field plus the observing device, must be future-pointing. In consequence the semi-classical Einstein equation can at best describe negative energy-density effects only as long as no observers are present to test it: Macavity, Macavity... he **breaks the law of gravity**."

The updated version, [arXiv:gr-qc/9709047v2](http://arxiv.org/abs/gr-qc/9709047v2), was entitled 'Operational' Energy Conditions, and was published in *Class. Quant. Grav.* The phrase "breaks the law of gravity", from [arXiv:gr-qc/9709047v1](http://arxiv.org/abs/gr-qc/9709047v1), is missing.

Pity you ignored your [arXiv:gr-qc/9709047v1](http://arxiv.org/abs/gr-qc/9709047v1) from Thu, 18 Sep 1997 16:18:34 GMT.

I will be happy to elaborate on Macavity, in case you'd consider an [arXiv:1105.1980 v2 \[gr-qc\]](http://arxiv.org/abs/1105.1980v2).

Take care,

Dimi

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Subject: Re: Suggestion  
Date: Mon, 25 Apr 2011 18:37:39 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Adam Helfer <helfera@missouri.edu>

Hi Adam,

> At the moment, though, I have no plans to rewrite  
> (or repost) [this article](#); I am too far behind with other things!

You have the [kinematics](#), now all you have to do is to add the dynamics from that "dark" energy of [Macavity](#), and you're done! What could be more important?

[snip]

Dimi

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Note: Notice that the negative energy-density effects are (in the way explained [above](#)) *always* "present" **iff** no one is "there" (local mode of spacetime) to look at them -- just like the invisible cat Macavity. Notice also that Adam Helfer suggested two concepts of time in "The Production of Time", [arXiv:0812.0605v1 \[gr-qc\]](http://arxiv.org/abs/0812.0605v1), Sec. 5, and "cosmic time vector" (*ibid.*, p. 10), even though he used **linear** quantum fields in "curved" spacetime. As he admitted [above](#), "we do not yet have a practical understanding of how to treat the nonlinear case" ([arXiv:1105.1980v1 \[gr-qc\]](http://arxiv.org/abs/1105.1980v1), p. 44).

Well, I do: forget about [Hilbert space](#). Let me briefly explain.

I stated [above](#) that once you "start with what you should derive *at the end* (Lorentzian metric), you are on a wrong track." The reason is that I endorse the opinion of [Jim Hartle](#) that the Lorentzian signature of classical spacetime "is an emergent property from an underlying theory not committed to this signature."

In order to *derive* the Lorentzian signature of classical spacetime as an *emergent entity* from some underlying [\[we-do-not-know-it\]](#), I think we should first elucidate the precise meaning of '[finite space](#)' and 'finite time [interval](#)' of classical spacetime. Regarding the latter, we contemplate a **bare Archimedean "template"** that we label with 'one second', and then we imagine **filling in** this [finite "template"](#) with "9,192,631,770 periods of transition the radiation corresponding to the transition between the two hyperfine levels of the ground state of the cesium-133 atom" (cf. [above](#)), after which we are search for some realistic physical process to manufacture [atomic clocks](#). But this is metrology. We need quantum gravity.

The crux of the matter is in the very existence of such [invariant finite templates](#), which define the "intrinsic time interval associated to any timelike displacement" (Ted Jacobson, pp. [18-19](#)). To be precise, the missing phenomenon (should be related to the "speed" of light) is some process of "reading" **all** infinitesimal "points" from *any* such '[finite template](#)' *en bloc*, and with precise and invariant "speed", as '**uncountably-infinite** infinitesimal "frames" per second' (say). Unless we encounter relativistic effects ([time dilation](#)), this "reading" does **not** slow down (for comparison, watch a slow motion of a water drop [here](#)).

This "reading" can originate *only* from the [Arrow of Space](#). The invisible Macavity is the *charge-neutral* (the two signs of "mass" included) [potential reality](#). It always exists 'out there', but in the [global mode](#) of spacetime. Can you take a snapshot from a dark room with a torch? Replace the 'torch' with an *already linearized* snapshot of [gravity & type I matter fields], and you'll get the [main idea in GR](#) and the intricate problems with the [geodesic hypothesis](#) and the "proper time" along causal curves (A. Helfer, [arXiv:0812.0605v1 \[gr-qc\]](#), p. 1).

Notice the seemingly obvious notion of "**locally**" in [\[Ref. 1\]](#). It originates from what I called [above](#) 'GR mantra'. It is a very misleading mantra, because once you add gravity, the world is [quasi-local](#). Adam Helfer acknowledged elsewhere the unsolved problem of "quasi-local kinematics" ([arXiv:0903.3016v1 \[gr-qc\]](#)), which I believe can only be resolved by [the proper dynamics](#).

As promised [above](#), I will be happy to elaborate, should [Adam Helfer](#) considers an [arXiv:1105.1980 v2 \[gr-qc\]](#). If not, I will keep working on Macavity -- [my way](#).

Does a fish need a bicycle?

D. Chakalov  
May 13, 2011

[Ref. 1] Raymond Angéilil and Prasenjit Saha, [arXiv:1105.0918v1 \[astro-ph.GA\]](#), [http://arxiv.org/abs/1105.0918v1](#)

"The (apparent - D.C.) equivalence of gravitational and inertial mass, or that gravity can be cancelled ([not quite](#) - D.C.) by transforming to a freely-falling frame, was tested within classical celestial mechanics to high precision by the end of the nineteenth century. After all, if Mercury had a gravitational constant differing from (say) Jupiter's by one part per million, Mercury's orbit would not have fitted classical dynamics well enough to highlight the anomalous precession (43'' per century, or  $10^{-7}$ ) that was later explained by general relativity.

"The Einstein equivalence principle (EEP) adds to the classical or weak equivalence principle the further physical postulate that special relativity holds **locally** (emphasis mine - D.C.) in a freely-falling frame. A consequence of the EEP is that the effects of gravity on test particles are fully described by endowing spacetime with a Riemannian metric, and having the particles follow [geodesics](#) of that metric."

=====

Subject: Re: Suggestion  
Date: Sun, 29 May 2011 15:24:31 +0100  
Message-ID: <BANLkTiKeeEbBf=+PPj5eJvU1Gk+W3v=6Bw@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Adam Helfer <helfera@missouri.edu>  
Cc: Robert M Wald <rmwa@midway.uchicago.edu>,  
George F R Ellis <george.ellis@uct.ac.za>,  
William G Unruh <unruh@physics.ubc.ca>,  
Karel V Kuchar <kuchar@physics.utah.edu>,  
Laszlo Szabados <lbszab@rmki.kfki.hu>,  
Chris Isham <c.isham@imperial.ac.uk>

Dear Adam,

Let me be perfectly clear: it's all about the fundamental unresolved issues of GR.

There is no way you could make any progress on your ideas without the so-called 'global mode of spacetime'. It is *\*the only possible\** solution to the task for defining an 'isolated system', by reaching the limit at which

"... the system becomes "self-contained." Roughly speaking, this should mean passing to an appropriate asymptotic regime such that all gravitational effects are localized inside of it" (Angular momentum of isolated systems in general relativity, [arXiv:0903.3016v1 \[gr-qc\]](https://arxiv.org/abs/0903.3016v1)).

My suggestion is to use the 'global mode of spacetime' (notice its [non-Archimedean geometry](#)) for new versions of 'asymptotic spacelike regime' and George's Finite Infinity.

All this inevitably leads to the Arrow of Space: Time does not originate from 'change in space', but from '[chance \\*of\\* space](#)'.

Again, there is no other way you could make *\*any\** progress on your ideas.

I have so far offered you and your colleagues only my web site, for the following reasons:

You haven't responded professionally to any of my email messages sent since Tue, 20 Aug 2002 17:02:51 +0300. You didn't even acknowledge my invitation sent on [Monday, 2 June 2008](#), nor my request for [endorsement](#) (Tue, 27 Oct 2009 12:10:26 +0200).

In fact, nobody from your colleagues has done so. Which is why I have offered you only my web site, and **nothing more**.

To sum up, it seems to me that you're treating your field of expertise with *\*total disrespect\**. You treat GR as some hobby. In your words, "we each need to work on our own ideas."

Point is, one of us -- either you or I -- have taken a totally wrong path.

If you, or any of your colleagues, agree with [Chris Isham](#) that I am "just another crank" -- don't bother to reply.

Dimi

-----

D. Chakalov  
35 Sutherland St  
London SW1V 4JU

On Thu, May 12, 2011 at 8:40 PM, Dimi Chakalov <dchakalov@gmail.com> wrote:  
>  
> On Thu, May 12, 2011 at 5:50 PM, Adam Helfer <helpera@missouri.edu> wrote:  
>>  
>> Dear Dimi,  
>>  
>> Thanks for your comments. I think we each need to work on our own ideas.  
>  
> Good luck, Adam. I will continue to work on your Macavity,  
>  
> <http://www.god-does-not-play-dice.net/#Macavity>  
>  
> Dimi

=====

Subject: [arXiv:1106.0394v1 \[gr-qc\]](#)  
Date: Tue, 7 Jun 2011 15:42:16 +0300  
Message-ID: <BANLkTin84r1jFZseFE5SAnf=CEuy00OnsnQ@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Alberto Chamorro <alberto.chamorro@ehu.es>  
Cc: Lluís Bel <wtpbedil@lg.ehu.es>,  
Luca Lusanna <lusanna@fi.infn.it>,  
Massimo Pauri <pauri@pr.infn.it>,  
Domenico Giulini <domenico.giulini@itp.uni-hannover.de>,  
John Stachel <john.stachel@gmail.com>,  
Norbert Straumann <norbert.straumann@gmail.com>,  
Adam Helfer <helpera@missouri.edu>

Dear Dr. Chamorro,

May I ask a question regarding the \*physical\* individuation of point-events in spacetime: in what shape or form do the "proto-points" exist **prior** to their physical individuation, so that '[more and more space appears](#)' due to the dynamic dark energy ([DDE](#)) of these proto-points ?

I will appreciate the opinion of your colleagues as well.

Kindest regards,

Dimi Chakalov

P.S. My efforts can be read at  
<http://www.god-does-not-play-dice.net/about.html#GR>  
<http://www.god-does-not-play-dice.net/#Macavity>

D.C.

=====

Subject: "Finally, results from Gravity Probe-B", [arXiv:1106.1198v1 \[gr-qc\]](#)  
From: Dimi Chakalov <dchakalov@gmail.com>  
Date: Wed, 8 Jun 2011 05:33:30 +0300  
Message-ID: <BANLkTimqQ\_Gtj5J6Q=7G3=rRfXdo=W4cjg@mail.gmail.com>  
To: Clifford M Will <cmw@wuphys.wustl.edu>  
Cc: Adam Helfer <helpera@missouri.edu>

Clifford M. Will, "Finally, results from Gravity Probe-B", arXiv:1106.1198v1 [gr-qc]  
<http://physics.aps.org/articles/v4/43>

<http://arxiv.org/abs/1106.1198>

"A massive body warps spacetime, the way a bowling ball warps the surface of a trampoline. A rotating body drags spacetime a tiny bit **around with it**, ..."

-----

Cliff:

GR cannot explain the gyroscopic effect itself, yet your colleagues used gyroscopes to "test" GR.

Do you have a theory of the gyroscopic effect and conservation of gravitational angular momentum?

Do you believe that "frame dragging" (if any) can be modeled with some parameterized post-Newtonian (PPN) approximation and the so-called "relaxed" Einstein equations, Sec. 4.3,

<http://relativity.livingreviews.org/Articles/lrr-2006-3/articlesu14.html#x21-430004.3> ?

[http://en.wikipedia.org/wiki/Spherical\\_cow](http://en.wikipedia.org/wiki/Spherical_cow)

I think your wife is right about you.

Dimi

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"At the end of Bernie's talk, a member of the audience asked whether Cliff had ever been known to be wrong on a **serious issue**. Bernie answered that to his knowledge, this had never happened. At this moment Leslie, Cliff's wife, raised an eager hand and offered to present many examples of Cliff being in error."

B. Schutz, "Will and Testament", MATTERS OF GRAVITY, Number 29, Winter 2007

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**Note:** The most puzzling paradox of GR is that you can use obviously wrong ideas, such as the PPN approximation, to make calculatory recipes which could match the recorded data very well. Another startling example is the pseudo-tensors. And even the Newtonian gravity, with its instantaneous "propagation" of gravity, works perfectly well FAPP.

The application of GR for adjusting the GPS system is **not** a confirmation of GR, just as the projection postulate in QM textbook does **not** confirm nor reject any speculation about *the* quantum world. In the case of the alleged "frame dragging", notice the tacit presumption of some ideal observer who can "see" the whole asymptotically flat spacetime *en bloc*, and verify the speculations that a massive body "warps spacetime," while a rotating body "drags spacetime".

There is no such thing as "curvature". Mrs. Leslie Will is right about her husband. Which isn't surprising, given the fact that Cliff's mentor was Kip Thorne. The two GR "experts" fully endorse the linearized approximation of GR for detecting the "ripples" of spacetime metric. And that's a **serious error**. But because they live in total socialism, their pay check is secured and, as long as *other* people pay for LIGO, LISA, etc., they will enjoy their hobby until they fully and totally retire.

By 2015, the "advanced" LIGO will fail miserably to detect any GW strain, and LIGO "scientific" collaboration will have to come up with some "explanation" -- they will claim that their total failure is actually of fundamental importance, like the negative result for the ether drift in the experiment of Michelson and Morley. Hence they will "prove" GR wrong.

There's none so blind as those who will not *think*.

D. Chakalov

June 10, 2011

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Subject: Group Action in Topos Quantum Physics, arXiv:1110.1650v1 [quant-ph]

Date: Tue, 11 Oct 2011 18:26:41 +0300

Message-ID:

<CAM7EKkk=ptY0mkiZTGe+CiqThHA2vFg7VB301jtFT+PSbfGFaQ@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: [Cecilia Flori](mailto:cflori@perimeterinstitute.ca) <cflori@perimeterinstitute.ca>

Cc: Karol Horodecki <khorodec@inf.ug.edu.pl> ,

Rafael Sala Mayato <rsala@ull.es> ,

Andreas <andreas.doering@comlab.ox.ac.uk> ,

Chris Isham <c.isham@imperial.ac.uk> ,

Jeremy <jb56@cam.ac.uk> ,

Ieke Moerdijk <I.Moerdijk@uu.nl> ,

Daniel Bedingham <d.bedingham@imperial.ac.uk> ,

Warren Leffler <>wkleffler@aol.com> ,

Josef Tkadlec <tkadlec@fel.cvut.cz> ,

Karl <svozil@tuwien.ac.at>

Hi Cecilia,

May I ask a question regarding your [arXiv:1110.1650v1 \[quant-ph\]](https://arxiv.org/abs/1110.1650v1), and ask for clarification of your understanding of Quantum Theory.

Look at the Peres-Mermin version of KS Theorem,

<http://www.god-does-not-play-dice.net/#Hermens2>

It is impossible that (i) all nine observables, at (ii) one instant (as recorded by your wristwatch), would possess (iii) context-independent, pre-existing values.

Rafael Sala Mayato and Gonzalo Muga explained the so-called Mermin's square ([N. D. Mermin](#), Hidden variables and the two theorems of John Bell, Revs. Mod. Phys. 65 (1993) 803-815) in [arXiv:1110.1723v1 \[quant-ph\]](https://arxiv.org/abs/1110.1723v1) as follows:

"[T]he observables are the Pauli matrices, with eigenvalues  $\pm 1$ , for two independent spin- $1/2$  particles. The nine observables are arranged in groups of three columns and three rows, and within each of them they are mutually commuting. The product of the three observables in the column on the right is  $-1$ , and the product of the three observables in the other two columns and all three rows is  $+1$ . It is easy to check that it is impossible to associate with each observable preexisting values,  $+1$  or  $-1$ , in such a way that they verify the identities satisfied by the observables themselves."

So, we reject the assumption (iii), about context-independent, pre-existing values, under the conditions (i) and (ii).

[David Mermin](#) says ([arXiv:quant-ph/9912081v1](https://arxiv.org/abs/quant-ph/9912081v1)): "The Kochen-Specker (KS) theorem (...) exhibits a finite set of finite-valued observables with the following property: there is no way to associate with each observable in the set a particular one of its eigenvalues so that the eigenvalues associated with every subset of mutually commuting observables obey certain algebraic identities obeyed by the observables themselves [1]. Such a set of observables is traditionally called **uncolorable**."

Q: Can you start counting the 'observables' from the "uncolorable" ones, in such way that they will obtain "color" at the expense of other 'states', which will be, \*in the context of this particular\* counting, "uncolorable" ?

<http://www.god-does-not-play-dice.net/#Castro>

1. If you can, the assumption (iii) may show you something that is missing in present-day quantum theory and its "[toposification](#)": the '[pre-existing values](#)' do exist, albeit in an UNdecidable pre-quantum state (never in plural); more from [Henry Margenau](#).
2. If you can't reverse the counting (cf. the link above), [please explain why](#). I extend this request to

all recipients of this email.

All the best,

Dimi

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**Note:** The notion of 'pre-existing values' is the crux of our understanding of 'reality'. In classical physics, the form of reality we encounter is 'objective reality', while in Quantum Theory the new (to some theoretical physicists, at least) form of reality is 'potential reality'. Notice that the latter can accommodate totally new things to *emerge* during the **non-unitary** evolution of the universe, which may, from the perspective of the fixed rigid 'objective reality', look like *creatio ex nihilo* or rather 'the set of all sets that have never been considered' ([David Batchelor](#)). Relative to the history of the universe up to the instant 'now', it's an **empty set**, but we **cannot** know what might come out from the 'the unknown unknown' -- it's a Free Will universe. As John Wheeler put it, "Time is Nature's way to keep everything from happening all at once". Stated differently, our common 'potential reality' evolves non-unitarily as well, resembling the "memory" of 'the universe as a [brain](#)'.

Why has the "[state vector collapse](#)" been a hugely effective, FAPP calculation tool? It has captured an *essential germ of truth*: the UNdecidable pre-quantum state does not, and cannot "collapse"; it only casts one [pre-correlated](#) "state" -- one-at-a-time, along the [Arrow of Space](#) -- which is being explicated with **certainty** in the *intact* quantum world 'out there'. The UNdecidable pre-quantum state itself must **not** be included in the set/topos of its color-able explications.

In the current QM, the only "[link](#)" we have between the [macroscopic world](#) and the quantum realm is provided by "probabilities", as explained eloquently by Chris Isham (C.J. Isham, *Lectures on Quantum Theory*, 1995, [p. 17, Eq. 2.8](#)).

**NB:** I invite all people who disagree with my interpretation of the [KS Theorem](#) to check out the generation of [particle's path](#) in Wilson cloud chambers; cf. Alessandro Teta, [arXiv:0905.1467v1](#), pp. 8-11: "The cloud chamber is filled by a supersaturated vapour which can undergo local phase transitions induced by the exchange of even a small amount of energy." The key word is **energy**. As pointed out by Sir Nevill Mott in 1929, "It is a little difficult to picture how it is that an outgoing spherical wave can produce a straight line."

Let's see how "little" this challenge is. Sean Carroll stressed in [arXiv:0811.3772v1 \[gr-qc\]](#), p. 6, that "the [basis states](#) [xxx] and the coefficients [xx] are completely time-independent; all of the time evolution is encoded in the **phases** [XXX]". Notice, however, the **imaginary unit** in [Eq. 4](#) and in [Alessandro Teta's paper](#).

How do you represent 'time evolution' with *complex* phases ([Chen Ning Yang](#)), in such fashion that (i) the imaginary unit will be kept **intact** throughout the whole track of the particle in Wilson cloud chamber, yet (ii) the time evolution of the particle will be represented, at **the same time**, with a real number? This is the essence of the '[macro-objectification problem](#)' bzw. the problem of reconciling the present-day quantum theory with [Special Relativity](#). If we wish to speak about 'time in quantum mechanics', we should never abuse Quantum Theory by imposing 'the time of facts' from Newtonian mechanics or Special Relativity.

Go ahead. Feel free to try some "[decoherence](#)" with "zeroing the off-diagonal elements" ([John Gamble](#)). I offered this task to Jonathan Halliwell and his colleagues from Imperial College ([Chris Isham](#) included) [two years ago](#), but haven't heard from them. Dorje Brody acknowledged, in a private talk in Imperial College London some eleven years ago, that Nevill Mott's paper encapsulates the essence of QM. I fully agree, and hope that some of the readers of these lines will try to refute my suggestion about 'the UNdecidable pre-quantum state' (never in plural) by solving the problem identified by [Sir Nevill Mott in 1929](#).

**NB:** Unlike [QM textbooks](#), Nature provides **smooth** transitions between 'the word of facts', governed by [Special Relativity](#), and the quantum realm. It is crucially important for any theory of quantum gravity to discover the 'back bone' of these smooth transitions: the UNdecidable pre-quantum KS state. Moreover, it is **impossible** to attach gravity to the color-able presentations of quantum fields alone. [No way](#). Before even contemplating about some 'quantum gravity', we need to resolve the puzzle of these **smooth** transitions, and also fix the problem of *quasi-local* [gravitational energy](#) in

present-day GR textbooks (MTW, p. 467).

However, [Chris Isham](#) boldly stated nine years ago ([23 October 2002](#)): "You do not know enough theoretical physics to help with any research in that area." He still hasn't backed his insulting claim with any evidence, nor has resolved *the* problem of QM known since 1929. Hopefully, some of the readers may [help him](#).

Going back to the KS Theorem, people picture the color-able "[states](#)" in some Hilbert space (or try some "[toposification](#)"), and impose our Boolean thinking upon the colored "observables" explicated at the length scale of tables and chairs. I suggest to reflect on the ability of your brain to handle its [UNdecidable state](#).

The crux of the *complex* phases is exposed in assumption (ii) above: "at one instant (as recorded by your wristwatch." You *inanimate* wristwatch cannot read *both* the "observables" *and* their UNdecidable pre-quantum state ([Henry Margenau](#) called it *Onta*). It is manifestly wrong to assume that "single atomic events" exist 'out there', so we **only** need to "amplify" their "effects" (cf. Alessandro Teta above) in order to be "readily observed by large systems" [[Ref. 1](#)].

Briefly, the structure of spacetime at macroscopic scale acts like a "filter" imposed on the quantum world, which produces artifacts, such as "quantum jumps", but on the other hand this "filter" makes the projection postulate (introduced in QM textbooks by hand) a very effective, FAPP calculation tool.

All you need is to consider the possibility that the universe works like a [brain](#). Sorry for repeating this again.

It's a [free world](#). Steven Weinberg, for example, has chosen to publish a new collection of essays, entitled: *Lectures on Quantum Mechanics*. I've been trying to reach him since May 2003, with no success; my last email is printed [below](#). Soon on [DVD](#).

D. Chakalov (a.k.a "[just another crank](#)")

October 13, 2011

Last update: October 25, 2011, 17:00 GMT

[Ref. 1] Richard P. Feynman and Albert R. Hibbs, *Quantum Mechanics and Path Integrals*: Emended Edition (1965 edition, emended by Daniel F. Styer), Dover Publications, 2010, [p. 22](#).

There are a few interpretational problems on which work may still be done. They are very difficult to state until they are completely worked out. One is to show that the probability interpretation of  $\phi$  is the *only* consistent interpretation of this quantity. We and our measuring instruments are part of nature and so are, in principle, described by an amplitude functions satisfying a deterministic equation. Why can we only predict the probability that a given experiment will lead to a definite result? From what does the uncertainty arise? Almost without doubt it arises from the need to amplify the effects of single atomic events to such a level that they may be readily observed by large systems. The details of this have been analyzed only on the assumption that  $|\phi|^2$  is a probability, and the consistency of this assumption has been shown. It would be an interesting problem to show that *no other* consistent interpretation can be made.

=====

Subject: You can lead a horse to water, but you can't make him read and think.

Date: Thu, 13 Oct 2011 03:59:31 +0300

From: Dimi Chakalov <dchakalov@gmail.com>  
To: Steven Weinberg <weinberg@zippy.ph.utexas.edu>  
Cc: Chris Isham <c.isham@imperial.ac.uk>

Steven Weinberg, [arXiv:1109.6462v3 \[quant-ph\]](https://arxiv.org/abs/1109.6462v3), 12 Oct 2011 01:32:12 GMT: "We assume as in ordinary quantum mechanics that the state of the system is **entirely** described by a vector in Hilbert space."

<http://www.god-does-not-play-dice.net/#Cecilia>

D.C.

=====

Subject: Marc Lachièze-Rey: Where is [the vertical](#) in empty space ?  
Date: Mon, 16 Apr 2012 15:30:53 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Marc Lachieze-Rey <mlr@apc.univ-paris7.fr>  
Cc: Henrik Zinkernagel <zink@ugr.es>, Hans Westman <hwestmanxx@gmail.com>, Brendan McMonigal <mcmmonigal@gmail.com>, eanderso@apc.univ-paris7.fr, malcubi@nucleares.unam.mx

Space, time, Spacetime, by Marc Lachièze-Rey, Slide #4  
<http://www.ugr.es/~zink/cosmo/LachiezeGranada.pdf>;  
Espace, Temps et Espace-Temps, [8 février 2012](#)

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Dear Dr. Lachièze-Rey,

Perhaps you will be interested to check out

<http://www.god-does-not-play-dice.net/#Brendan>

<http://www.god-does-not-play-dice.net/#ESI>

I hope you can help Eddie Anderson with his "[ice dragon](#)".

All the best,

Dimi Chakalov

=====

In my opinion,  
quantum theory needs  
to be changed.

- *Christopher Isham*



Subject: Re: Quantum gravity  
Date: Sun, 23 Oct 2011 14:18:06 +0300  
Message-ID:  
<CAM7EkxmJ-A=fOCnpRWa0Yc1axbDgPVVaQ3vQ68OoTyUHspO6eA@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Chris Isham <c.isham@imperial.ac.uk>  
Cc: Jeremy <jb56@cam.ac.uk>,  
Cecilia Flori <cflori@perimeterinstitute.ca>,  
Andreas <andreas.doering@comlab.ox.ac.uk>,  
Jonathan Halliwell <j.halliwell@ic.ac.uk>,  
Amihay Hanany <a.hanany@imperial.ac.uk>,  
Helen Fay Dowker <f.dowker@imperial.ac.uk>,  
J M Yearsley <james.yearsley03@imperial.ac.uk>,  
Daniel Bedingham <d.bedingham@imperial.ac.uk>,  
Josef Tkadlec <tkadlec@fel.cvut.cz>,  
Karl <svozil@tuwien.ac.at>,  
Roland Omnes <roomnes@wanadoo.fr>,  
Claus Kiefer <kiefer@thp.uni-koeln.de>,  
Domenico Giulini <giulini@zarm.uni-bremen.de>,  
Alessandro Teta <teta@univaq.it>,  
Norbert Straumann <norbert.straumann@gmail.com>,  
Lars Andersson <laan@aei.mpg.de>,  
Sean Carroll <seancarroll@gmail.com>,  
Dorje Brody <d.brody@imperial.ac.uk>

Chris,

Nine years ago, on [Wed, 23 Oct 2002 19:24:15 +0100](#), you wrote:

"You do not know enough theoretical physics to help with any research in that area."

You still haven't made any effort to show any evidence supporting your insulting claim. Instead, four years ago ([Fri, 12 Oct 2007 15:14:09 +0100](#)), you pictured me as "just another crank".

May I offer you and your colleagues a simple task from 1929: check out the **NB** section in the note at

<http://www.god-does-not-play-dice.net/#Cecilia>

If you can resolve the problem, you will obliterate my efforts to suggest a new path toward [quantum](#)

[gravity](#), but most importantly we all will hear about your discovery at CNN Breaking News.

Please go ahead. Say something as a physicist. Don't be shy.

["just another crank"](#)

**Note:** Many physicists are inclined to endorse the opinion of Chris Isham by simply pointing to the fact that I have not offered math. But there is no math available in the first place. None. You guys do diff geometry like [bartenders](#). The math I need is **not** present in your textbooks (included the one from [Chris Isham](#)), simply because you introduce 'differentiable structure' in GR by referring **only** to the color-*able* states of 'physical reality', and have **totally missed** the *fine structure* of "points" where the UNdecidable pre-quantum KS state quietly resides, along with '*the ideal monad without windows*' (cf. A. Döring and C.J. Isham, [quant-ph/0703066](#), p. 2, footnote 3).

I will be happy to [elaborate](#), starting from [Thompson Lamp Paradox](#) and some simple examples with the [Cauchy sequence](#) and the infinitesimal [[Ref. 1](#)].

To paraphrase [Lord Rutherford](#), we haven't the math, so we've got to think!

D.C.

October 24, 2011

[Ref. 1] George Lakoff and Rafael E. Núñez, *Where Mathematics Come from: How the Embodied Mind Brings Mathematics into Being*, Basic Books, New York, 2001, [p. 189](#).

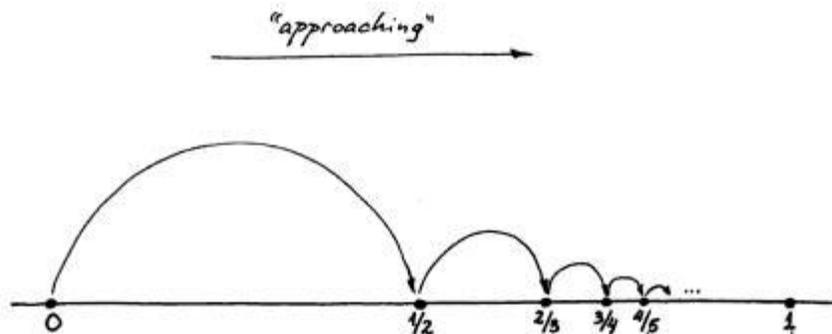
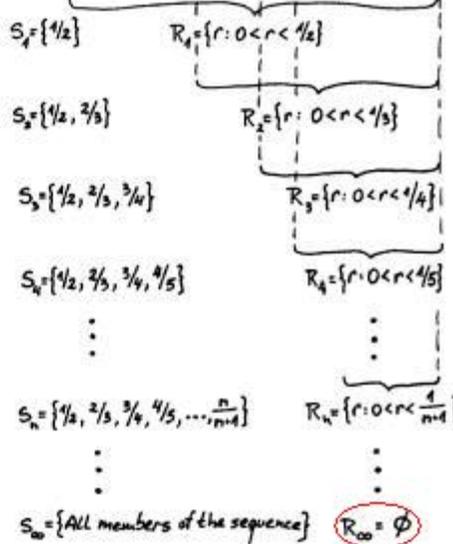


FIGURE 9.1 Here is how the Basic Metaphor of Infinity characterizes the idea of a sequence approaching a limit. The sequence here is  $\{x_n\} = n/(n + 1)$ . The limit is 1. In the special case of the BMI, two sets are formed at each stage. The  $S_n$ 's progressively gather the terms of the sequence as they are generated. The corresponding sets  $R_n$  characterize the real numbers between 0 and  $1 - x_n$ —the portion of the real line (which remains at the  $n$ th stage) between the  $n$ th term of the sequence and the limit. At the final resultant state,  $S_\infty$  contains all the members of the sequence and  $R_\infty$  is empty. This will be true only for the number that is the limit—namely, 1. Note that, in this case, the limit does not occur in the sequence.



- This is what is implicitly meant when we say that the infinite sequence  $x_n$  "approaches  $L$  as a limit." Note, incidentally, that  $L$  can be entirely outside the sequence and still have terms of the sequence infinitely close to it.

Comment: The exercise above is cast in the Archimedean geometry of the [local](#) (teleological) mode of spacetime; there is **no direct link** to the [non-Archimedean](#) realm of the global mode spacetime, hence it "shows up" as an empty set ( $\mathbf{R}$ ).

The old saying 'the whole is *more* than the sum of its parts' should be understood in the sense that 'the whole' contains a unique element -- an "empty set" -- that is **different** from its *physical* constituents ("all members of the sequence", cf. the drawing above). In other words, Baldy's Law [[Ref. 2](#)] should read "some of it plus the rest of it is all of it, plus the empty set of [the infinitesimal](#)." The latter may FAPP be considered "zero" only at the length scale of tables and chairs, and only for inanimate systems, while in the quantum-gravitational realm its physical influence will look "[dark](#)", simply because it does **not** exist as 'physical reality' or "members of the sequence."

As [Alexandre Grothendieck](#) put it, "These "probability clouds", replacing the reassuring material particles of before, remind me strangely of the elusive "open neighborhoods" that populate the topoi, like evanescent phantoms, to surround the imaginary "points"." See also John Wheeler's "[cloud](#)" and the parable of John's jackets [here](#).

If we examine the physical, color-able "[quantum states](#)" only, the UNdecidable pre-quantum KS state "shows up" as an empty set as well; it does **not** belong to 'physical reality', because it is **non-colorizable in principle**. Physically, we can only observe its 'shadows on the cave's wall', as Plato would have said.

In [QM textbooks](#), the 'cave's wall' is replaced with Hilbert space, while in the [Isham-Döring approach](#)

it is replaced with topos, yet again **everything** is dropped in 'one pot' (Eintopf gemacht). Total mess, totally wrong, from the outset.

To be specific: the value *ascribed* (the result of measuring) to the physical quantity B is contextual, in the sense that it depends on whether the *ascribed* (color-able) "value" is considered together with A1, or together with A2, as explained by Chris Isham ([arXiv:1004.3564v1](http://arxiv.org/abs/1004.3564v1), Sec. 5.1, 'The Kochen-Specker theorem and contextuality', p. 20), but the **non-colorizable**, UNdecidable, pre-quantum Kochen-Specker (KS) state -- the 'back bone' along which the contextual quantity B flips over, if it is considered together with A1 or together with A2 -- is an 'empty set'.

All questions about its *physical* existence yield the same answer: **YAIN**. Not "somewhere in between".

I'm not aware of such YAIN (dual-valued) logic of propositions, however. Certainly not in topos theory.

D. Chakalov  
October 24, 2011  
Last updated: October 27, 2011

[Ref. 2] Baldy's Law: "Some of it plus the rest of it is all of it".

=====

Subject: Re: Quantum gravity  
Date: Mon, 24 Oct 2011 00:58:07 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Roland Omnes <roomnes@wanadoo.fr>  
Cc: Chris Isham <c.isham@imperial.ac.uk>, [snip]

On Sun, 23 Oct 2011 23:03:28 +0200, Roland Omnes <roomnes@wanadoo.fr> wrote:  
>  
> Mister Chakalov,  
>  
> I am not used to receive this kind of message

According to your Rule 1 from "The Interpretation of Quantum Mechanics" (reviewed by [William Faris](#)), an individual isolated physical system is \*entirely\* formulated in terms of a specific Hilbert space and a specific algebra of operators, together with the mathematical notions associated with them. You were quite precise: "The word 'entirely' that occurs in it will be taken in its strongest sense, to mean that not only dynamics, but also the logical structure of the theory and the language one uses when applying it to observations and experiments will be cast into the mold of Hilbert space."

Only you should forget about Hilbert space. If you disagree, check out the task from 1929; the link is in my [preceding email](#).

You also wrote: "One must distinguish between the facts, the microscopic properties that may be said to be true, and also the vast number of microscopic properties that cannot even be said to be true or false."

Well, I only wanted to help you, from the perspective of [Henry Margenau](#) and the [Kochen-Specker Theorem](#).

Recall my email from Tue, 29 Mar 2005 06:00:04 +0300, Subject: Is "reduction" a last step in completing "decoherence"?, regarding your arXiv:quant-ph/0411201v2. Pity you ignored it.

> and I ask you to never again send anything to me.

Mais bien sûr, mon cher ami. You can read my preceding email at

[http://www.god-does-not-play-dice.net/#OG\\_final](http://www.god-does-not-play-dice.net/#OG_final)

My web site will be available on [DVD](#), and I hope it will help kids understand Quantum Theory and never repeat your errors.

All the best,

Dimi Chakalov

On Sun, 23 Oct 2011 14:18:06 +0300, Dimi Chakalov <dchakalov@gmail.com> wrote:  
[snip]

=====

Subject: What observational quantities need to be isotropic in order to enforce isotropy of spacetime geometry ?

Date: Tue, 11 Oct 2011 01:08:26 +0300

Message-ID:

<CAM7EkxkUtaXU0-nBe3XpiXEhb5EKOW\_iWS70b\_s=Ee6VJEqOuQ@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Roy Maartens <roy.maartens@port.ac.uk>

Dear Roy,

Thank you for your [arXiv:1104.1300v2](http://arxiv.org/abs/1104.1300v2). Beautiful paper.

My proposed answer: the Heraclitean time, after Weyl's principle (Rugh and Zinkernagel, arXiv:1006.5848v1 [gr-qc], [p. 2](#)),

<http://www.god-does-not-play-dice.net/#Heraclitus>

<http://www.god-does-not-play-dice.net/#Waldyr>

<http://www.god-does-not-play-dice.net/#facts>

All the best,

Dimi

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**Note:** Can we have our cake and eat it? In the case of 'homogeneous vs [inhomogeneous](#) universe', the answer is: yes we can. Namely, the universe is indeed homogeneous, to the extent to which it is endowed with perfect isotropy of spacetime geometry due to the [Arrow of Space](#); yet it is also "inhomogeneous" in terms of its physical structure (e.g., the [cosmic equator](#); more [above](#)). One reason for the latter faculty is the fundamental *asymmetry* in the [tug-of-war](#) manifestation of gravity: the so-called DDE points to the future, while the so-called [CDM](#) points to the past.

Don't ever say you knew nothing about it! 🙌

D. Chakalov  
October 13, 2011

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Subject: Re: [arXiv:1210.0831v1 \[gr-qc\]](http://arxiv.org/abs/1210.0831v1), Footnote 1: "To clarify: we have not performed the demonstrably impossible feat... "  
Date: Wed, 03 Oct 2012 14:07:45 +0100  
From: Roy Maartens <Roy.Maartens@port.ac.uk>  
Message-Id: <506C46BD02000A50012B05F@gwia-04.iso.port.ac.uk>  
To: <dchakalov@gmail.com>

PLEASE STOP SENDING ME EMAILS

>>> Dimi Chakalov <dchakalov@gmail.com> 03/10/12 2:01 PM >>>

P.S. Note added at  
<http://www.god-does-not-play-dice.net/#Luke>

D.

=====

Subject: Structure and dynamics of the cosmic vacuum/quantum aether vs. [arXiv:1110.3358v1 \[gr-qc\]](http://arxiv.org/abs/1110.3358v1)  
Date: Tue, 18 Oct 2011 18:27:02 +0300  
Message-ID:  
<CAM7EkxmQO3y-OUxqW5t28VGgiMnwCUX=2q=mzL8-kfSRALP9yA@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Ronald J Adler <adler@relgyro.stanford.edu>  
Cc: hm@berkeley.edu, martin@slac.stanford.edu, saurya.das@uleth.ca, evagenas@academyofathens.gr, saslanbeigi@perimeterinstitute.ca

Hi Ron:

Since "we know essentially nothing about the nature of dark energy on a smaller and presumably more fundamental scale", one can expect that "dark energy (i.e. the cosmic vacuum) has a more interesting structure than if described entirely by the cosmological constant."

So far so good, but regarding your assumption that "dark energy on the cosmological scale is well-described by the cosmological constant," check out what you and your colleagues have missed at

<http://www.god-does-not-play-dice.net/#facts>

<http://www.god-does-not-play-dice.net/#Roy>

If you and your colleagues don't wish to consider ideas that contradict yours, please at least confirm the receipt of this email.

All the best,

Dimi Chakalov

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Comment: The only reply from Ron Adler arrived roughly ten years ago, after my email praising his 'vacuum catastrophe' article (Ronald J. Adler *et al.*, Vacuum catastrophe: An elementary exposition of the cosmological constant problem, [Am. J. Phys. 63 \(1995\) 620-626](#), cf. Sec. IX, 'An *ad hoc* canceling term: The cosmological constant'). Surely we can afford such 'canceling terms' -- check out the UNdecidable pre-quantum KS state [above](#).

In January last year, Ron Adler acknowledged the following (see [above](#)): "At present it is certainly not clear what might replace our present concept of spacetime at the Planck scale." Let me try to help: first of all, forget about all "[uncertainly principles](#)" and "quantum fluctuations". We have a rock solid physical reality -- one-at-a-time, along the [Arrow of Space](#) -- explicated with **certainty**.

Stated differently, the normalization procedure ("the sum of the squared moduli of the probability amplitudes of **all the possible states** is equal to one," [Wiki](#)) does **not** include the UNdecidable pre-quantum KS state [above](#). Otherwise you cannot attach gravity to quantum fields. **No way**.

Needless to say, the structure and dynamics of the cosmic vacuum/quantum aether is not about some "dark" entity: see [Heraclitus](#), [Aristotle](#), and [[John 1:1](#)].

D.C.  
October 18, 2011

=====

Subject: The initial orientation of the physical space itself, [arXiv:1110.5876v1 \[quant-ph\]](#)  
Date: Thu, 27 Oct 2011 13:43:22 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Florin Moldoveanu <fmoldove@gmail.com>  
Cc: Carlos Perelman <perelmanc@hotmail.com>, Joy Christian <joy.christian@wolfson.ox.ac.uk>

Dear Dr. Moldoveanu,

Joy Christian repeated his claim that his \*model\* of the EPR-Bohm correlations is "complete, local, and realistic, in the precise senses defined by EPR and Bell [6]," and is "perfectly cogent and error free", because "the hidden variable in this picture is the initial orientation of the physical space itself, which predetermines all possible outcomes at all possible measurement directions in the EPR-Bohm scenario. As a result, the measurement results are not contextual in any sense."

I think Joy Christian is one of those [Russian-type physicists](#), who does not reply to my email and will never, in no circumstances, look at the KS Theorem,

<http://www.god-does-not-play-dice.net/#Castro>

<http://www.god-does-not-play-dice.net/#Cecilia>

I wouldn't mind if Mr. Christian writes manuscripts, provided they aren't publish on paper -- it is a valuable commodity and should not be wasted.

Kind regards,

Dimi Chakalov

=====

Subject: Re: Tue 24 Nov 13:30pm - 14:30pm  
Date: Mon, 21 Jan 2013 08:12:38 +0200  
Message-ID: <CAM7Ekx=YjmjuxY6f3mEoA3EDUQ0SPa0XVdJ4x-+WS9=EgcKh8g@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Jonathan Halliwell <j.halliwell@ic.ac.uk>  
Cc: James Yearsley <jmy27@cam.ac.uk>,  
Roland Omnes <roomnes@wanadoo.fr>,  
Amihay Hanany <a.hanany@imperial.ac.uk>,  
Helen Fay Dowker <f.dowker@imperial.ac.uk>,  
Larry Schulman <schulman@clarkson.edu>,  
Chris Isham <c.isham@imperial.ac.uk>,  
Charis Anastopoulos <anastop@physics.upatras.gr>,  
Ntina Savvidou <ksavvidou@physics.upatras.gr>,  
Claus <kiefer@thp.uni-koeln.de>,  
Jeremy <jb56@cam.ac.uk>,  
Cecilia <cflori@perimeterinstitute.ca>,  
Andreas <andreas.doering@comlab.ox.ac.uk>,  
Daniel <d.bedingham@imperial.ac.uk>,  
Alessandro <teta@univaq.it>,  
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dmitri\_sokolovski@ehu.es,  
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svozil@tuwien.ac.at

P.S. I provided link to your recent [arXiv:1301.4373v1 \[quant-ph\]](https://arxiv.org/abs/1301.4373v1) at

<http://www.god-does-not-play-dice.net/#localization>

We could have settled the issue from 1929 on 24 Nov 2009, but you weren't interested and wasted a lot of time and efforts, included those of your younger colleague, James Yearsley. Back in the year 2000, Dorje and I discussed Mott's paper at Imperial College, so there's nothing new here. See also some very simple prerequisites at

<http://www.god-does-not-play-dice.net/#Klauder>

As always, I will be happy to respond, should you and/or any of your colleagues decide to comment professionally.

D.

[snip]

=====

Subject: Re: [Tue 24 Nov 13:30pm - 14:30pm](https://arxiv.org/abs/1301.4373v1)  
Date: Thu, 27 Oct 2011 16:53:56 +0300  
Message-ID:  
<CAM7Ekxn5u7+WwHsS0+3wsEO0jU9S17eVSFDvtKxySH6kDWedXQ@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Jonathan Halliwell <j.halliwell@ic.ac.uk>  
Cc: theoryseminar@googlemail.com,  
James Yearsley <james.yearsley@imperial.ac.uk>,  
Amihay Hanany <a.hanany@imperial.ac.uk>,  
Dorje Brody <d.brody@imperial.ac.uk>,

J G Muga <jg.muga@ehu.es>,  
Andreas Ruschhaupt <andreas.ruschhaupt@itp.uni-hannover.de>,  
Adolfo del Campo <adolfo.delcampo@gmail.com>,  
Helen Fay Dowker <f.dowker@imperial.ac.uk>

Jonathan,

I attended your talk two years ago (was sitting next to Fay Dowker), told you about the problems of your "decoherence" hypotheses, and sent you the link to A. Teta's paper regarding the 1929 paper by Sir Nevill Mott.

I looked today at the Ph.D. Thesis of James Yearsley, [arXiv:1110.5790v1 \[quant-ph\]](https://arxiv.org/abs/1110.5790v1), and searched for "Mott." No reference. **None.**

Why did you let your younger colleague muse on "what exactly is the status of the variable  $t$  that appears in Schrödinger's equation", but didn't tell him what you learned from me at your talk on [Tuesday, 24 November 2009](#)?

James Yearsley considers himself "incredibly fortunate" to have had you as a teacher and collaborator, but you left him in the dark.

It's **not** fair, Jonathan. You should know very well that all those "decoherence" hypotheses cannot explain the path of a single particle, nor the dwell time problem.

More at  
[http://www.god-does-not-play-dice.net/#OG\\_final](http://www.god-does-not-play-dice.net/#OG_final)

Dimi

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**Note:** At the Tuesday Seminar on [24 November 2009](#), I raised my hand and asked Jonathan Halliwell whether **he** can explain the "trajectory" of particle with "decoherence", and also reminded him of my email messages prior to his talk, with reference to Alessandro Teta's paper. Jonathan Halliwell firmly stated that one can explain these "paths" with "decoherence", but didn't mention any paper dealing with this issue.

Jonathan Halliwell is Professor of Theoretical Physics at Imperial College London. It should be agonizingly clear to him that the reason why his so-called [decoherence](#) hypotheses cannot explain the path of a single particle in Wilson cloud chambers is encoded in the key issue of [energy exchange](#): "The cloud chamber is filled by a supersaturated vapour which can undergo local phase transitions induced by the exchange of even a small amount of energy" (A. Teta, [arXiv:0905.1467v1](#), pp. 8-11).

Let's examine Halliwell's favorite phrases (emphasis mine) "**strongly peaked** about the classical evolution equations" or "**quite strongly peaked** about one path" in [quant-ph/0501119v1](#). Does he mean some delocalized energy exchange between the particle and the supersaturated vapor in Wilson cloud chamber? Surely the time parameter of the visible path is the one read by his wristwatch, so one can claim that **something** in the cloud chamber is indeed undergoing 'classical evolution', producing a classical path.

But how can you relate/map this 'something' with the single quantum particle -- not for one instant but for **all** instants from its trajectory? Check out the dynamical/intrinsic time of the quantum object vs. its observable/event time in Paul Busch's [quant-ph/0105049v3](#), and ponder on the poetic expression "unsharpness of energy", p. 32 therein.

Again, the puzzle is **not** in the *probability* for detection of the quantum particle. (The probability can be non-zero only if the "connecting line" of two molecules is parallel to the velocity direction of the quantum particle, as explained by Werner Heisenberg in 1930.) It is about what this quantum particle actually **does** at macroscopic level, by giving away its "unsharp" **energy**.

The puzzle is that we observe a path created by exchange of **energy** between a single quantum

particle and its measurement device, throughout its trajectory and **during** its continuous measurements, as recorded with a classical clock. The so-called "good approximation" (Albert Messiah, *Quantum Mechanics*, Vol. 1, North-Holland, Amsterdam, 1970, p. 215) cannot elucidate the conversion of particle's "unsharp" **energy** to well-defined, "sharp" energy of the constituents of the classical trajectory, and back to the "unsharp" **energy** of the quantum particle.

The famous quote from Lev Landau, "To violate the time-energy uncertainty relation all I have to do is measure the energy very precisely and then look at my watch!" (source [here](#)), is typical for people who haven't read Nevill Mott's 1929 paper [[Ref. 1](#)].

Another example is Prof. [Hermann Nicolai](#), who suggested on German SAT 1 TV (June 7, 2004) that the classical world *emerges* from [Feynman paths](#). Just like his colleague from Imperial College London, Hermann Nicolai didn't explain his insights.

Or [Wojciech H. Zurek](#), who was co-editor of *Quantum Theory and Measurement* [[Ref. 1](#)], but conspicuously "missed" to test his hypotheses with Nevill Mott's paper.

Remember, you have to explain the bi-directional transitions between the quantum realm and the macroscopic world at **all** instants of energy exchange, which build up the trajectory of the quantum particle, as observed in the cloud chamber. And if you use probabilities ("[overwhelmingly probable](#)" or "appreciable weight", [John S. Bell](#)), you will end up scratching your head and craving for some fresh air. Nothing more, nothing else.

Why? Because energy & time are **not** related by probabilities. Besides, probabilities alone do **not** make things 'happen'. All this should be clear to undergraduates.

Unless, of course, you are professor of theoretical physics, like Jonathan Halliwell. Then you'll have the extra choice to ignore the whole issue and keep dead quiet.

To sum up, the 1929 Mott paper showed the ultimate puzzle in Quantum Theory: the smooth transitions between the macroscopic and quantum worlds, facilitated by their 'back bone' -- the UNdecidable pre-quantum uncolorizable KS state, with which one can also recover the smooth continuum from the alleged Planck scale "discreteness", so that we "look around, and see as far as we like" (Lee Smolin, *Three Roads to Quantum Gravity*, Phoenix, 2000, [p. 205](#)). Ignore it at your peril.

D. Chakalov

October 30, 2011

Last updated: November 7, 2011, 22:03 GMT

P.S. The *quasi-local* gravitational energy (MTW, [p. 467](#)), also called "the *intangible* energy of the gravitational field" (H. Bondi, Conservation and Non-Conservation in General Relativity, *Proc. R. Soc. London A427 (1990) 249-258*), has to be considered as well -- in both cases, we face a quasi-local, intangible energy (*wegtransformierbar* global mode of spacetime), which shows up **only by** its physical, color-*able* state (local mode). Namely, the former is immune to any "collapse" (just like the invisible cat [Macavity](#), it can never be directly observed), while the latter is never "unsharp" or non-local; and they happily live together.

In the interpretation of the KS Theorem explained [above](#), the energy exchange continuously occurs between the color-*able* states of the quantum particle and the supersaturated vapor in the cloud chamber, while the dynamics of the quantum particle is driven by its UNdecidable, uncolorizable, pre-quantum state that is immune to any "collapse" or "decoherence".

D.C.

[Ref. 1] Nevill Mott, The wave mechanics of alpha-ray tracks, *Proceedings of the Royal Society A126 (1929) 79-84*. (Reprinted as Sec. 1.6 of *Quantum Theory and Measurement*, Ed. by John A. Wheeler and Wojciech H. Zurek, Princeton University Press, 1983, pp. 129-134)

We can now see what form the wave function must have, in order that we

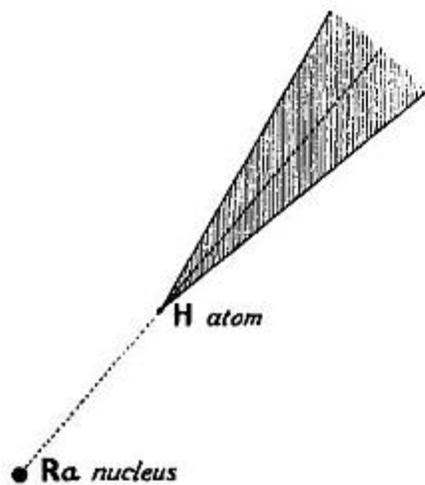


FIG. 1.

shall obtain straight tracks. Interpreting our wave function, we see that  $|f_{J_1, J_2}(\mathbf{R})|^2 dV$  is the probability that we shall find the  $\alpha$ -particle in the volume element  $dV$ , and at the same time the first atom in the excited (or ionised) state  $J_1$  and the second in the state  $J_2$ . To obtain a consistent theory of the straight tracks, we must have  $f_{00}(\mathbf{R})$  representing an outgoing spherical wave, at any rate for  $|\mathbf{R}|$  less than either  $|a_1|$  or  $|a_2|$ .  $f_{J_1, 0}(\mathbf{R})$  will represent the probable positions of an  $\alpha$ -particle that has excited the first atom, but not the

second. It should therefore be independent of  $a_2$ , and should represent a

\* We do not consider the possibility of a collision between the  $\alpha$ -particle and the nucleus.

Everett was complacent neither about gravitation nor quantum theory. As a preliminary to a synthesis of the two he sought to interpret the notion of a wave function for the world. This world certainly contains instruments that can detect, and record macroscopically, microscopic and other phenomena. Let  $A$  be the recording part, or 'memory', of such a device, or of a collection of such devices, and let  $B$  be the rest of the world. Let the coordinates of  $A$  be denoted by  $a$ , and of  $B$  by  $b$ . Let  $\phi_n(a)$  be a complete set of states for  $A$ . Then, one can expand the world wave function  $\psi(a, b, t)$  at some time  $t$  in terms of the  $\phi_n$ :

$$\psi(a, b, t) = \sum_n \phi_n(a) \chi_n(b, t) \quad (\text{E})$$

We will refer to the norm of  $\chi_n$

$$\int db |\chi_n(b, t)|^2$$

as the 'weight' of  $\phi_n$  in the expansion. As an example  $A$  might be a photographic plate that can record the passage of an ionizing particle in a pattern of blackened spots. The different patterns of blackening correspond to different states  $\phi_n$ . Then it can be shown<sup>9</sup> along lines laid down long ago by Mott and Heisenberg, that the only states  $\phi_n$  with appreciable weight are those in which the blackened spots form essentially a linear sequence, in which the blackening of neighbouring plates, or of different parts of the same plate, are consistent with one another, and so on. In the same way Everett, allowing  $A$  to be a more complicated memory, such as that of a computer (or even a human being), or a collection of such memories, shows that only those states  $\phi_n$  have appreciable weight in which the memories agree on a more or less coherent story of the kind we have experience of.

If we do give an operational meaning to the localisation of an event in a neighborhood of a point, specified with the accuracy described by uncertainties in the coordinates, we see that, according to Heisenberg principle, an uncontrollable energy has to be transferred, which is the larger the smaller is the infimum of the spacetime uncertainties.

This energy will generate a gravitational field which, if all the space uncertainties are very small, will be so strong to prevent the event to be seen by a distant observer. However, if we measure one of the space coordinates of our event with great precision but allow large uncertainties  $L$  in the knowledge of at least one of the other space coordinates, the energy generated may spread in such a way that the gravitational potential it generates would vanish everywhere as  $L \rightarrow \infty$ .

One has therefore to expect *Space Time Uncertainty Relations* emerging from first principles, already at a semiclassical level. Carrying through such an analysis [64, 65] one finds indeed that at least the following minimal restrictions must hold

$$\Delta q_0 \cdot \sum_{j=1}^3 \Delta q_j \gtrsim \lambda_P^2; \quad \sum_{1 \leq j < k \leq 3} \Delta q_j \Delta q_k \gtrsim \lambda_P^2, \quad (8)$$

where  $\lambda_P$  denotes the Planck length

$$\lambda_P = \left( \frac{G\hbar}{c^3} \right)^{1/2} \simeq 1.6 \times 10^{-33} \text{ cm}. \quad (9)$$

Thus points become fuzzy and locality loses any precise meaning. We believe it should be replaced at the Planck scale by an equally sharp and compelling principle, vet unknown, which reduces to locality at larger distances.

=====  
Subject: Does the Superluminal Neutrino Uncover Torsion?

[arXiv:1111.0286v1 \[gr-qc\]](https://arxiv.org/abs/1111.0286v1), p. 4

Date: Wed, 2 Nov 2011 03:42:46 +0200

Message-ID:

<CAM7EKx=iAQYWR752zXxueoscJtTP6VF+n+svDTXL2yEQKcifCg@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: M B Altaie <maltaie@yu.edu.jo>

Cc: Asher Yahalom <asya@ariel.ac.il> ,

Luca Fabbri <luca.fabbri@bo.infn.it> ,

[Friedrich W Hehl](mailto:hehl@thp.uni-koeln.de) <hehl@thp.uni-koeln.de>

Dear Basil,

I like your Dakik al-Kalam paper. May I offer some thoughts for your consideration.

You wrote (p. 4):

"Now, if we have to take care of the chiral symmetry of the spacetime and look for the introduction of spinning matter we have to introduce torsion; for torsion is the object that is related in essence to chirality. (...) The fact that torsion is basically antisymmetric motivates one to foresee some

connection with the rotational properties of the spacetime, and perhaps this what Cartan had in mind originally."

Check out the rotational properties of the spacetime (some profoundly dumb people called it 'the axis of evil') at

<http://www.god-does-not-play-dice.net/#Copi>

I don't know what Élie Cartan had in mind originally, but I would seek the [true torsion](#) in the time-orientability (asymmetry) of spacetime and its "driving force",

<http://www.god-does-not-play-dice.net/#Waldyr>

<http://www.god-does-not-play-dice.net/#Heraclitus>

As you stated in '[On Physics and Metaphysics](#)', "This is how we may come in touch with the unknown, the most absolute and the most known unknown, Almighty God."

All the best,

Dimi

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**Note:** One can hardly overestimate the importance of 'spin', but its geometrical origin, ensuing from the *fine structure* of spacetime points, is [very unclear to me](#).

Why does Mother Nature "rotate" its *physical* constituents, from the [cosmic equator](#) and galaxies to the [color-able](#) presentations of quantum particles? Regarding the latter, Wolfgang Pauli stressed in 1924 that we're dealing with "eigentümlichen, klassisch nicht beschreibbaren Art von Zweideutigkeit" (quoted after N. Straumann, [physics/0010003v1](#), p. 7). Any direct comparison with anything we can imagine in Euclidean space may be *very* misleading.

Suppose we take off our [Euclidean spectacles](#) and try to zoom on the fine structure of "points", by approaching '[the empty set  \$\mathbf{R}\$](#) ': what can we see? A quantum hedgehog, maybe?



I have allocated a special place for torsion in the [wegtransformierbar](#) global mode of spacetime: the *topology* of the elementary transition 'now', along the global time ( $\tau$ ) from the [Arrow of Space](#), is some kind of **superposition** of 'both linear and cyclical', as we could imagine with our classical and *distorted* [Euclidean eyes](#).

In other words, matter does not produce torsion; it only *experience* its "dark" physical effects in the local mode of spacetime, cast from the [atemporal loop](#) (global mode) that is "located" **]between[** two neighboring points from the [continuum](#) of the local (physical) mode of spacetime.

Look at the drawing below, from [Bob Wald's textbook](#):



## 1.2 Space and Time in Prerelativity Physics and in Special Relativity 5

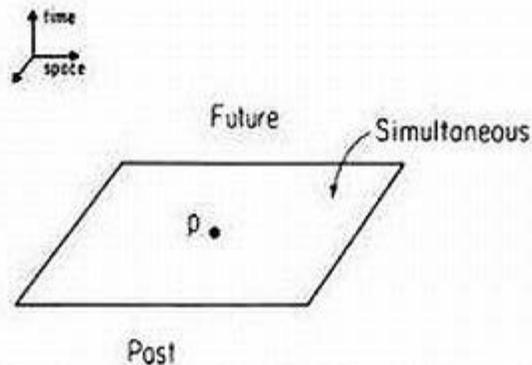


Fig. 1.1. A diagram showing the causal structure of spacetime in prerelativity physics. Given an event  $p$ , all other events in spacetime either are to the future of  $p$ , to the past of  $p$ , or simultaneous with  $p$ . The simultaneous events form a three-dimensional surface in spacetime.

The event  $p$  is [pre-correlated](#) with 'everything else in the universe' ([MOG](#)), at the instant 'now' from the *absolute time* ( $\tau$ ) generated by the [Arrow of Space](#).

This bootstrapping is an [atemporal phenomenon](#) which "takes place" exclusively in the [wegtransformierbar](#) *global mode of spacetime*: its physical duration, recordable by a physical clock, is **zero**, rendering the local (physical) mode of spacetime a *perfect* continuum. It does not exist in the local (physical) mode, hence all macroscopic effects from it will be "**dark**". (In Quantum Theory, this *atemporal* phenomenon also lives the *potential future* from the [Arrow of Space](#), and shows up as *the* UNdecidable, uncolorizable, pre-quantum Kochen-Specker (KS) state (never in plural); cf. [above](#)).

In plain words, what lives **only** in the *potential future* from the [Arrow of Space](#) cannot be directly observed in the local (physical) mode of spacetime. In the case of present-day GR, all physical effects from **it** will be [untraceable](#), hence its [source](#) will look "**dark**", or 'emerging from spacetime geometry only', at best.

Consequently, we are bewildered by some weird "[non-baryonic CDM](#)", which is just as wrong as imagining a physical axis of electron's spin. The gravitational effects known as 'dark matter' and 'dark energy' are *not entirely* produced by matter, just as the [time-orientability](#) of spacetime is *not entirely* produced by physical stuff; this 'not entirely' conundrum is a well-known faculty of the [Aristotelian First Cause](#) which cannot be nailed down with causal investigation. Its physical effects will inevitably look "dark" to those who are not familiar with the First Cause. In the current GR paradigm, these new effects will look like *emerging* from purely geometrical properties of spacetime. Corollary: in the presence of gravity, any [energy conservation](#) law is unfeasible, as acknowledged by [Sean Carroll](#).

**NB:** Perhaps the quantum hedgehog above "rotates" simultaneously along all radial directions taken from any point in 3-D space (including a new symmetry operation, called '[space inversion](#)', along these radial directions), facilitating a [web of correlations](#) ('[pre-established harmony](#)', Leibniz) of all [color-able](#) constituents of the physical universe. If we could take a 'sum-over-rotations' à la [Feynman](#)

[paths](#), perhaps a macroscopic rotation can be derived. Then we *might* understand the origin of [angular momentum](#) in GR, find out how [purely geometrical effects](#) of spacetime lead to rotation, spin, [wegtransformierbar](#) torsion and [spinors](#), and learn to [extract "dark" energy](#) from the [cosmic vacuum/quantum aether](#).

Not surprisingly, [Fred Hehl](#) isn't interested, and neither is any of his colleagues. They take for granted that mass *must* be [non-negative](#) and spacetime *must* be [time-orientable](#), then introduce [differentiable structure](#) and Lorentzian metric [by hand](#), and finally notice that all this exercise is actually valid for 4 % from the stuff in the universe. On the positive side, they have no problems with [publishing their essays](#) and posting manuscripts at [arxiv.org server](#).

D. Chakalov

November 2, 2011

Last updated: November 3, 2011

=====

Subject: Re: "The torsional effects manifest themselves as spinorial self-interactions,"  
[arXiv:1201.5498v1 \[gr-qc\]](#)

Date: Fri, 27 Jan 2012 17:42:29 +0200

From: Dimi Chakalov <dchakalov@gmail.com>

To: [fabbri@diptem.unige.it](#), [luca.fabbri@bo.infn.it](#)

Cc: [vignolo@diptem.unige.it](#), [c.boehmer@ucl.ac.uk](#), [hehl@thp.uni-koeln.de](#)

Dear Luca,

Thanks for your prompt reply; hope you can make it to Prague.

Just to make sure we understand each other: as you wrote in [arXiv:gr-qc/0608090v3](#),

"Given the metric tensor  $g$ , the most general connection (called the Levi-Civita connection) that can be defined is decomposable as ... [XXX] (Eq. 1) ... "

But if we try to *derive* the metric tensor from the most general case of spacetime (cf. the first link below), the most general connection won't be the so-called Levi-Civita connection, but a special affine connection called The Aristotelian Connection.

We have torsion and spinorial self-interactions, but no special preferences to Dirac field, because your statement that "if torsion is completely antisymmetric then the spin must be completely antisymmetric as well" doesn't hold for the coupling of torsion to matter in the most general case of spacetime (cf. the first link below).

All the best,

Dimi

On Fri, Jan 27, 2012 at 4:37 AM, Dimi Chakalov <dchakalov@gmail.com> wrote:

>

> Dear Luca,

>

> I'll talk about spinorial self-interactions and torsion, but from a  
> different perspective:

>

> <http://www.god-does-not-play-dice.net/#Beig>

>

> [http://www.god-does-not-play-dice.net/#Einstein\\_Prague](http://www.god-does-not-play-dice.net/#Einstein_Prague)

>  
> Any chance to see you in Prague?  
>  
> All the best,  
>  
> Dimi

=====  
Subject: <http://www.amazon.com/Arrows-Time-Cosmology-Fundamental-Theories/dp/3642232582>, [December 28, 2011](#)  
Date: Thu, 3 Nov 2011 17:08:10 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Laura Mersini-Houghton <mersini@physics.unc.edu>, Ruediger Vaas <ruediger.vaas@konradin.de>

Laura and Rüdiger,

See what you missed at

[http://www.god-does-not-play-dice.net/#Mott\\_Macavity](http://www.god-does-not-play-dice.net/#Mott_Macavity)

Perhaps you were thinking that should ignore the facts I've been communicating to you by email, because I'm not some '[academic scholar](#)', right?

But you ignored the bold facts known since 1929, and much MUCH more.

I will review your collections of essays at my web site (soon on [DVD](#)).

No need to reply, please.

Dimi

=====  
Subject: Re: "Robert P. Crease loves priority battles. Robert P. Kirshner does not."  
Date: Sun, 9 Oct 2011 14:27:33 +0300  
Message-ID: <CAM7Ekxna5jB7n2DG3o64gGCBz9v9-t44owu=vxHrhcAPVV-g@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Robert P Kirshner <kirshner@cfa.harvard.edu>, Robert P Crease <rcrease@notes.cc.sunysb.edu>, Saul Perlmutter <saul@lbl.gov>, Adam Riess <ariess@pha.jhu.edu>, Mike Turner <mturner@uchicago.edu>, Josh Frieman <frieman@fnal.gov>, Norbert Straumann <norbert.straumann@gmail.com>, Sean Carroll <seancarroll@gmail.com>, Lawrence M Krauss <lmk9@cwru.edu>, Paul Davies <deephought@asu.edu>, Laszlo Szabados <lbszab@rmki.kfki.hu>, Luca Bombelli <luca@phy.olemiss.edu>, Adam Helfer <adam@math.missouri.edu>, Malcolm A H MacCallum <m.a.h.maccallum@qmul.ac.uk>, Chris Isham <c.isham@imperial.ac.uk>, Luca Bombelli <bombelli@olemiss.edu>, Luca Lusanna <lusanna@fi.infn.it>, Domenico Giulini <giulini@zarm.uni-bremen.de>

P.S. RE my email from Fri, 8 Jan 2010 12:59:59 +0200, check out the '[tug-of-war manifestation of gravity](#)' at

<http://physicsworld.com/cws/article/news/47392#comment15133>

Some Nobel Prize laureates missed the fact that "expansion" of space cannot be defined with respect to **itself**,

<http://www.god-does-not-play-dice.net/#Heraclitus>

Pity nobody cares.

D.C.

=====

Subject: Re: [arXiv:1106.6053v1](#)

Date: Wed, 9 Nov 2011 19:03:17 +0200

Message-ID:

<CAM7Ekxmt5WFTiY4GL\_hghw9YXg7Dnvnym6RAiX3q39Lmbm-a4A@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: [YUAN K. HA](#) <yuanha@temple.edu>

Cc: Reiner Hedrich <reiner.hedrich@udo.edu> ,

Reiner Hedrich <Reiner.Hedrich@phil.uni-giessen.de> ,

[Manfred Requardt](#) <requardt@theorie.physik.uni-goettingen.de> ,

[Anthony Zee](#) <zee@kitp.ucsb.edu>

Dear Yuan,

Thank you, once more, for informing me about your very interesting paper on quantum gravity.

Perhaps you've noticed that I proposed an Arrow of Space, because I believe the global time [tau] does not come from 'change in space' (coordinate "time"), but from 'change **of** space'. The Arrow of Space is also needed to accommodate the "dark" energy from the outset and recover the true dynamics of GR. As Reiner Hedrich wrote in [arXiv:0908.0355v1 \[gr-qc\]](#), p. 25:

"Some people think that such attempts at a construction of a theory of Quantum Gravity are not radical enough, that not only gravity and spacetime, but also the quantum could be an emergent phenomenon. [101] According to those people, the still unknown fundamental theory could quite perfectly be a non-quantum theory, describing a [substrate](#) from which gravity, spacetime and the quantum emerge."

The prerequisites come from the KS Theorem and Nevill Mott,

[http://www.god-does-not-play-dice.net/#Mott\\_Macavity](http://www.god-does-not-play-dice.net/#Mott_Macavity)

Details from Heraclitus,

<http://www.god-does-not-play-dice.net/#Heraclitus>

All the best,

Dimi

On Wed, Nov 9, 2011 at 2:39 AM, YUAN K. HA <yuanha@temple.edu> wrote:

[snip]

=====

The right hand side is a formal condensation of all things whose comprehension in the sense of a field theory is still problematic. Not for a moment did I doubt that this formulation was merely a makeshift in order to give the general principle of relativity a preliminary closed-form expression. For it was essentially no more than a theory of the [gravitational field](#), which was isolated somewhat artificially from a total field of as [yet unknown structure](#).

A. Einstein

*Albert Einstein, Philosopher-Scientist*, ed. by Paul A. Schilpp, Open Court, 1998, [p. 75](#)

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Relativity and Gravitation

100 Years after Einstein in Prague

June 25 – 29, 2012, Prague, Czech Republic

<http://ae100prg.mff.cuni.cz>

**Note:** This is an informal and frank outline of my intended oral presentation (not poster) at the Conference in Prague above, entitled '[Arrow of Space](#)'; the abstract below was submitted on Friday, [16 December 2011](#). The objective of my talk is to offer a candidate for "a total field of as yet unknown structure": a special form of reality (known since Plato), which could serve as [the reference fluid of GR](#), identifying 'the points of space' and 'the instants of time' from the physical spacetime [dynamically](#), with '[Arrow of Space](#)'. The talk aims at quantum gravity, by suggesting a [new](#) (to the best of my knowledge) quantum spacetime unifying Quantum Theory and General Relativity from the outset.

As is well known, Einstein was very much hoping, until the last day of his life, to complete his General Relativity. I also very much hope to deliver my talk at the Einstein Conference in Prague -- after all, it's all about his unfinished theory of the [gravitational field](#).

I sincerely hope that the [Scientific Organizing Committee](#) will allow me to address the audience at the [Einstein Conference in Prague, June 25 – 29, 2012](#).

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Arrow of Space

By D. Chakalov

Abstract

I will argue for the existence of (i) General Platonic Ideas (GPIs) in the human brain, quantum theory (KS Theorem and Nevill Mott), and general relativity ("colored" spacetime), and (ii) an Arrow of Space, originating from GPIs, which drives the "colored" (after KS Theorem) quantum-gravitational reality: *Panta rei conditio sine qua non est*. The ideas presented in my talk offer an alternative to the "dynamics of GR" (ADM) by suggesting a conceptual framework in which Quantum Theory and General Relativity may be unified from the outset; details at <http://tinyurl.com/Einstein-Prague-details>

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The [Arrow of Space](#) requires a new quantisation of the gravitational field, preserving the [continual nature](#) of spacetime at [all length scales](#) by '[quantum spacetime](#)' -- the "verdammten Quantenspringerei" (Erwin Schrödinger) are eliminated from the outset, after resolving the [macro-objectification problem](#) in Quantum Mechanics by *smooth transitions* between the quantum and classical words, based on General Platonic Ideas (GPIs). The idea is to model the universe as a

[brain](#), equipped with GPIs residing in the *potential future* of the Arrow of Space, in which the universe is self-determined/bootstrapped by the rule 'think globally, act locally' ([Machian quantum gravity](#)) of its [quantum spacetime](#): Dead matter makes quantum jumps; the living-and-quantum matter is smarter.

What follows is a compilation of brief, frank, and [incomplete](#) notes on my intended talk (details on "GW astronomy" [here](#)).

The hypothetical 'global mode of spacetime' is postulated to accommodate the so-called General Platonic Ideas (GPIs) -- "a total field of as yet unknown structure," [A. Einstein](#). GPIs are inferred from Quantum Theory ([KS Theorem](#) and [Mott](#)) and General Relativity ("[colored](#)" spacetime), while the 'local mode of spacetime' is reserved for 'the realm of irreversible facts fixed in the past'. The [Arrow of Space](#) is introduced to explain the conversion of GPIs into 'facts' (local mode). Notice that GPIs in the [human brain](#) are *not* some mental phenomenon, because they [act on the brain](#); yet they are not 'facts' (local mode) either. They exist as *purely geometrical* and [non-Archimedean](#) 'potential reality', and keep the genidentity (Genidentität, [Kurt Lewin](#)) of the physical ("[colored](#)") reality explicated in the local (physical) mode of spacetime -- the persistence and *endurance* of objects during the Arrow of Space, or their '[sameness](#)', due to GPIs. They show up in GR *only* as '[absolute structures](#)', hence are camouflaged as "[gauge-dependent](#)"; see [above](#).

Also, the Arrow of Space is an 'arrow', because the conversion of GPIs into 'facts' (local mode) is irreversible -- there is no link, no connection whatsoever [from](#) the local mode of irreversible facts [to](#) the global mode of 'potential reality' of GPIs. Any attempt at finding GPIs in the local mode will yield zero result or 'zero term', as in the example from Richard Feynman [below](#). The question of how these two forms of reality, potential (GPIs) and physical, placed in the global and local modes of spacetime, may *interact* requires new [metaphysics](#). Namely, they do **not** interact directly, but *via* their common source (the doctrine of *trialism*); see the story about the Eskimo observing an elephant's trunk [above](#).

Hence the two forms of reality, potential (GPIs) and physical, follow the rule *Panta rei conditio sine qua non est*, while their common source is just a [Noumenon](#), or 'the true monad without windows', or *maybe* [John 1:1]. It *could* be at 'absolute rest', [residing within the instant 'now'](#) from the Arrow of Space. As [Lao Tzu](#) noticed, "If you realize that all things change, there is nothing you will try to hold on to." Yes we can: **It** is the whole universe as ONE, according to [Finite Infinity](#). The latter may require a new [fiber bundle](#) structure, perhaps similar to the "vertical vector field as *connecting vector*" ([R. Geroch](#)).

Notice that the [mathematical task](#) hinted with the expression '*Panta rei conditio sine qua non est*' is highly non-trivial: with the sole exception of 'the true monad without windows' (or the Aristotelian [First Cause](#), or [John 1:1]), everything else is [dynamical](#). Even the underlying topological manifold is being **re-created** along the Arrow of Space, at every instant 'now' from the global, explicit (but unmeasurable), nondynamical Heraclitean time ([W.G. Unruh and R. M. Wald](#)). The [standard prerequisites](#) that "all manifolds are assumed to be Hausdorff, second countable and  $C^\infty$ " ([Lars Andersson](#)) do not hold for a **re-created** manifold equipped with differentiable structure from [Finite Infinity](#): the very *continuum* of the local (physical) mode of spacetime is being **re-created** at each and every instant 'now'. It is different to the proposal for Phoenix Universe by Abbé Georges Lemaitre only by the stipulation that every **re-created** 'now' is a *bona fide* Phoenix Universe in its *local* mode of spacetime: all GPIs are **eliminated** and all [negotiations](#) are fully completed, in the sense that "there's energy in the gravitational field, but it's negative, so it **exactly** cancels the energy you think is being gained in the matter fields" ([Sean Carroll](#)). All the problems with "dark energy" stem from examining *only* the chain of such [already created](#) physical states (cf. the Photoshop layers [below](#)).

If we try to imagine the [Arrow of Space](#) in the world of 'facts' (local mode), it would have to point *simultaneously* to [all directions in 3-D space](#). The resulting, in the local mode of spacetime, "free fall" will be *universal*, the "force" of gravity will have to be "[fictitious](#)", and 'the fixed reference frame of distant stars' ([Ernst Mach](#)) won't be [physically present](#) in 3-D space. We cannot picture the "direction" of the Arrow of Space along some "4th spatial dimension" ([Ned Wright](#)), because the dimensions of *physical* bodies along such 4th spatial dimension match *the infinitesimal* -- see [the empty set \(R\)](#) used to derive Finite Infinity [above](#). In the local (physical) mode of spacetime, it must be **non-existent**, just like the UNdecidable pre-quantum noncolorizable [Kochen-Specker state](#).

Once we relate geometry and matter with the symbol " $=$ " in the Einstein field equation, we freeze their mutual negotiations (particularly evident in the "problem of time" of canonical quantum gravity), and cast just one "[colored](#)" (physicalized) instant 'now' from the Arrow of Space. In a way, [geometry and matter "talk" to each other via GPIs](#). The latter are also dynamical, and not some rigid absolute "ether": at every instant 'now' from the Arrow of Space, they act on matter *while* being affected in turn by matter. Notice that such non-linear dynamics, depicted with the Escher's 'drawing hands' below, cannot be modeled with 1-D Euclidean space, the current geometrical model for 'time'.

The instantaneous, in *all* (inertial and [non-inertial](#)) reference frames, bi-directional negotiations between the two sides of the Einstein field equation require two *modes* of spacetime: *global* mode for GPIs and *local* mode for the physicalized -- one-at-a-time -- geometry & matter. The immediate predictions from the postulated two *modes* of spacetime lead to [dual cosmological time](#) and modifications of G F R Ellis' [Finite Infinity](#): the universe resembles an *unbroken* ring with no circumference, for the circumference is nowhere, and the "center" (cf. the quasi-local point  $\mathbf{x}$  below) is everywhere. The [Weyl Principle](#) applies to all of these ([uncountably infinite](#)) "centers", and each of these "centers" can also serve as 'absolute reference frame' in which 3-D space would look like "expanding" with [constant acceleration](#) (Java applet [here](#)).

As Francis Farley noticed (private communication), Einstein did not ask **what** was pushing such a frame of reference "outwards." My answer: the Arrow of Space. If we imagine the universe at its largest possible length scale of 'an *unbroken* ring with no circumference' (denoted by  $\mathbf{L}$  [above](#)), it may be a *bona fide isotropic universe* in which "the metric is automatically flat and remains flat at all times" (F. Farley, [arXiv:1005.5052](#), pp. 6-7). However, the space topology of such '[de facto infinite universe](#)' may be undecidable, in the sense that it should be in some superposition of 'open & closed', while the topology of 'the global time [ $\tau$ ]' (cf. below) should be in some superposition of 'line and closed circle'. [Headaches, yes](#).

Well, I don't like the idea of 'curvature' and [balloon metaphors](#), and prefer to speculate about what happens at just *one* quasi-local point  $\mathbf{x}$  (cf. below), and then multiply it to [uncountably infinite](#) to reproduce 'space' as [dynamically emerging phenomenon](#) equipped with '[speed of light](#)'. First and foremost, I need an explanation of the initial '[free fall](#)', because the idea of 'curvature' simply doesn't make sense to me. As Richard Feynman noticed in *Character Of Physical Law*, 1967, [p. 8](#): "The next question was - what makes planets go around the sun? At the time of Kepler some people answered this problem by saying that there were angels behind them beating their wings and pushing the planets around an orbit. As you will see, the answer is not very far from the truth. The only difference is that the angels sit in a different direction and their wings push inward."

I expect lively discussions with [my opponents](#) in Švejk's [favorite pub](#), but will be [utterly polite](#) (not frank, as in the outline here). If we subscribe, *faute de mieux*, to the idea of d'Alembert and Einstein that gravity is some "[fictitious force](#)", the Arrow of Space may provide inertia and "free fall" by driving the whole universe "upwards", with [constant acceleration](#) -- all physical objects, [light beams](#) included, would seem to "fall" under the influence of gravity [exactly the same as any other object](#).

Point is, trying to stop such "free fall" requires a **real force** in the "direction" of the Arrow of Space, which we can only describe as '**time**' (see the full CPT-invariant phenomenon in the drawing below). This **real force** is proportional to the object's mass, "which would be equal to, and *appear to be*, its real weight" (C. Seligman). If the Arrow of Space drives the universe *en bloc* and with the constant acceleration of '[change of space](#)', then the opposite, 'free fall' image from such "upward" acceleration will be **the same** for every physical object, be it a feather or a stone block. Well, **if** we manage to eliminate (reversibly) the *initial* 'free fall', perhaps we could cancel such zero free fall effortlessly, by zero real force (and build [pyramids](#), say). The first off task is to "[dissolve](#)" (reversibly, of course) the initial "free fall" of a stone block ([AVC](#)) back to its [GPIs](#) (NASA called their project '[propellantness propulsion](#)', which sounds much better than '[space polarization](#)', only they couldn't make it either).

Well, perhaps we could gather at Švejk's [favorite pub](#) (Special Agent [Bretschneider](#) included) to discuss [the origin](#) of inertial "[forces](#)" over a pint of beer or five...

Truncated URLs:

<http://tinyurl.com/Einstein-Prague>

<http://tinyurl.com/Einstein-Prague-details>

Some history. On 24 August 1920, Berlin's Philharmonic Hall (which had a capacity of over 1600 people) hosted a rally organized by Paul Weyland and Ernst Gehrcke, at which Einstein was denounced as a fraud. Paul Weyland's talk was "Betrachtungen über Einsteins Relativitätstheorie und die Art ihrer Einführung", while Ernst Gehrcke elaborated on "Die Relativitätstheorie, eine wissenschaftliche Massensuggestion". One month later, Nobel Laureate [Philipp Lenard](#) was also involved in "denouncing" the theory of relativity.

You may say, all this happened many years ago; people now are open-minded and prone to consider different viewpoints, right? Well, it depends.

People invariably neglect any theory that may challenge their *religious* beliefs. If the theory gets published and gains influence, they won't keep quiet anymore, but will strike as harsh as they can. That's how religion works. What I mean is a *very* strong and sticky religion, known as 'anti-theism': if the universe does indeed function as a [brain](#), the question of whether such brain may, or may not, have its 'mind' cannot be left to philosophers and theologians alone. It will be subject to rigorous quantum cosmology research, and nobody knows what the math could expose from 'the true monad without windows', say.

I suspect many theoretical physicists would *hate* to get **very** close to [John 1:1]. For example, how would these people comment on Virgil's statement *Mens agitat molem* (*The Aeneid*, [Ch. 6, 727](#))? In German: *Der Geist bewegt die Materie*. Does [time-orientability](#) emerge *only and exclusively* only from physical ([colored](#)) stuff, in such fashion that the Unmoved Mover [[Ref. 1](#)] would be redundant? For if matter alone were *the necessary and sufficient cause* for [time-orientability](#), it would have to be endowed with the faculty of self-acting, much like Baron Munchausen who pulled himself, along with his horse, out of the swamp by his own hair.

Many theoretical physicists would deeply hate to have their anti-theistic religion exposed. They *love* to picture themselves as 'objective scientists', while in fact they have only subscribed to different religions: they either deeply believe that God does not exist, or consider themselves "agnostics", which means they deeply believe there is *nothing* to believe in. And if you show them [John 1:1] and the Unmoved Mover [[Ref. 1](#)] with quantum gravity -- they will *really hate* you. Deeply indeed. In October 2002, while preparing for a seminar at the Imperial College London scheduled on [November 27th](#), I emailed Briton's leading expert in quantum gravity (my email from Thu, 24 Oct 2002 20:34:51 +0300) and asked him to explain what kind of "time" is implied with the proverbial phrase 'moving points around in [Diff\(M\)-invariance](#)'. His reply (Fri, 25 Oct 2002 16:46:34 +0100) was as follows:

"As for time, wrist-watches and Diff(M), one of the key things that emerged from all the discussions on the problem of time was that although it is true that, because of the Diff(M) action, no physical meaning could be attached to a point on the space-time manifold, a physical meaning *\*can\** be attached to specifying a space-time location by the values of various physical quantities. [Karel Kuchar](#) is probably the person who has done most work on this, but it is something that number of people have remarked on in recent years. For example,  $\phi$  is a scalar field on the manifold and  $X$  represents the space-time coordinate of a particle, then although  $\phi(x)$  has no physical meaning (if  $x$  is a point in the space-time manifold) nevertheless  $\phi(X)$  *\*does\** have a meaning: ie you can talk in a Diff(M)-invariant way about the value of a field where a particle 'is', and similarly for a [trajectory](#). And, after all, general relativity does seem to work well as a theory, and yet I can certainly read the time on my wrist watch!"

Surely the notion of 'spacetime' is to be regarded as an adjective: just as we can't say "dark" without specifying what *is* "dark" and [with respect to what](#), a bare spacetime manifold doesn't have any *physical* meaning; we need Type I matter fields to talk about "[colored](#)" spacetime, whereas any *purely geometric*, [noncolorizable](#) component of spacetime, such as 'pre-geometric plenum', the reference fluid of GR, and Anderson's [absolute structures](#) will be expelled from present-day GR [[Ref. 1](#)]: "The generator of change itself, the Hamiltonian, is a constraint only and thus has instantaneous character. This is why time is a mere label in the classical theory and disappears completely in the quantum theory" ([Claus Kiefer](#)).

But notice the last sentence from the email above: it contains a typical [non sequitur](#). Surely GR "does seem to work well as a theory", but only for those cases in which we can apply its linearized approximation, say, to adjust the [GPS system](#). GR for sure cannot work for [CDM & "dark" energy](#),

firstly, and secondly -- the fact that he "can certainly read the time" on his wristwatch is a profound mystery: the alleged dynamics of GR is "entirely generated by constraints", and the dynamical data "do not explicitly include a time variable" [Ref. 1]. Why not? Because his wristwatch can **only** read a linearized, change-**in-space** "time" modeled with 1-D Euclidean space, which is nothing but the (local mode of) time pertaining to the "**colored**" spacetime. Any input from the *purely geometric, noncolorizable* (global mode of) spacetime **must** be perfectly well hidden **by** the 'speed of light', rendering the local mode a *perfect* continuum. Stated differently, for a system of gravity coupled to matter fields  $t_{\mu\nu}$  **must** be zero, or else "the ether would come back!" ([Merced Montesinos](#)).

Which brings us to the Equivalence Principle and the misguided search for 'the right answer to a wrong question' (MTW, [p. 467](#)): the "ether", with respect to which the global time [tau] from the Arrow of Space is defined, **must** be hidden in such a way that the energy-momentum inserted from it on the r.h.s of Einstein field equation must remain a "dark" **self-force**. We must **not** be able to reach the Aristotelian First Cause, or else there can be no theory of relativity: "the ether would come back!" No 'energy conservation' can be elaborated within the linearized, change-**in-space** "time" ([Sean Carroll](#)), so the fact that Chris Isham can indeed read **any** time with his "wrist watch!" is a deep mystery -- nothing to do with those mundane cases of applying a linearized approximation of GR.

We take for granted that "the metric is treated as a field which not only affects, but also is (**at the same time** - D.C.) affected by, the other fields" ([John Baez](#)), correct? The metric "has a double role: it is a field variable and defines the geometry **at the same time**" (Laszlo Szabados, private communication), right? The key phrase "at the same time" pertains to the instant 'now' from the Arrow of Space, at which the two *modes* of time, global and local, **coincide**.

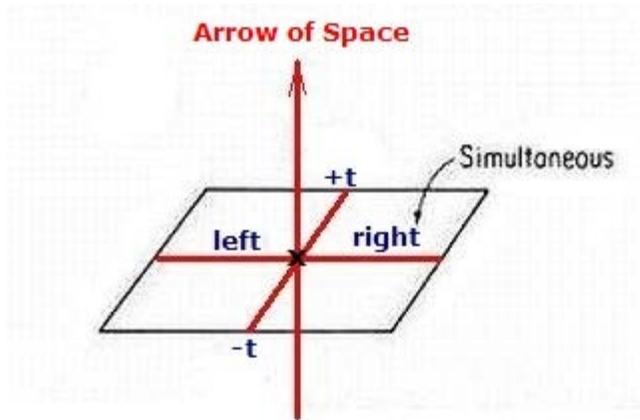
The resulting dynamics of GR resembles a school of fish: in the atemporal global mode of spacetime gravity 'knows about everything' and acts on the local (colored) mode of spacetime by the rule 'think globally, act locally', which makes the physical (colored) interactions **quasi-local**. Hence **any** observable of the gravitational field is "*necessarily* quasi-local" ([Laszlo Szabados](#)).

There is no need to be a virgin to grasp the *eternally present* global time [tau] [[Ref. 1](#)] from the Arrow of Space; the brain uses it effortlessly.

More importantly, if the universe -- the only truly isolated system -- is wrapped by **its own non-Archimedean 'global mode of spacetime'**, one could seek a modification of G F R Ellis' Finite Infinity to resolve the problem of "passing to an appropriate asymptotic regime such that **all** gravitational effects are localized **inside** of it" ([Adam Helfer](#)); from mathematical viewpoint, the current *asymptotic spacelike* regime is pure poetry, just like the statement by [Bernard Schutz](#) that "null infinity is *very far away*." Only Chuck Norris has reached it (twice).

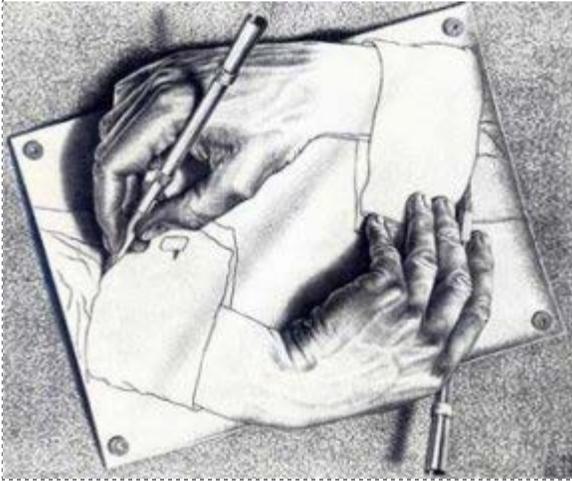
The Arrow of Space is suggested to explain the quasi-local (colored) observables resulting from '*already completed*', at each and every instant you look at your wristwatch, negotiations between the two sides of Einstein field equation. The end result is a *perfect continuum* of quasi-local "points" **x** (see the animated picture below) at which the *wegtransformierbar* gravity **must** indeed be vanishing (present *continuous*; see the empty set (R) above). Notice also that the duration of the negotiations between the two sides of Einstein field equation in the atemporal global mode of spacetime (the **blue** square) is **zero**, as recorded with Chris Isham's "wrist watch!": it can only read a linearized (polynomial) "time".





The global mode of spacetime in Flatland (adaptation from Bob Wald's [textbook](#)): the point  $x$  from the animation above is *the only* point from the local ([colored](#)) mode of spacetime, which **coincides** with the global mode. In 3-D space, the point  $x$  will *inherit* three symmetries from the global mode, known as CPT-invariance (charge symmetry cannot be shown in Flatland; it requires 3-D space). The [atemporal](#) correlations are [simultaneous](#), and their "duration" is [zero](#) in the local mode. Notice that the point  $x$  is also the global instant 'now' from the Arrow of Space, but we can *physically* (local mode of spacetime) observe only a *composition* of 'flashes' made **by** 'the speed of light' (see [below](#)). In GR textbooks, these 'flashes' are fused (flattened) like [Photoshop layers](#), hence we end up with a timeless "trajectory" immersed in a dead frozen 4-D "[block universe](#)", in which time can evolve just as much as space can: "There is no dynamics *within spacetime itself*: nothing ever moves therein; nothing happens; nothing changes" ([Robert Geroch](#)). Yet GR textbooks shouldn't be blamed, because they cannot, and should not reveal the [Unmoved Mover](#), or else there can be no theory of relativity. Which is why we need [quantum gravity](#) to explain the empirical fact that Chris Isham can indeed read the global time [tau] & the local, coordinate time with his "wrist watch!"

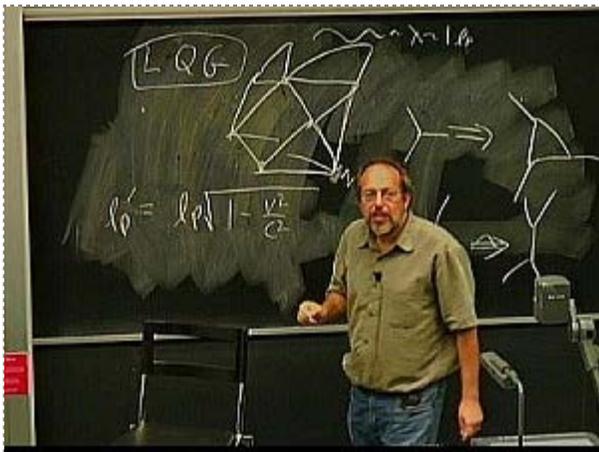
Well, [Chris Isham](#) wasn't interested in the implications from the requirement for general covariance, which "takes away from space and time the last remnant of physical objectivity". Albert Einstein was, very much indeed, and was struggling to avoid it (cf. John Norton, pp. [802-804](#)). To solace Einstein, it isn't about 'physical objectivity' and 'physical reality out there': yes, there is an underlying reality in spacetime, but it is an UNdecidable, pre-quantum, [potential reality](#). Hence the unsettled issue with the ["ripples" of the metric field](#): yes, GWs do exist, but we cannot detect them with devices that have access **only** to a linearized, change-**in**-space "time". At any instant  $x$  from 'the time read by our wristwatch' we observe an *already* completed, *already* linearized end-result from the negotiations between the two sides of Einstein field equation.



At this single instant,  $\mathbf{x}$ , the global time  $[\tau]$  and the local, change-in-space "time" **coincide**, which is why we cannot *detect* with experiments any difference between [gravitational and inertial mass](#): no [difference](#) can manifest itself "over" a **single** instant. And if we try to recover the true dynamics of GR solely from this **single** instant, we face the insoluble [Cauchy problem](#).

Briefly, once you impose the mystery of '[time-orientability](#)' by hand, along with the unwarranted assumption that "the spacetime and the metric are  $C^\infty$ " (R. Bartnik and J. Isenberg, [p. 3](#)), you cannot recover the true dynamics of GR with the physical stuff that you drop on this '[smooth spacetime](#)' afterwards, and will be haunted by the problems of  $C^\infty$  forever -- check out [Ioannis Raptis](#); details [here](#).

Or take another renowned expert in quantum gravity, Lee Smolin. On July 22, 2010, he delivered a talk to a group of (very polite) kids, explaining his views on the so-called loop quantum gravity (LQG):



ISSYP 2010 - Keynote (Smolin)

Date: 22/07/2010 - 10:30 am

Length: 1 Hour 24 Minutes 34 Seconds

Title: Lee Smolin on Quantum Gravity

<http://pirsa.org/10070034/>

Lee Smolin, 01:23:28 - 01:23:56: "If there is a fundamental discreteness in Nature, how could all the universe with all its complexity (...) follows laws from something down to the fundamental scale? That's a great question. [Do you think I know the answer?](#)"

But is Lee Smolin genuinely interested in finding the answer? Because the answer is not in "loop quantum gravity". That we know for sure, firstly because Lee Smolin and most of his colleagues

practice GR as [bartenders](#).

The fine structure of the infinitesimal -- [the empty set \(R\)](#) -- is **not** covered in Smolin's diff geometry textbooks. The correct interpretation of the [KS Theorem](#) is not presented in his QM textbooks either.

Like a drunken man who has lost his keys in the dark, Lee Smolin is trying to find them under the street lamp, just because it is brighter there. In his last email from Sun, 24 Feb 2002 17:30:25 +0000 (BST), he wrote: "don't refer me to web pages." Eight years and five months later, he could only offer a rhetoric counter-question to his audience.

The kids were *very* polite indeed, and perhaps didn't notice that what Lee Smolin did to them was **not** fair. It was **not** fair to tell kids only a *selective* portion from what he knows about quantum gravity, to promote his obsession with "loop quantum gravity" -- it is impossible *in principle* to recover the continuum of spacetime from those "loops", and "[look around, and see as far as we like.](#)"

You can't achieve this 'test of the pudding' even with classical GR: "If the theory does not allow us, **even in principle**, to extend solutions **arbitrarily far** in one direction, it may be difficult to view this direction as a dimension of the world", says another proponent of LQG, Martin Bojowald, in [arXiv:0807.4874v1](#), p. 12. Properly speaking, "GR does not admit a description as a system evolving in terms of an observable time variable" ([Carlo Rovelli, gr-qc/0604045v2](#), p. 4).

No need to read "web pages", Lee. Just read *your book*. It is impossible to recover the continuum of spacetime from your [QM textbooks](#) in the first place. Besides, the alleged "fundamental discreteness" at Planck scale is an [illusion](#), because there is no "discreteness" in the [non-Archimedean realm](#) of 'pure geometry'.



Check out '[the quantum principle](#)' and the Gedankenexperiment with [four dice](#): there is no "discreteness" in the *quantum world out there*. The quantum of action is an **artifact** from the linearized ([polynomial](#)) "time" of the measuring devices. If Nature were employing only such 1-D linearized time, the trajectory of a fish, **negotiated** with the [school of fish](#) in the *global mode* (cf. the Escher drawing above), would not be *quasi-local* but non-local; and it won't be *continual* but "quantized". To be precise, the quantized energy levels, proposed by Neils Bohr (electrons can be observed only in particular energy levels), are *the stable* configurations of 'the school of fish' -- every 'fish' selects *one* of these stable configurations to become its 'next state' along the Arrow of Space, and the transition is [perfectly continual](#); more on [November 25, 2015](#).

It is *very* difficult to describe properly the *quasi-local* kernel of spacetime -- the point **x** above -- with the 'time read by your wristwatch', because it will look *sequential*, as in the animated picture above. It will be certainly *impossible* to explain it with a [poster](#). No way.

Back in July 2004, I was hoping to talk on these issues at [GR17](#) (Workshop D1, Quantum General Relativity, chaired by T. Thiemann), but Thomas Thiemann, who was at that time with Lee Smolin at the Perimeter Institute, didn't allow me to talk. He downgraded my oral presentation to 'poster', then buried it in an evening poster session, and granted Lee Smolin three talks: on Monday, July 19th ("Background independent approach to M theory", D2), on Tuesday, July 20th ("The low energy behavior of loop quantum gravity", D1), and finally on Friday, July 23rd ("Inflation in loop quantum gravity", B2i).

I can only hope that Thomas Thiemann, Lee Smolin, and the like will not be in the Scientific Committee at the Einstein Conference in Prague [next June](#). Will see. I will file my abstract [next month](#) and apply for oral presentation (not poster), hoping to recover "the last remnant of physical objectivity" in spacetime (Albert Einstein, Grundlage der allgemeinen Relativitätstheorie, *Annalen der Physik* 49 (1916) 769-822) with the [Arrow of Space](#). Will compete with **all** participants, both individually and *en bloc*. It will be great fun, as Karel Kuchar [[Ref. 1](#)] has already provided the

ammunition: GR textbooks can only offer a *linearized* snapshot at **one** instant of time along the global time  $[\tau]$ , while the bi-directional "talk" between the two sides of Einstein field equation (cf. the 'pure geometry' smile of the Cheshire cat above) requires an Arrow of Space: *Panta rei conditio sine qua non est*.

Sorry, [quantum gravity](#) cannot be explained with a [poster](#).

D. Chakalov

November 10, 2011

Last updated: December 30, 2011, [22:56:40 GMT](#)

Truncated URL:

<http://tinyurl.com/Einstein-Prague>

[Ref. 1] Karel V. Kuchar, [Time and interpretations of quantum gravity](#), in: Proceedings of Fourth Canadian Conference on General Relativity and Relativistic Astrophysics, May 16-18, 1991 (World Scientific, Singapore), 1992, pp. 211-314.

"These are the laws of an instant in canonical gravity. (...) (T)he super-Hamiltonian constraint (1.2), (1.4) has no counterpart in electrodynamics. It is this constraint that ultimately yields the dynamics of geometry.

"Any reference to the hypersurface  $E \rightarrow M$  which carries the geometrical data  $g_{ab}(x)$ ,  $p^{ab}(x)$  is conspicuously absent in the constraints (1.1) - (1.4). The hypersurface  $E \rightarrow M$  represents [an instant of time](#); the fact that it drops out of the constraints (1.1) - (1.4) underlines the problem of time in quantum gravity.

...

"In general relativity, dynamics is entirely generated by constraints. The dynamical data [do not explicitly include a time variable](#)."

-----

*Idem*, Canonical quantum gravity, [gr-qc/9304012v1](#), 8 April 1993.

"The third alternative is to say that because perennials are constants of motion, it does not matter when they are observed. (...) This does not make me too happy either. If **all time  $[\tau]$  is eternally present**, all time is irredeemable."

...

"Perennials in canonical gravity may have the same ontological status as unicorns -- a priori, these are possible animals, but a posteriori, they are not roaming on the Earth. According to bestiaries, the unicorn is a beast of fabulous swiftness, strength, and beauty, but, alas, it can be captured only by a virgin [38]. Corrupt as we are, we better stop hunting mythical beasts."

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*Idem*, The Problem of Time In Quantum Geometrodynamics, in [The Arguments of Time](#), ed. by Jeremy Butterfield, Oxford University Press, Oxford, 1999, [p. 193](#).

## 6. How Serious is the Problem of Time?

I have discussed the problem of time within the framework of quantum geometrodynamics which casts Einstein's theory of spacetime into canonical form and quantizes it by replacing conjugate variables by operators. Admittedly, geometry is not the only field to quantize, canonical quantization is not the only (or necessarily the best) way of quantizing a field, and local field theory is not the only (or necessarily the best) model of the deep structure of the world. Does this mean that better ways of quantizing a system and better ways of capturing its structure will turn the problem of time into a mere pseudo-problem? I doubt it. The profound message of general relativity is that spacetime does not have any fixed structure which is not dynamical but governs dynamics from outside as an unmoved mover. The problem of time is only one facet of the missing unmoved mover, and canonical quantization only a handy tool for laying bare the consequences. Unless the deep structure of the world reveals a hidden unmoved mover and thus overturns all expectations raised by general relativity, the quantum theory of the deep level is likely to encounter a problem similar to the problem of time, though in a different guise. If so, the problem of time in quantum geometrodynamics may be only a wind that precedes the storm.

=====

Subject: Re: The dead-end of [Ashtekar's quantization program](#)  
Date: Thu, 10 Nov 2011 22:53:02 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Karel Kuchar <kuchar@physics.utah.edu>  
Cc: Abhay Ashtekar <ashtekar@gravity.psu.edu>

Dear Professor Kuchar,

I quoted from one of your fundamental articles at

[http://www.god-does-not-play-dice.net/#Yuan\\_OG](http://www.god-does-not-play-dice.net/#Yuan_OG)

Hope to see you and Prof. Ashtekar in Prague next June.

Sincerely,

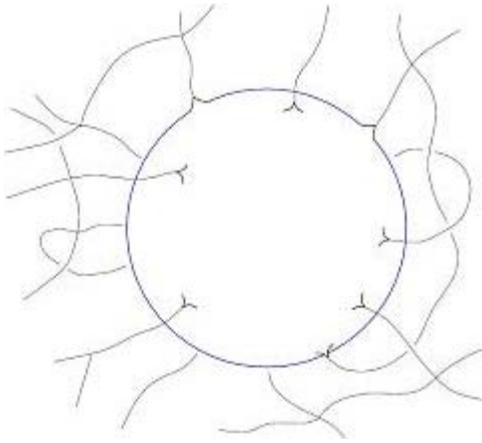
Dimi Chakalov

On Mon, 27 Jan 2003 15:13:51 -0700 (MST), Karel Kuchar <kuchar@physics.utah.edu> wrote:  
[snip]

-----

**Note:** The only reply from Abby Ashtekar was an automated email from Thu, 10 Nov 2011 15:53:05 -0500 (EST), "away from my mail". Which means that he has received my email above, but decided to keep quiet.

Look at the drawing below: What do you see?



According to the artist, these are "polymer excitations in the bulk puncture the horizon, endowing it with quantized area", but to me it looks just like cheesecake, only slightly overcooked (hence the cracks). My wife managed to produce it last year, without any advanced math. And it was delicious.

D. Chakalov  
November 30, 2011

=====



Subject: Re: [arXiv:1205.2019v1 \[gr-qc\]](https://arxiv.org/abs/1205.2019v1)  
Date: Thu, 17 May 2012 03:28:35 +0300  
Message-ID:  
<CAM7EkxkCMHEmiSapciT6YdNQggjzMeHBZ5Vd2rDydtSPXHr3aA@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Alejandro Perez <perez@cpt.univ-mrs.fr>  
Cc: Karel V Kuchar <kuchar@physics.utah.edu>, Claus Kiefer <kiefer@thp.uni-koeln.de>, Carlo <rovelli@cpt.univ-mrs.fr>, José Antonio Zapata <zapata@matmor.unam.mx>, Johannes Tambornino <johannes.tambornino@ens-lyon.fr>, Lee Smolin <lsmolin@perimeterinstitute.ca>, Erik Curiel <erik@strangebeautiful.com>, Martin Bojowald <bojowald@gravity.psu.edu>, Abhay Ashtekar <ashtekar@gravity.psu.edu>, Hermann Nicolai <Hermann.Nicolai@aei.mpg.de>, Chris Isham <c.isham@imperial.ac.uk>

Hi Alejandro,

> Yes, I would like to know.

I provided [link to p. 4](#) from your article at my web site, and wish to thank you for your discussion of the pitfalls from "treating the gravitational field according to the splitting given in Equation (1)." I'm afraid you haven't escaped from these problems, and never will, [because you can't](#).

Since your theory is "based on the Hamiltonian (or canonical) quantization of general relativity", it inherits all the problems from the initial splitting of spacetime, "thereby doing grave injustice to space-time covariance that underlies general relativity" (A. Ashtekar, arXiv:gr-qc/0410054v2, [p. 32](#)). These generic problems, and the limitations they impose on your theory, haven't been made clear in your article. Do you read Karel Kuchar ?

You wrote: "The background independence of general relativity **implies** (Sic! - D.) that the canonical formulation of the field theory is that of a gauge theory with diffeomorphism as part of the gauge group. LQG is constructed by quantizing a phase space formulation of general relativity in terms of SU(2) connection variables."

But the background independence in the Hamiltonian formulation of GR is a \*big\* can of worms: check out Baron Münchhausen at

<http://www.god-does-not-play-dice.net/#Claus>

Unless you resolve the dynamics of GR, I don't think you could claim that you understand the seemingly innocent word "implies".

First things first, right?

I believe the spin foam approach to the quantization of gravity is dead wrong from the outset, firstly because it cannot -- not even in principle -- recover the smooth continuum at the length scale of tables and chairs, such that we could "look around, and see as far as we can" (L. Smolin, Three Roads to Quantum Gravity, p. 205).

One part of the continuum problem stems from the current formulation of GR: "If the theory does not allow us, even in principle, to extend solutions arbitrarily far in one direction, it may be difficult to view this direction as a dimension of the world", says M. Bojowald in 'Relativity and the Dimensionality of the World' (ed. by Vesselin Petkov, Springer, 2007, Ch. 8, p. 149).

So, with the current formulation of GR, you cannot recover what we call 'dimension of space'. Surely "the Hamiltonian analysis of general relativity is the basic starting point for canonical quantization", but why "formulating Hamiltonian general relativity in terms of Yang–Mills-like connection variables", given the severe shortcomings of the initial Hamiltonian GR?

You also admit that "the very notion of space-time geometry is most likely not defined in the deep quantum regime", yet insist on "quantum theory that reproduces gravity in the semi-classical limit", and also deeply believe that a "spacetime picture would only arise in the semi-classical regime with the identification of some subsystems that approximate the notion of test observers."

I'm afraid that "semi-classical regime" is totally confusing statement, because the crux of the task is to find the phenomenon which can erect Lorentzian metric from the so-called spacetime foam "in the deep quantum regime".

That's the first off task of any quantum gravity program. Yours is set on a dead-end from the outset, with "the kinematical Hilbert space of LQG", because you haven't solved the initial problems from Quantum Theory,

<http://www.god-does-not-play-dice.net/#Singh>

... in such a way that we could "look around, and see as far as we can" (L. Smolin).

First things first, right?

I fully agree that if we want to get a quantum theory that reproduces gravity in the continuum classical limit "we should have a background independent formalism", but why you didn't quote Karel Kuchar regarding what 'background independent formalism' actually means ?

Would you like some references for your updated arXiv:1205.2019 v2 [gr-qc] ? Just wait for his forthcoming talk '[Canonical quantum gravity: Einstein's posthumous anathema](#)'. You gonna love it :-)

Meanwhile, if you or your colleagues have questions, please don't hesitate. I will be happy to help, in my capacity of "just another crank" (Chris Isham).

Dimi

> On Wed, May 16, 2012 at 4:12 PM, Dimi Chakalov <dchakalov@gmail.com> wrote:  
>>  
>> Hi Alejandro,  
>>  
>> Do you wish to learn why the spin foam approach to the quantization of  
>> gravity is dead wrong ?  
>>  
>> Carlo doesn't care, but I guess you might be curious.  
>>  
>> Dimi  
>

=====

Subject: [arXiv:1210.6977v1 \[quant-ph\]](#)  
Date: Mon, 29 Oct 2012 16:22:27 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Peter G Morrison <smallscience@hotmail.com>,  
Pete Morrison <over9000theories@gmail.com>  
Cc: Francesco Ticozzi <francescoticozzi@gmail.com>,  
Claudio Altafini <altafini@sissa.it>,  
Maciej Blaszkak <blaszakm@amu.edu.pl>,  
Ziemowit Domanski <ziemowit@amu.edu.pl>,  
Michel <michel.dyakonov@gmail.com>

Dear Dr. Morrison,

May I ask two questions.

Given the hypothesis that "the state vector travels along a path of least time on the complex projective manifold," you tried to construct some "time-optimal Hamiltonian matrix which moves us from state-to-state on the projective manifold, in least time", but the "expressions for field densities for matrices of infinite dimension, which represent the continuous degrees of freedom", are still out

of site.

I wonder if you can use the geometrical formulation of QM (Abhay Ashtekar and Troy A. Schilling, [arXiv:gr-qc/9706069v1](http://arxiv.org/abs/gr-qc/9706069v1)).

In general, please let me know if you can solve an old task from 1929,

<http://www.god-does-not-play-dice.net/#Renner>

The opinion of your colleagues will be greatly appreciated, too.

Kind regards,

Dimi Chakalov

--

<http://tinyurl.com/dollar-ratio>

<http://tinyurl.com/steel-evaporation>

**Note:** Don't mix apples with oranges. The Hilbert space does **not** describe the quantum world, but only some biased **projection** at the length scale of tables and chairs, calculated with the incomprehensible Born Rule based on the squared module of quantum wave "amplitude". The Hilbert space is **for us**, not for the quantum world, which is why QM cannot be used as fundamental theory -- just 'shut up and calculate' (D.N. Mermin). If you try to avoid the Hilbert space, Born Rule, and the "parameter" **t** in the Schrödinger equation [[Ref. 1](#)], you will hit the so-called "non-viable" quasi-probabilities (J.M.Yearsley and J.J.Halliwell, [arXiv:1210.6870v1](http://arxiv.org/abs/1210.6870v1) [[quant-ph](#)]), which nobody knows what the heck they are referring to.

Point is, we don't have '[projective measurements](#)' with the [Kochen-Specker Theorem](#), which is a clear evidence [against the Hilbert space](#). The Hilbert space is about what you may or may not *observe* at macroscopic level, but [not about the quantum world](#).

Recall again [Erwin Schrödinger](#): "The rejection of realism has logical consequences. In general, a variable *has* no definite value before I measure it; then measuring it does *not* mean ascertaining the value that it *has*. But then what does it mean?"

It means that both "before" and "after" the measurement *the* quantum system has always been, and will always remain in its UNdecidable pre-quantum Kochen-Specker state. It is the genuine *ontic* quantum state, which nobody can fit in any Hilbert space whatsoever. If we use inanimate measuring devices (not the human [brain](#)), we can *only* observe its classical "shadows" ([Sir Nevill Mott](#)).

Now you can explain the task from 1929 [below](#). Or keep dead quiet and ignore the basic basics of Quantum Theory, until you fully and irreversibly [retire](#). The choice is yours.

D. Chakalov

October 29, 2012

Last updated: November 7, 2012

[Ref. 1] [Tejinder P. Singh](#), The problem of time and the problem of quantum measurement, [arXiv:1210.8110v1](http://arxiv.org/abs/1210.8110v1) [[quant-ph](#)]

"Dynamical evolution in quantum theory is described by the Schrödinger equation. The time parameter which is used for describing this evolution is part (Sic! - D.C.) of a classical spacetime (**wrong** - D.C.)."

**Comment:** In the classical spacetime of Special Relativity, the parameter  $t$  corresponds to 'objective classical reality *out there*', which is why we know that the Moon is 'out there' even if we can't see it. However, the *variable*  $t$  in the Schrödinger equation is not a "parameter", because we cannot even think about an elementary particle as 'reality out there' resembling the Moon; see Erwin Schrödinger above. This variable isn't some absolute Newtonian time either, contrary to statements in modern QM textbooks (e.g., [Chris Isham](#)). It may become "part (Sic! - D.C.) of a classical spacetime" for one instant only, and only under the requirements from the Kochen-Specker Theorem. Forget about Hilbert space.

D.C.  
October 31, 2013

=====

Subject: Re: [arXiv:1210.6977v1 \[quant-ph\]](#)  
Date: Tue, 30 Oct 2012 03:01:59 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Pëtr <over9000theories@gmail.com>

On Tue, 30 Oct 2012 11:31:30 +1100,  
Message-ID:  
<CAPZZGkVfOGEpFjb9LGv4LtCh5DVg5vUxnjBDvr2ZkNCJBPho4Q@mail.gmail.com> ,  
Pete Morrison <over9000theories@gmail.com> wrote:

[snip]

>> Now you can explain the task from 1929 below. Or keep dead quiet and ignore  
>> the basic basics of Quantum Theory, until you fully and irreversibly retire.  
>> The choice is yours."  
>  
> BLAH BLAH BLAH BLAH BLAH AD INFINITUM

Пëтр dorogoi,

I'm afraid you are [Russian](#).

> I don't care about the measurement problem, only about the free evolution.

Yes, you are very much Russian. And since you "don't care about the measurement problem," I will let you contemplate on your dreams, until you fully and irreversibly retire.

> Seems like your website is a load of crap, based on your perceived need to  
> explain things with far too many words and not enough equations.

If you can't suggest any argument in favor of your ideas, all you can do is spit insults. Usually people keep dead quiet, but not Russians like you. So typical.

Forget it.

D.C.

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Subject: М. Г. Иванов, 'Как понимать квантовую механику', 2012, с. 30  
Date: Sun, 30 Dec 2012 15:06:07 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Mike Ivanov <mgi@mi.ras.ru>  
Cc: Lev Okun <okun@itep.ru>,  
Igor Reznikoff <dominiqueleconte@yahoo.xx>,  
Serge Krasnikov <gennady.krasnikov@pobox.spbu.ru>,  
Dmitry Slavnov <slavnov@goa.bog.msu.ru>,  
Andrei NB <novikov.borodin@gmail.com>,  
Stanislav.Babak@aei.mpg.de,  
mukhanov@theorie.physik.uni-muenchen.de,  
yrylov2006@yandex.ru,  
Andrei.Khrennikov@lnu.se,  
irina.basieva@lnu.se

"Уравнение Шрёдингера не содержит ничего вероятностного. Оно полностью описывает, как меняется со временем волновая функция..."

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Dear Dr. Ivanov,

I'm afraid there is too much Russian poetry in your quote above.

Check out an explanatory note (December 30, 2012, 11:39:19 GMT) at

<http://www.god-does-not-play-dice.net/#cloud>

Please reply in English.

Sincerely,

Dimi Chakalov

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**Note:** The quote above reads: "Schrödinger's equation contains nothing probabilistic. It fully describes how the wave function changes over time..."

But what kind of 'time' is implied here? If it were from [classical mechanics](#), the "wave function" would be 'objective reality *out there*', just like in the example with the [Sun](#).

Check out [Erwin Schrödinger](#) and read the note at the link above.

D. Chakalov  
December 30, 2012

=====

Subject: Re: "[A spoken thought is a lie](#)"  
Date: Tue, 1 Jan 2013 20:03:58 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>

To: Lev Okun <levokun@gmail.com>, Lev Borisovich Okun <okun@itep.ru>  
Cc: Mike Ivanov <mgi@mi.ras.ru>,  
Serge Krasnikov <gennady.krasnikov@pobox.spbu.ru>,  
Dmitry Slavnov <slavnov@goa.bog.msu.ru>,  
Andrei NB <novikov.borodin@gmail.com>,  
Stanislav.Babak@aei.mpg.de,  
mukhanov@theorie.physik.uni-muenchen.de,  
yrylov2006@yandex.ru,  
Andrei.Khrennikov@lnu.se,  
irina.basieva@lnu.se

Dear Dr. Okun',

Thank you for your feedback. I know some of your articles and 'Particle Physics Prospects' since 1980s. You were teaching at the Moscow Institute of Physics and Technology (Fiztech) since 1962, and are personally responsible for implanting **many wrong ideas** in theoretical physics, both in [USSR](#) and in [the normal world](#).

Please reply to my email from Wed, 27 Oct 2010 07:04:57 +0300, "A spoken thought is a lie".

- > I would be grateful for receiving your
- > response to my interpretation of
- > QM in the attached copy of my little book
- > "[ABC OF PHYSICS](#)".

Thank you for your essay. May I offer you six brief comments:

- 
1. p. iii: "the [exchange of gravitons](#) -- massless particles with spin 2h -- explains gravitation."
    - 1.1. Nope. You can't. Nobody can. [Forget it](#).
  2. p. iv: "the correctness of descriptions of gravitation as exchange of [gravitons](#) has been confirmed by experiments at all attainable energies."
    - 2.1. See (1.1) above.
  3. p. iv: "The amplitude modulus squared gives the probability of transition (...) as a function of [time](#) for an ensemble of identical states."
    - 3.1. Please see what you've missed from Schrödinger and Margenau,  
<http://www.god-does-not-play-dice.net/#cloud>  
<http://www.god-does-not-play-dice.net/#Ivanov>
  4. p. 3: "Motion is the displacement of a particle in space", and Sec. 15.5 'Dark energy'.
    - 4.1. Please see another interpretation of 'motion' in the so-called [Arrow of Space](#), which produces "dark" energy,  
[http://www.god-does-not-play-dice.net/#Dennis\\_Sciama](http://www.god-does-not-play-dice.net/#Dennis_Sciama)
  5. p. 71: "A theory describing the physics at the [Planck scale](#) has not yet been developed."
    - 5.1. [Sure](#). See (1.1) above, and (4.1).

6. Sec. 27.4 'LHC and prospects'.

6.1. As John von Neumann put it, "There's no sense in being precise when you don't even know what you're talking about."

<http://www.god-does-not-play-dice.net/#Kibble>

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The proof of (1.1) is at the links above. It's not a matter of opinion, and I'm not its author either.

I will be happy to elaborate, once I receive your reply to my email from Wed, 27 Oct 2010 07:04:57 +0300.

Wishing you and your Russian colleagues a Happy New Year,

Dimi Chakalov

-----

**Note:** Back in [1950](#), Isaak Yakovlevich Pomeranchuk has told Lev Borisovich Okun' that the **vacuum** "is filled with the most profound physical content."

Sure, but this 'most profound content' is **not** "physical", as explained [below](#). It has been the most profound secret of Nature ever since [Walther Nernst](#) introduced the notion of "zero point energy" in **1916**. That's correct, one year prior to the establishment of [USSR](#).

Lev Okun' (b. 7 July 1929 in Suchinitschi, USSR) is definitely [good in math](#), but in his latest essay "[ABC of Physics](#)" he didn't even try to explain the misleading trends in the definition of 'mass', which stem from the simple fact that "the total energy" might look "conserved" only in Newtonian mechanics (*idem*, arXiv:hep-ph/0602037v1, [p. 3](#)). You **cannot** separate mass from its energy (and *vice versa*), and therefore the first off task is to explain the notion of '[time](#)' during which the total mass-energy of the universe, bootstrapped by its [gravitation](#), could be "conserved". Otherwise you can't talk about time, energy, and mass. Which brings us to 'the most profound secret of Nature' from **1916**.

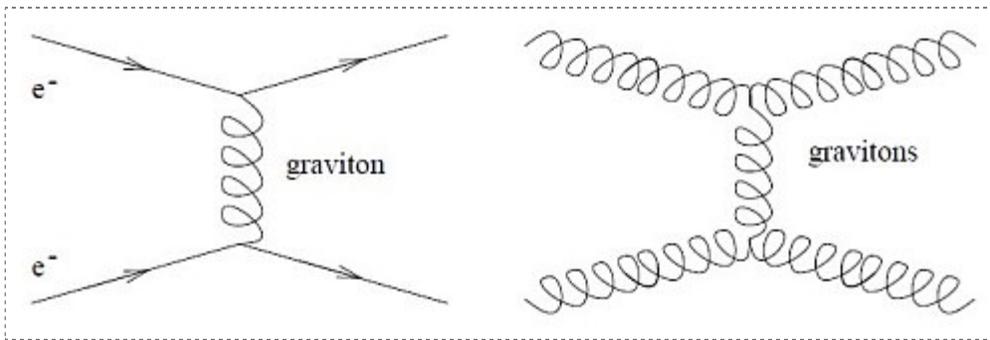
May I recall the three forms of 'mass' from [Yakov Terletskii](#), the "mirror world" paper (1965) mentioned by Lev Okun' *et al.* (Spacetime and vacuum as seen from Moscow, arXiv:hep-ph/0112031v1, [p. 3](#)), and the current state of affairs 'as seen from Moscow' (arXiv:physics/0111134v1, Sec. 61, [p. 5](#)):

61. The existing terminology is obsolete and non-adequate. Fermions (quarks and leptons) are usually referred to as "matter", though neutrinos kinematically behave like photons. Even very heavy bosons are often referred to as "radiation". Actually all fields and their quantum excitations (including photons) are matter.  
Massive vacuum; is it also matter?

Welcome aboard, Lev Borisovich (**бурные продолжительные аплодисменты**).

The "[god particle](#)" and the "[graviton](#)" are involved in gravitation, along with the "[massive vacuum](#)", plus everything else (see above), but *only* the "graviton" performs non-linear [self-interaction](#) of

matter plus the self-interaction of "gravitons" with themselves. If you can "explain" this miracle with [impeccable math](#), you're [Russian](#).



Here's another quote from Lev Okun (The theory of relativity and the Pythagorean theorem, *Physics - Uspekhi* 51(6) 601-636 (June 2008), [p. 627](#); emphasis added):

**Энергия без частиц?** В реакциях распада и аннигиляции материя не исчезает подобно чеширскому коту, от которого остается только его улыбка — энергия. Носителями энергии во всех этих процессах являются частицы материи. Во всех изученных до сих пор процессах энергии без материи ("чистой энергии") не бывает.

Это, правда, не относится к так называемой темной энергии, которая была открыта в последние годы XX в. Темная энергия проявляется в ускоряющемся расширении Вселенной. (Об этом ускоряющемся расширении свидетельствуют скорости далеких сверхновых звезд.) Похоже, что носителем темной энергии является вакуум и что она составляет три четверти всей энергии Вселенной. Оставшаяся четверть заключена в массе обычной материи (5 %) и темной материи (20 %). В лабораторных опытах с обычным веществом темная энергия не проявляется. В таких опытах носители энергии — это всегда частицы.

**Energy without particles?** Matter does not disappear in decay and annihilation reactions leaving behind only energy like the **Cheshire cat** would leave behind only its [smile](#). In all these processes the carriers of energy are particles of matter. Energy without matter ('[pure energy](#)') has never been observed in any process studied so far.

True, this is **not so for so-called dark energy**, which was discovered in the last years of the XXth century. Dark energy manifests itself in the accelerating expansion of the Universe. (The evidence for this accelerating expansion is found in recession velocities of remote supernovas.) Three-fourths of the entire energy in the Universe is dark energy and its carrier appears to be the vacuum. The remaining quarter is carried by ordinary matter (5%) and dark matter (20%). Dark energy does **not** affect processes with ordinary matter observed in laboratories. In a laboratory experiment energy is **always** carried by particles.

But can we *directly* observe **pure dark energy** ? No, we can't. To paraphrase [Fyodor Tyutchev](#), a spoken (explicated) thought is a "[colored](#)" thought. We can *only* detect a *physical* particle -- not its unphysical [UNspeakable pre-quantum Kochen-Specker source](#).

Which is why nobody can detect the **pure dark energy** of some "[god particle](#)". We can only detect particles which *had already been* affected by their common UNphysical source -- not the **pure dark source** itself. These *detectable* particles will look "self-acting", like [Baron Munchausen](#), but again, [CERN](#) cannot *in principle* detect their **pure dark source**.

Besides, we always place the cat smile in the left-hand size of Einstein's equations: it is **pure geometry** and [cannot be directly detected](#) either.



Back in January 1987, I had a huge discussion at BG Academy of Sciences in Sofia with a prominent theoretical physicist from Dubna ([USSR](#)), which was mentioned [here](#). Shortly after that, in March of 1987, I wind up on the street, because it turned out that the BG Academy of Sciences doesn't have money for my salary, after I confronted the view of spacetime and vacuum 'as seen from Moscow'. I had to immediately take the first available job, which was in a printing house, and soon I was cutting stacks of paper with industrial paper cutters. It was unforgettable experience (there's nothing heavier than paper!), and I vowed to *never* offer arguments to [Russians](#).

Now we live in different times, but I won't say more either, because I do not offer math to people who don't care about [Quantum Theory](#) and [General Relativity](#) ([Matthew 7:6](#)).

D. Chakalov

January 1, 2013

Last updated: January 4, 2013, 01:53 GMT

=====

Subject: [arXiv:1209.1836v1 \[quant-ph\]](#)  
Date: Tue, 18 Sep 2012 02:45:21 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Adan Cabello <adan@us.es>  
Cc: Robert W Spekkens <rspekkens@perimeterinstitute.ca>, [Michael Seevinck](#) <m.p.seevinck@science.ru.nl>

Adan, your [latest paper](#) is a Russian joke.

The conflict between classical and quantum physics can be identified through a series of color-able ("yes-no") tests on quantum systems: assigning the full set of possible color-able results is

impossible for \*any\* quantum state for Hilbert space dim 3 and more.

Thus, the UNcolor-able KS state always show up for Hilbert space dim 3 and more, but you can't fit it into any Hilbert space: it's not there. You cannot prove anything. None. Zilch.

More at

<http://www.god-does-not-play-dice.net/#Renner>

Dimi Chakalov

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For years, state-independent contextuality (SIC) has been based on a mathematical result pointed out by Kochen and Specker (KS) [1, 3] and Bell [2]: the nonexistence of a map  $f : \mathbb{C}^d \rightarrow \{0, 1\}$  for  $d \geq 3$  such that for all orthonormal bases  $b \subseteq \mathbb{C}^d$ ,  $\sum_{v \in b} f(v) = 1$ . A set  $S \in \mathbb{C}^d$  for which this map is impossible is called a KS set.

Adán Cabello, [arXiv:1112.5149v1 \[quant-ph\]](https://arxiv.org/abs/1112.5149v1)

In the example [above](#), there are 4 sayings pertinent to 2 Platonic ideas. Notice that no **set** of such "measurements" can reveal the full spectrum of all **potential** explications of these two Platonic ideas. Likewise, the UNdecidable pre-quantum Kochen-Specker (KS) state does **not** correspond to any 'physical reality' about which we can expect 'yes-no' answers to our questions/measurements. It will offer only one answer: **YAIN** (forget about [topos](#)).

In Quantum Theory, the UNdecidable pre-quantum KS state is 'one entity'. It pertains *simultaneously* to **all** possible measurements on a quantum particle, therefore if we try to "decompose" **it** in the case of one specific **non-commuting** observable, **it** will leave 'blank spots' and will be shifted into the "uncolored KS sphere" (Helena Granström, [p. 2](#)). This is a fundamental phenomenon, which has *nothing* to do with Bell's theorem.

To quote from Erwin Schrödinger (November 1950): "It seems to me that the concept of probability is terribly mishandled these days. Probability surely has as its substance a statement as to whether something is or is not the case — an uncertain statement, to be sure. But nevertheless it has meaning **only** if one is indeed convinced that the something in question quite definitely **is** or **is not** the case. A probabilistic assertion presupposes the **full reality** of its subject."

In the quantum realm, the "probability" of selecting **one** "[jacket](#)" to fill in the unitarity template of the instant 'now' from the Arrow of Space is **exactly unity**, as depicted with the [photo](#) below. This is *the only possible solution* to the non-unitary "collapse" (cf. [Steve Adler](#)), which also resolves the problem of quantum spacetime down to the [Planck scale](#).

Again, there is **no other option** to construct the correct theory of quantum gravity.



We can observe the 'is or is not' "[jacket](#)" *only* at the length scale of tables and chairs; the UNdecidable *pre-quantum* Kochen-Specker state cannot fit in any Hilbert space. It keeps the genidentity (Genidentität, [Kurt Lewin](#)) of the physical (or "colored", after KS Theorem) quantum reality: check out the 1929 paper by Sir Nevill Mott [here](#).

In the case of the "[god particle](#)", the solution proposed is [here](#).

D. Chakalov  
February 18, 2012  
Last updated: June 4, 2012  
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Subject: Re: UNdecidable pre-quantum [Kochen-Specker \(KS\) state](#) ?

Date: Tue, 15 Nov 2011 12:53:04 +0200

Message-ID:

<CAM7EkxnySyHhKRNw0jyOCqSRdasgCSzOWVDwASS5N3PXjCChPw@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Joel Ouaknine <Joel.Ouaknine@cs.ox.ac.uk>

Cc: Felix Arends <felix.arends@gmx.de>,  
Charles W Wampler <charles.w.wampler@gm.com>,

P K Aravind <paravind@wpi.edu>,  
Mladen Pavicic <mpavicic@irb.hr>,

Norman D Megill <nm@alum.mit.edu>,

Jean-Pierre Merlet <Jean-Pierre.Merlet@sophia.inria.fr>,

Brendan McKay <bdm@cs.anu.edu.au>,

Matthew F Pusey <m@physics.org>,

Jonathan Barrett <jon.barrett@rhul.ac.uk>,

Terry Rudolph <tez@imperial.ac.uk>,

John Benavides <navarro@math.unifi.it>,

Adam Helfer <adam@math.missouri.edu>,

Chris Isham <c.isham@imperial.ac.uk>

Dear Joel,

Thank you for your kind reply.

> We simply quoted the assertion from [\[11\]](#). The crux of our paper focuses on  
> computational methods for searching for Kochen-Specker vector systems, and  
> we are merely taking the formulation of the problem as given.

I cannot write down 'the quantum state' (QS) for Hilbert dimensions 3 and above.

In the simple -- and highly misleading -- case examined in Feynman Lectures on Physics III, Quantum mechanics, 12-1, the *context-dependent* QS, after 'preparation', includes a zero term in the set of so-called "basic states":

QS =>  $|1\rangle = |++\rangle$ ,  $|2\rangle = |+-\rangle$ ,  $|3\rangle = |-+\rangle$ ,  $|4\rangle = |--\rangle$ , KS = 0 .

In the case of Alice & Bob, the KS state is also zero; in the usual Hilbert space presentation, it will correspond to H dim = 0.

Briefly, the KS state can't "collapse", because the "probability" for its observation is *\*always\** zero, like the invisible cat Macavity, which *\*always\** shows up as KS state, but *\*only and exclusively only\** when no-one is looking at it,

[http://www.god-does-not-play-dice.net/#Mott\\_Macavity](http://www.god-does-not-play-dice.net/#Mott_Macavity)

As Chris Isham put it in [arXiv:quant-ph/0508225v1](http://arxiv.org/abs/quant-ph/0508225v1), Sec. 3.4, 'The question of normalisation', p. 16, "one never gets reduction to an eigenstate for which there is zero probability of finding the associated eigenvalue. Or, more precisely: such zero probability events are swept under the carpet as never happening."

The crucial difference in Hilbert dimensions 3 and above, and the crux of KS Theorem, is that we **push** the KS state to be explicated as 'observable', by writing down 'the full catalog of expectations values' after the 101 rule, and of course the KS state says -- no way José, you can never catch me in the uncolored KS sphere :-)

Best wishes,

Dimi

On Tue, 15 Nov 2011 03:57:41 +0200, Dimi Chakalov <dchakalov@gmail.com> wrote:

>

>> Dear colleagues,

>>

>> In your latest [arXiv:1111.3301v1 \[quant-ph\]](http://arxiv.org/abs/1111.3301v1), p. 2, Footnote 4, you  
>> wrote: "As pointed out in [11], such measurements 'commute', so the  
>> order in which they are performed does not matter."

>> ---

>> [11] J. H. Conway and S. Kochen. The free will theorem. Found. Phys.,  
>> 36(10):1441-1473, 2006.

>>

>>

>> Please check out

>> <http://www.god-does-not-play-dice.net/#Cecilia>

>>

>> Your critical comments and suggestions will be highly appreciated.

>>

>> Sincerely,

>>

>> Dimi Chakalov

>> <http://tinyurl.com/Einstein-Prague>

>>

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**Note:** The UNdecidable KS state, *inferred* from KS Theorem (Asher Peres, [p. 196](#)), does not suffer from any "non-commutativity" (cf. [above](#)), so if we choose two or more "incompatible frameworks", say,  $S_z = +1/2$  AND  $S_x = +1/2$  for a spin-half particle ([Robert Griffiths](#)), then the *ontic* state of 'the spin-half particle *out there*' cannot be presented with Hermitian operator: it will keep quiet, like in

the incident with the dog below.

Notice also that the KS Theorem spells out the specific notion of 'quantum contextuality': it is **not** about some fictional case in which one could distill 'the quantum state' (QS) into a full set of context-dependent physical observables, **all** of which jointly possess well-defined values at particular instant, as read by your wristwatch, and then claim that these 'observables' didn't actually have well-defined values prior to fixing the experimental context, so they should have been 'contextual'. No. Such fictional case would correspond to some 'quantum kaleidoscope' that is being shaken by the 'context', after which **all** colored pieces acquire new, and again well-defined, values at particular instant. That would be a variation on the theme 'hidden non-local contextual variables'.

In our case, the UNdecidable pre-quantum KS state cannot be decomposed into 'observables' at the length scale of tables and chairs in principle: no way José !

For more than 80 years, people have been trying to bridge Quantum Theory and General Relativity *solely* from the "colored" explications of reality -- the unique message from Kochen-Specker Theorem has been swept under the carpet (just some "complement" to Bell's theorem, according to Wiki), while in GR textbooks the differentiable structure of spacetime is introduced by 'bartenders', obscuring the corresponding 'zero term': the empty set R.

Consequently, GR bartenders [Ref. 1] face the fake problem of singularities: they "do **not** belong to the space-time which is only constituted by regular points", yet can "reach, or come from, the *edge* of space-time. This is some kind of boundary, or margin, which is **not** part of the space-time but that, **somehow**, it is accessible from within it" (José Senovilla). Even more: they keep talking about some black holes [Ref. 1], although nobody can rigorously define the notion of event horizon (not "apparent"), and called one of their artifacts "Schwarzschild black hole" -- it doesn't rotate and, most importantly, Karl Schwarzschild himself has proven in 1916 that black holes do not exist as 'physical reality' [Ref. 2].

We need a new, and much broader, form of reality (dubbed GPIs), which includes 'physical reality' as a limiting case: just shadows on Plato's cave, called here 'local (colored) mode of spacetime'.

As to the "black holes", it may be an effect of geometry: check out the so-called 'invariant finite templates', defined *only* in the global mode of spacetime. Now, these 'templates' have **dual** presentation: they define a finite chunk of space which looks 'the same' to an observer in the immediate vicinity of the template, but a *distant* observer will see it "distorted", as 'space being contracted' (CDM) or 'space being expanded' (DDE), as I tried to explain above. Suppose that such *purely geometrical* template, for some (unknown to me) reason, "shrinks" at particular location at the Milky Way galaxy -- people will imagine some anomalous "black hole", simply because they are 'distant observers', while a space traveler going into this area of "distorted" (relative to the distant observer on Earth) space template won't notice any change of *his* 'one meter' template: there are plenty of "points" -- uncountable infinity [Ref. 3] -- in such invariant finite templates to accommodate any "distortion" that can be seen by distant observes as contraction viz. expansion of space. Again, the CDM/DDE effect of gravity is of *purely geometrical* origin; it is **wrong** to search for some "non-baryonic cold dark matter", or "quintessence field" and the like for the opposite (DDE) effect. You just can fit so much anomalous matter in the universe. No way José !

To sum up, the breakdown of manifold differentiability [Ref. 3] was anticipated by Lucretius some 2060 years ago; the task to unravel the proper structure of *the* continuum is strictly mathematical.

D. Chakalov

November 21, 2011

Last updated: December 3, 2011

"Is there any other point to which you would wish to draw my attention?"

"To the curious incident of the dog in the night-time."

"The dog did nothing in the night-time."

"That was the curious incident," remarked Sherlock Holmes.

Sherlock Holmes, The Adventure of Silver Blazes, by Sir Arthur Conan Doyle.

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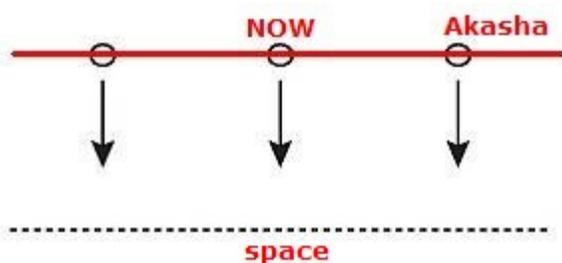
[Ref. 1] The Role of Mathematics in the Description of Gravitation

By Gerhard Huisken *et al.*,

[http://www.aei.mpg.de/english/aS/more\\_GeomAnalysis/index.html](http://www.aei.mpg.de/english/aS/more_GeomAnalysis/index.html)

"When using a [Hamiltonian formulation](#) of general relativity, where space-time is considered in a suitable (3+1)-splitting of space and time, the Einstein equations give a prescription for the evolution of a three-dimensional curved space **in time**, driven by its **own geometry** and the matter fields present in the system."

Comment: A three-dimensional space cannot "evolve" without the Unmoved Mover ([Karel Kuchar](#)). What people call "time" is just a different view taken at *one and the same* entity, called 'spacetime'. It is *one* thing, as [Hermann Minkowski](#) explained back in 1908. Any "splitting" of spacetime is "contrary to the whole spirit of relativity" ([Stephen Hawking](#)). In GR, you have only a dead frozen "[block](#)" -- there isn't any [outside-sitting observer](#) equipped with some [Akasha-like](#) global memory and a special torch 'NOW' that can highlight some canonical data at some Cauchy surface, so that she could verify that the canonical data at this instant NOW (provided the spacetime is [globally hyperbolic](#)) are different than those "before" and "after", so *something* should have indeed been "driven by its **own geometry** and the matter fields present in the system," as stated above.



As [Abby Ashtekar](#) acknowledged in [arXiv:gr-qc/0410054v2](#), p. 32, "A common criticism of the canonical quantization program pioneered by Dirac and Bergmann is that in the very first step it requires a splitting of space-time into space and time, thereby doing **grave injustice** to space-time covariance that underlies general relativity. (...) Loop quantum gravity program accepts this price... "

... and for that reason it will never solve the [Hamiltonian constraint problem](#) nor the [Hilbert space problem](#). In the context of canonical quantum gravity, these two problems are specific presentation (sort of 'translation' into the language of LQG) of the Unmoved Mover ([Karel Kuchar](#)) that has been deleted from the outset. People are actually trying to recover the Unmoved Mover from its distorted LQG presentations, but it simply ain't there. It is hidden in the [purely geometrical](#) structure of spacetime. Surely the Unmoved Mover works *only* if there are Type I physical fields dropped on this 'spacetime', yet it is a different entity altogether.

Compared this to the cases of '[time-orientability](#)' and '[positive mass conjecture](#)': people introduce them by hand because they are "obvious", but there is no way to **derive** them from the physical stuff alone, which inhabits such "space-time". If you postulate some Killing vector field out of thin air, you will be able to perform calculations and obtain results that match observational data perfectly well, simply because you employ a case-specific presentation of the [Unmoved Mover](#). Or recall the Newtonian gravity: NASA has been using it without hesitation, with perfect practical results, although everybody knows that gravity doesn't travel "instantaneously". Why no errors? Because gravity does have an instantaneous *component* (global mode of spacetime), which makes matter coupled to, or rather bootstrapped **by**, gravity '[quasi-local](#)'.

Going back to [Gerhard Huisken et al.](#): "It has proven to be very fruitful to carefully study the change of geometric data on the 3-dimensional slices **as time evolves** in order to understand the overall behaviour of the system. Similarly, when tracking **the horizon of a black hole** through space-time one is **naturally** led to the study of 2-dimensional surfaces evolving in a 4-dimensional ambient space."

Comment: Once you sort out the intricacies of those [4-dimensional ambient spaces](#), you may be naturally led to consider the interiors of the supermassive black holes, as they may be inhabited by **advanced** [Russian](#) civilizations! No joke, [Slava Dokuchaev](#) has just published his theory in [2011](#)

[Class. Quantum Grav. 28 235015](#), with *impeccable* math and beautiful drawings. In principle, one can get information from the interiors of black holes by observing their white hole counterparts. Some additional highlighting during the night time would come from those *eternally* circulating photons ([arXiv:1103.6140v4 \[gr-qc\]](#), p. 10), as you might have already guessed. Read the paper and pass it to [Slava Mukhanov](#).

[Ref. 2] Angelo Loinger, The black holes do not exist - "Also Sprach Karl Schwarzschild", [arXiv:physics/0402088v1](#)

[Ref. 3] Anastasios Mallios and Ioannis Raptis, Smooth Singularities Exposed: Chimeras of the Differential Spacetime Manifold, [arXiv:gr-qc/0411121v14](#)

"One of the main reasons for singularities and the infinities that they are associated with is that the manifold picture of spacetime allows one, even if just in theory, to pack an uncountable infinity of events into a **finite** spacetime volume.

.....

"Having learned that the world need not be Euclidean in the large, the next tenable position is that it must at least be Euclidean in the small, a manifold. The idea of infinitesimal locality presupposes that the world is a manifold. But the infinities of the manifold (the number of events per unit volume, for example) give rise to the terrible infinities of classical field theory and to the weaker but still pestilential ones of quantum field theory."

=====  
Subject: Re: Road Map to Success  
Date: Thu, 17 Nov 2011 12:02:59 +0200  
Message-ID:  
<CAM7EkxkLbDJ1i8boEnHCjBzk447sH1OHunkO0R29mtZZO7oPBg@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Suresh Srinivasamurthy <bs\_suresh1963@yahoo.com>  
Cc: Alex Ramm <ramm@math.ksu.edu>, [erast@hotmail.com](mailto:erast@hotmail.com),  
Lev Okun <okun@itep.ru>,  
[legor Reznikoff](mailto:legor.Reznikoff@yahoo.xx) <xxxx@yahoo.xx>,  
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Igor Novikov <novikov@tac.dk>,  
Dmitri Novikov <d.novikov@imperial.ac.uk>,  
Simon Kochen <kochen@math.princeton.edu>

Dear Mr. Srinivasamurthy,

> I thought of reach out and connect, with you.

A road map to success may require solving tough mathematical puzzles, such as the one known since Plato. In case you've lost my preceding email, here's the link:

<http://www.god-does-not-play-dice.net/#Joel>

Alex Ramm would probably say, 'nel'zia obniat' neobniatnogo' ([K. Prutkoff](#)) -- "a spoken thought is a lie" ([E. Tyutchev](#)). Yet I think one can solve the task with math. Good luck.

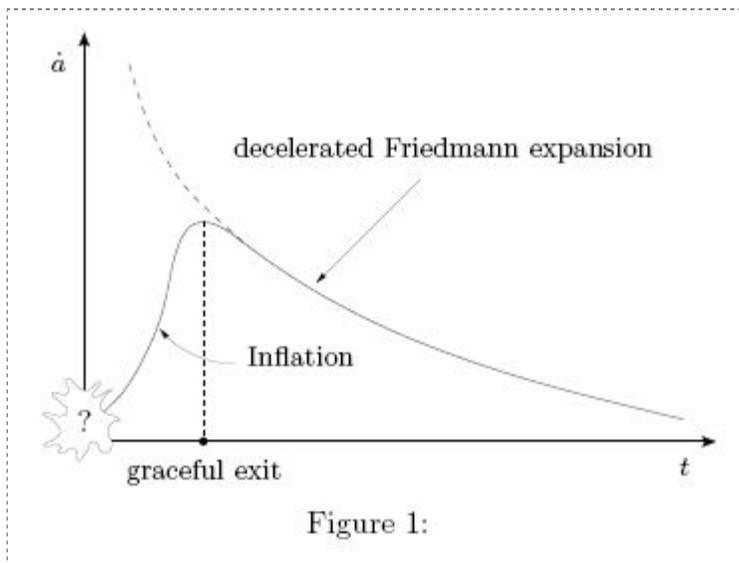
Please reply to me only. Thank you.

Regards,

Dimi Chakalov

<http://tinyurl.com/Einstein-Prague>

**Note:** If we take into account the two *modes* of spacetime and [GPIs](#), we can solve the puzzle (?) of cosmological time origin ([Slava Mukhanov](#)): in the local (physical) mode of spacetime, The Beginning cannot be reached for any **finite** duration of 'time as read by your wristwatch'. Just like the instant " $\sqrt{0}$ " from [Special Relativity](#), The Beginning does **not** belong to the local mode of spacetime, and neither is The End: these "two" -- in fact, ONE -- event(s) are hidden "inside" the fleeting instant 'now' from the [Arrow of Space](#).



The "[colored](#)" (physicalized) presentation of the universe refers to the so-called local mode of spacetime, in which the age of the universe, as well as its origin and fate, are 'UNdecidable propositions' (K. Gödel) -- there is **no direct link** between the physical or "[colored](#)" state of the universe and The Beginning. The latter shows up only in the postulated (to accommodate [GPIs](#)) global mode of spacetime, as a [finite time](#) interval of  $13.75 \pm 0.13$  billion years elapsed so far since [John 1:1]. Thus, once created by [John 1:1], the universe has been **eternal** in its *local mode* of spacetime, and there is no way, even by math, to actually **hit** The Beginning from the "[colored](#)" (physicalized) state of the universe. Hence the question mark (?) above. Yet in the global mode of spacetime the size and the age of the universe are always [finite](#), and grow from '[time zero](#)'.

People don't like the [dual age model](#), and of course make [blatant errors](#).

Notice also that there is no "curvature of space" in the global instant 'now' from the [Arrow of Space](#): it's all about properties of the *connection* ([R. Aldrovandi and J. G. Pereira](#)). The so-called tangent space from GR textbooks ("there is no natural way of identifying the tangent space at a point **p** with the tangent space at a different point **q**", Robert Wald, [p. 8](#)) and the notion of 'parallel transport along a curve' ([ibid.](#)) point to the global mode of spacetime.

To explain the latter, suppose you're in a pitch dark room. You hold a torch in your hand, but want to "see" *the darkness itself, before you observe the room with your torch*. (The 'darkness itself' stands for the 'UNdecidable pre-quantum reality' [above](#), which cannot fit into any Hilbert space whatsoever.) Obviously, your task is not feasible. With your torch, you can only observe the "[colored](#)" (after [KS Theorem](#)) presentations of 'the dark room', which are just 'shadows on Plato's cave'. To paraphrase [Fyodor Tyutchev](#), a spoken thought is a "[colored](#)" thought.

If you take snapshots from the 'dark room' with your flash camera, and arrange these "colored" snapshots along a [trajectory](#), the quantum-gravitational effects from the *connection* in the global mode of spacetime can indeed be FAPP zero, but *only* in classical physics and *only* if we imagine some 'flat spacetime'. We can never observe the global mode *directly* -- in present-day GR we can only *infer* the notion of 'geodesic' ([Alan Rendall](#)), "as a curve whose tangent is *parallel transported* along the curve, i.e., the covariant derivative of the tangent in the direction of the tangent vanishes" (Robert Wald, [p. 8](#)). The difference to these textbook hypotheses is in the treatment of '[quasi-local points](#)' from the underlying manifold: each and every "point" is a **nexus** of *already-completed atemporal* negotiations (global mode) between 'the point' and 'the rest of the universe', hence one can develop a [Machian Quantum Gravity](#) from the outset, and explain the so-called "dark energy" from the [GPIs](#) in the global mode of spacetime.

Of course, people don't like the proposal, and prefer to talk about "dark energy" like parapsychologists, without being able to specify *what stuff* is "dark", and with respect to [what](#). They also introduce [time-orientability](#) by hand, and stumble at those 96% "dark" stuff in the universe, which cannot fit in their GR textbooks.

More in Sec. Summary, pp. 35-36, in [ExplanatoryNote.pdf](#); update due [next June](#).

D. Chakalov  
November 17, 2011  
Last updated: February 26, 2012

=====  
Subject: Is general relativity 'essentially understood' ? [arXiv:gr-qc/0508016v1](#)  
Date: Sat, 26 Nov 2011 00:33:18 +0200  
Message-ID:  
<CAM7Ekxm1kpWFE46KnDBgX8XNV8E5M+W0tAJeVX\_edbvW7ioa0w@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Helmut Friedrich <hef@aei.mpg.de>, [helmut.friedrich@aei.mpg.de](mailto:helmut.friedrich@aei.mpg.de)  
Cc: Lars Andersson <laan@aei.mpg.de>, Alan Rendall <rendall@aei.mpg.de>, Jiri Bicak <Jiri.Bicak@mff.cuni.cz>

Dear Dr. Friedrich,

I noticed your name in the list of confirmed speakers at [http://ae100prg.mff.cuni.cz/ae100prg\\_2nd\\_announcement.pdf](http://ae100prg.mff.cuni.cz/ae100prg_2nd_announcement.pdf)

If possible, please send me your manuscript, on which your talk will be based, prior to the opening of the Conference in Prague. My intended talk (still waiting for opening the abstract submission next month) will heavily overlap with your paper in the subject line, particularly on three issues:

1. You wrote: "Doubts have been raised subsequently whether the notion of gravitational radiation referred to a real physical phenomenon (cf. [104]), but again the prediction has been confirmed convincingly."

I respectfully disagree with your conclusion, and will also argue on a separate issue, that LIGO and the like cannot, not even in principle, detect GWs. Will refer to Hermann Bondi (energy transport by GW is "a fundamentally nonlinear phenomenon"), Hermann Weyl ,

<http://www.jstor.org/pss/2371768>

and Jürgen Ehlers, Sec. 5 in <http://www.god-does-not-play-dice.net/Ehlers.pdf>

As you acknowledged in [arXiv:gr-qc/0508016v1](http://arXiv:gr-qc/0508016v1), the linearized field equations can "hardly be expected to provide reliable answers in situations involving strong and highly dynamical fields, it is useless for calculating radiation generated by the coalescence of black holes."

In my opinion, [LIGO scientific collaboration](http://LIGO_scientific_collaboration) doesn't have any theory whatsoever, because they cannot derive the 'weak limit' of GWs from strong GWs. Instead, they postulate that GWs can be modeled as 'propagating in flat spacetime' (Kip Thorne, [Weak GW's in Flat Spacetime](http://Weak_GW's_in_Flat_Spacetime), Caltech's Physics 237-2002), and run against Hermann Weyl's 1944 article cited above.

2. You wrote: "It may be noted that 'singularity' is defined in the singularity theorems as the existence of a causal geodesic which is non-extendible and non-complete."

I will argue that the singularity theorems were derived under assumptions (cf. Alan D. Rendall, The nature of spacetime singularities, [arXiv:gr-qc/0503112v1](http://arXiv:gr-qc/0503112v1), p. 4) which are nowadays challenged by some 2700+ papers dealing with various issues of dynamical "dark energy". I also believe that the very idea of 'singularity' is an **artifact** from unjustified mathematical presumptions, usually placed in footnotes; for example:

Lars Andersson (June 27, 2004), The global existence problem in general relativity, [arXiv:gr-qc/9911032v4](http://arXiv:gr-qc/9911032v4), Footnote 1, p. 3: "All manifolds are assumed to be Hausdorff, second countable and  $C^\infty$ , and all fields are assumed to be  $C^\infty$  unless otherwise stated."

3. And finally, you wrote: "There is, however, still a large and potentially most important part of the theory we do not have access to, neither mathematically, nor theoretically, nor observationally."

I will offer some ideas to improve the 'physical objectivity in GR', referring to Einstein's statement that the requirement for general covariance "takes away from space and time the last remnant of physical objectivity",

<http://tinyurl.com/Einstein-Prague>

Needless to say, I will be happy to send you my manuscript, at least one month prior to the opening of the Conference in Prague. Details at the link above.

Kind regards,

Dimi Chakalov

=====

Subject: Re: [arXiv:1201.3660v1](http://arXiv:1201.3660v1) [gr-qc]  
Date: Sat, 21 Jan 2012 14:54:04 +0200  
Message-ID:  
<CAM7Ekx=vPAr3cXTYhD-743pgeP\_NDaEjJbLv1ok-iaJ\_162tw@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: psj <psj@tifr.res.in>  
Cc: Ted <newman@pitt.edu>,  
Roger Penrose <rouse@maths.ox.ac.uk>,  
Laszlo Szabados <lbszab@rmki.kfki.hu>,  
Adam Helfer <helfera@missouri.edu>,  
Jörg Frauendiener <joergf@maths.otago.ac.nz>,  
George <george.ellis@uct.ac.za>

Dear Pankaj,

> Sorry if i was not clear enough, but it is  
> very difficult to write long emails on such points  
> which do involve lots of background information

> and technicality.

As a rule, the devil is in the details. Here, it is a tacit presumption which people consider "obvious". For example, in 1962 Penrose tacitly assumed that the spacetime would remain [Archimedean](#)

[http://prl.aps.org/abstract/PRL/v10/i2/p66\\_1](http://prl.aps.org/abstract/PRL/v10/i2/p66_1)

even at "future null infinity" (cf. Jonathan Thornburg below).

Just one example:

"The fuzzy idea of where and what is infinity was clarified and made more specific by the work of Penrose [45, 46] with the introduction of the conformal compactification (via the rescaling of the metric) of spacetime, whereby infinity was added as a boundary and brought into a finite spacetime region." (Ted Newman et al.)

<http://relativity.livingreviews.org/Articles/lrr-2009-6/articlese1.html#x4-10001>

- > The basic point remains the same,
- > namely event horizon is a global object, which is
- > not determined by purely local measurements.

Penrose wrote the article above in 1962. **60** years later, I think we should get serious about 'global objects in GR',

<http://www.god-does-not-play-dice.net/#Beig>

All the best,

Dimi

>>>>

>>>>> On 01/19/2012 07:59 AM, Dimi Chakalov wrote:

>>>>>>

>>>>>> Dear Pankaj,

>>>>>>

>>>>>> I provided link to your latest article at

>>>>>>

>>>>>> <http://www.god-does-not-play-dice.net/#Bengtsson>

>>>>>>

>>>>>> Please send me a reference to a \*rigorous\* formulation of 'event  
>>>>>> horizon' (not 'apparent horizon') -- "a global property of an entire  
>>>>>> spacetime and is defined nonlocally in time: The event horizon in a  
>>>>>> slice is defined in terms of (and cannot be computed without knowing)  
>>>>>> the full future development of that slice," according to Jonathan  
>>>>>> Thornburg (Event and Apparent Horizon Finders for 3 + 1 Numerical  
>>>>>> Relativity, [lrr-2007-3](#)).

>>>>>>

>>>>>> All the best,

>>>>>>

>>>>>> Dimi

>

**Note:** In a previous email, Pankaj Joshi suggested to look at '[Global aspects in gravitation and cosmology](#)'. I quoted from p. 194, after which he responded as follows:

>>

- >> Fig. 44 and p. 194 ("an achronal surface generated by null geodesics
- >> which could have past end points in M but have no future end points")
- >> are very unclear to me, just as any 'global property of an entire
- >> spacetime' (Jonathan Thornburg).
- >>
- >
- > An achronal surface is one no two points of which are
- > timelike connected. This is always foliated by null geodesics.
- > These can go up to infinity in future.

Nothing, achronal surfaces included, can be extended to "infinity in future". If you start from the local mode of spacetime, you [cannot enter the global mode](#). No way.

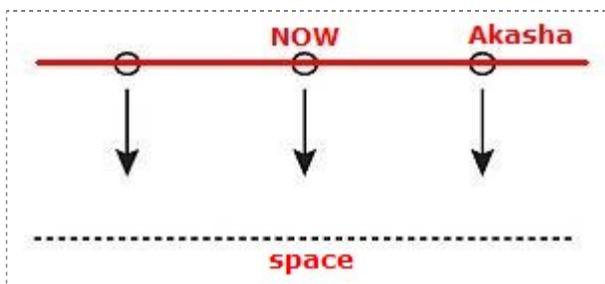
I hope the status of [Finite Infinity](#) will be resolved by 2022, sixty years after Roger Penrose wrote the manuscript of the article cited above. As of today, nobody cares.

**Nobody.**

D.C.

January 21, 2012

=====



Subject: Re: [arXiv:1201.3765v2 \[gr-qc\]](#)  
 Date: Sat, 21 Jan 2012 15:53:37 +0200  
 From: Dimi Chakalov <dchakalov@gmail.com>  
 To: Diego Marin <dmarin.math@gmail.com>  
 Cc: [Michal Chodorowski](#) <michal@camk.edu.pl>

- > With "expansion" I mean the growth of the 3D-metric, that is the 4D-metric projected
- > over a Cauchy surface. It's this for every physicist :-)

It's self-referential parapsychology, because in [current GR](#) 'the 4D-metric projected over a Cauchy surface' can only be defined \*with respect to itself\*. [Capiche?](#)

Regards,

Dimi

- >
- > -----Messaggio originale-----
- > Da: Dimi Chakalov [mailto:dchakalov@gmail.com]
- > Inviato: sabato 21 gennaio 2012 14.13
- > A: Diego Marin
- > Oggetto: Re: arXiv:1201.3765v2 [gr-qc]
- >

> Hi Diego,  
>  
>> It's almost obvious that for  $G < 0$  exists a cosmological solution whose  
>> scale factor has a positive second derivative.  
>  
> First and foremost: Isn't it obvious that you cannot define 'expansion  
> of space' w.r.t. itself?  
>  
> <http://www.god-does-not-play-dice.net/#Heraclitus>  
>  
> E sarà mia colpa se così è?  
>  
> Regards,  
>  
> Dimi  
>

=====  
Subject: The identification of points, [arXiv:1112.5318v1 \[gr-qc\]](http://arxiv.org/abs/1112.5318v1)  
Date: Fri, 23 Dec 2011 04:30:47 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Ingemar Bengtsson <ibeng@fysik.su.se>  
Cc: josemm.senovilla@ehu.es, eli.waxman@weizmann.ac.il,  
jthorn@astro.indiana.edu, demetri@math.ethz.ch,  
mcohen@caltech.edu, tonyc@caltech.edu, scheel@tapir.caltech.edu,  
Saul Teukolsky <saul@astro.cornell.edu>

Dear Dr. Bengtsson,

It seems that you've taken the 'identification of points' as something obvious and trivial in [GR](#), and have put aside the complications that can arise from quantum theory, in the case of quantum spacetime,

<http://tinyurl.com/Einstein-Prague>

Anyway, could you please send me a reference to a rigorous formulation of '[event horizon](#)' (not 'apparent horizon') in FRW Cosmology? I extend this request to all your colleagues who are smart enough to understand (I can't) 'The Very End of Space and Time',

<http://www.black-holes.org/gwa2-3.html>

Kind regards,

Dimi Chakalov  
-----

**Note:** The [Cosmic Censorship Conjecture](#) stipulates that "black holes" may be lurking behind some "[event horizons](#)" that are "[causally connected to future null infinity](#)," and if we add Hawking radiation, "the hole could evaporate into [nothingness](#)." Read my mind.

As I mentioned [previously](#), I was able to "understand" the Jabberwocky of "[black holes](#)" only once, in my freshman year in June 1972, and it [didn't last long](#) (MTW, [p. 467](#)).

In fact, the very hypothesis for '[geodesics](#)' involves a perplexing paradox: if you imagine that gravity can indeed be eliminated 'at *any* point', and also believe that GR is a *bona fide* classical theory, then by summation of 'zero effects of gravity' at all points from the geodesic, it will disappear into Minkowski spacetime: "Locally all physics is as it is in Minkowski space. Gravity is in the way these local Minkowski spaces are connected. (...) Through this connection the metric  $g_{ab}$  becomes the glue

that connects the local Minkowski spaces" (Olaf Dreyer, arXiv:1203.2641v1 [gr-qc], [p. 3](#)).

Which means that the proper GR should be some quasi-classical theory in the first place. As an analogy, nobody would claim that the "trajectory" of a quantum particle in [Wilson cloud chambers](#) is comprised from its "collapsed" states. Obviously (to me), the puzzle of quasi-classical GR is in its [affine structure](#) [[Ref. 1](#)] introduced by hand, to help us imagine parallel-transported vectors from one spacetime "point" to another. It is independent of the metric structure. It is a whole different entity.

Which brought me to [Fl 2nd Ed](#), some forty years after I had the impression that can "understand" GR. Sorry, nobody *understands* GR, especially the *purely* affine connection [[Ref. 1](#), p. 112] and the "open sets" of the underlying manifold [[Ref. 2](#)].

D.C.

December 23, 2011

Last updated: March 14, 2012

[Ref. 1] Erwin Schrödinger, *Space-Time Structure*, Cambridge University Press, [1950](#).

p. 2:

**The geometric structure of the space-time model envisaged in the 1915 theory is embodied in the following two principles:**

**(i) equivalence of all four-dimensional systems of coordinates obtained from any one of them by arbitrary (point-) transformation;**

**(ii) the continuum has a metrical connexion impressed on it: that is, at every point a certain quadratic form of the coordinate-differentials,**

$$g_{ik} dx_i dx_k,$$

**called the 'square of the interval' between the two points in question, has a fundamental meaning, invariant in the aforesaid transformations.**

**These two principles are of very different standing. The first, the principle of general invariance, incarnates the idea of General Relativity. I will not commit myself to calling it unshakable.**

p. 9:

The most important number in mathematics is the zero. Our present sign for it as well as the word zero comes from the Arabs. (It is, by the way etymologically the same as English cipher, French *chiffre*, German *Ziffer*, which have, however, acquired a different meaning.) But the notion is older, it turns up in Babylonian Mathematics soon after 1000 B.C.† and may have been received from India. Let me dwell for a moment on the importance of this concept. A great many of our propositions and statements in mathematics take the form of an equation. The essential enunciation of an equation is always this: that a certain number is zero. Zero is the only number with a charter, a sort of royal privilege.

† V. Gordon Childe, *Man Makes Himself* (London: Watts and Co., 1936), pp. 222 and 255.

[Ref. 2] James Dungundji, *Topology*, McGraw-Hill, 1988, [p. 63](#).

Elements of topological spaces are called *points*. The members of  $\mathcal{F}$  are called the “open sets” of the topological space  $(X, \mathcal{F})$  (or of the topology  $\mathcal{F}$ ). There is no preconceived idea of what “open” means, other than that the sets called “open” in any discussion satisfy the axioms 1.1 (1–3). Observe that since the union (resp. intersection) of an empty family of sets in  $X$  is  $\emptyset$  (resp.  $X$ ), Axiom (3) of 1.1 is actually redundant.

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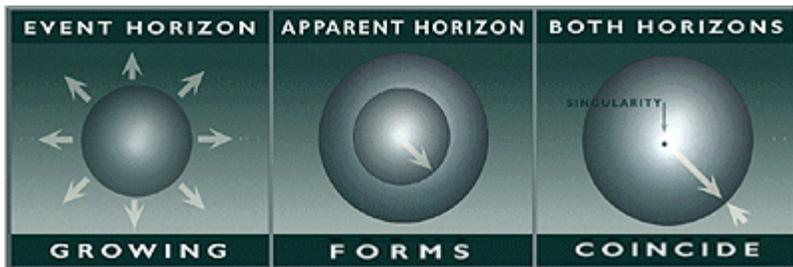
**Comment:** I believe there is a preconceived idea of what “open” means. The “open sets” refer to ‘the *unknown unknown*’ in the [phenomenon of time](#), which in turn leads to the [creative, non-unitary evolution](#) of ‘the universe as ONE’. Due to the theorems of [Kurt Gödel](#), “any axiomatization A of arithmetic, if it is consistent, then it is **incomplete**, in the sense of there being truths (theorems) expressible in A but not provable within A. An existential proof of the result is that the set of theorems in A has the cardinality of the continuum, i.e., it is **uncountably** large, whilst the number of proofs is only countably infinite” (S. Aravinda and R. Srikanth, [p. 5](#)). Thus, the world is “open” in time, up to ‘the *unknown unknown*’, due to the [phenomenon of time](#).

“Whether you believe you can do a thing or believe you can't, you are right”, said Henry Ford. Analyze that “open” future, please!

D. Chakalov  
December 5, 2012

=====

G. W. Gibbons deeply believes in the picture below. I don't, for reasons explained by Pankaj Joshi and Daniele Malafarina, [arXiv:1201.3660v1 \[gr-qc\]](#).



Just read a recent announcement from the [Institute of Physics](#): "Inside the box, gas and dark matter, a form of matter that interacts through gravity alone, were represented by 65.5 billion particles. (...) As a result, each gas "particle" had the mass of 57 million Suns, while dark matter weighed in at **280** million solar masses per particle."

All you need is people like G. W. Gibbons and "a [humongous](#) computer simulation". To help then pinpoint the "dark matter" which "interacts through gravity alone", look in Slava Mukhanov's 'Physical Foundations of Cosmology,' 2005, [p. 203](#):

In the minimal supersymmetric extension of the Standard Model, "for every gauge particle we have a fermionic superpartner with spin 1/2, called a gaugino. Among these, gluinos are superpartners of gluons, and winos and the bino are the superpartners of the gauge bosons of the electroweak group. The gauginos mediate the interaction of the scalar particles and their fermionic partners, with a strength determined by the gauge coupling constant. The [Higgs particle is accompanied by a higgsino](#). The lightest neutral combination of -inos (mass eigenstate), called the neutralino, must be stable; if supersymmetry were broken at the electroweak scale, it would interact weakly with ordinary matter.

"Therefore, the neutralino (**280** million solar masses? D.C.) is an **ideal candidate** for cold dark matter. To conclude our brief excursion to the "s- and -ino zoo," we should mention the gravitino -- the spin 3/2 superpartner of the graviton which could also serve as a dark matter particle (**280** million solar masses? D.C.). Thus we see that supersymmetric theories provide us with the weakly interacting massive particles necessary to explain dark matter in the universe."

If [Jon Stewart](#) had said all this, it would have been hilarious. But he isn't good in math.

D.C.

January 20, 2012

-----

Subject: Re: [What is \\*event\\* horizon ?](#)

Date: Thu, 12 Jan 2012 13:33:15 +0200

Message-ID:

<CAM7Ekx=mFC6VXz2tK+qJooEF1kUWHZTqyg4LGj3np8P7KefQ\_Q@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: G.W.Gibbons@damtp.cam.ac.uk

Cc: Steven Giddings <giddings@physics.ucsb.edu> ,

Jonathan Thornburg <jthorn@astro.indiana.edu>

Dear Dr. Gibbons,

Thank you for your reply from 12 Jan 2012 07:04:36 +0000.

- > Standard definitions are provided in the well known textbooks of Hawking and
- > Ellis, Wald etc etc and are extensively discussed in the contemporary
- > literature. Misner Thorne and Wheeler is still an excellent introduction to
- > General Relativity and the books by Hartle and by Carroll are also excellent.

The standard definitions of \*event\* horizon postulate it as "a global property of an entire spacetime

and is defined nonlocally in time: The event horizon in a slice is defined in terms of (and cannot be computed without knowing) the full future development of that slice," according to Jonathan Thornburg (Event and Apparent Horizon Finders for 3 + 1 Numerical Relativity, [lrr-2007-3](#)).

Which textbook cited above resolves this problem?

Notice that calculations using the 3+1 ADM formalism, as in [lrr-2007-3](#), cannot be relevant to the brand new (to ADM) case of "expanding" space driven by some "dark" energy.

I will appreciate the opinions of Drs Giddings and Thornburg as well.

> Glancing at your Web site I would strongly recommend that you  
> carefully study at least a few of these, since you appear not to be aware of  
> the enormous amount of work on the subject in recent years.

I hope to understand what you meant by "few of these" in your professional opinion on the issues raised above.

Sincerely,

Dimi Chakalov

On Thu, 12 Jan 2012 04:06:08 +0200, Dimi Chakalov <dchakalov@gmail.com> wrote:

>  
>> Dear Dr. Gibbons,  
>>  
>> I glanced at your latest [arXiv:1201.2340v1 \[gr-qc\]](#), and was struck by  
>> your statement: "By "horizon" I shall mean "apparent horizon" ...".  
>>  
>> If possible, please let me know if you are aware of any sensible  
>> definition of '[event horizon](#)' in GR, given the problems with locality.  
>>  
>> I extend this request to Dr. Giddings as well, since I couldn't find  
>> any hint to a proper '[event horizon](#)' in his latest [arXiv:1201.1037v1](#)  
>> [hep-th].  
>>  
>> The reason for my request is my tentative (awaiting approval) talk at  
>> the Einstein Conference in Prague,  
>>  
>> <http://tinyurl.com/Einstein-Prague>  
>>  
>> Kind regards,  
>>  
>> Dimi Chakalov  
>>  
>

-----

**Note:** G. W. Gibbons didn't even *sign* his email (original [here](#)). Perhaps he will choose to keep quiet, like [Carsten Gundlach](#). Or maybe he will reply, but in a manner similar to Prof. [Gerard 't Hooft](#), that is, "transparently even to babies": "R\_abcd (x) = 0 FOR ALL VALUES OF ITS 4 INDICES, AT ALL POINTS x in this region of space-time." How is "this region of space-time" made separable from the rest of "regions" from the same spacetime is a bit of a mystery to the "babies".

Look at *Introduction to General Relativity*, by [Gerard 't Hooft](#), 15 November 2010, [pp. 25-26](#) (emphasis added):

An important theorem is that the Riemann tensor *completely* specifies the extent to which space or space-time is curved, if this space-time is simply connected. We shall not give a mathematically rigorous proof of this, but an acceptable argument can be found as follows. Assume that  $R^\nu_{\kappa\lambda\alpha} = 0$  everywhere. Consider then a point  $x$  and a coordinate frame such that  $\Gamma^\nu_{\kappa\lambda}(x) = 0$ . We assume our manifold to be  $C_\infty$  at the point  $x$ . Then consider a Taylor expansion of  $\Gamma$  around  $x$ :

$$\Gamma^\nu_{\kappa\lambda}(x') = \Gamma^{[1]\nu}_{\kappa\lambda,\alpha}(x' - x)^\alpha + \frac{1}{2}\Gamma^{[2]\nu}_{\kappa\lambda,\alpha\beta}(x' - x)^\alpha(x' - x)^\beta \dots, \quad (5.33)$$

From the fact that (5.27) vanishes we deduce that  $\Gamma^{[1]\nu}_{\kappa\lambda,\alpha}$  is symmetric:

$$\Gamma^{[1]\nu}_{\kappa\lambda,\alpha} = \Gamma^{[1]\nu}_{\kappa\alpha,\lambda}, \quad (5.34)$$

and furthermore, from the symmetry (5.6) we have

$$\Gamma^{[1]\nu}_{\kappa\lambda,\alpha} = \Gamma^{[1]\nu}_{\lambda\kappa,\alpha}, \quad (5.35)$$

so that there is complete symmetry in the lower indices. From this we derive that

$$\Gamma^\nu_{\kappa\lambda} = \partial_\lambda \partial_k Y^\nu + \mathcal{O}(x' - x)^2, \quad (5.36)$$

with

$$Y^\nu = \frac{1}{6}\Gamma^{[1]\nu}_{\kappa\lambda,\alpha}(x' - x)^\alpha(x' - x)^\lambda(x' - x)^\kappa. \quad (5.37)$$

If now we turn to the coordinates  $u^\mu = x^\mu + Y^\mu$  then, according to the transformation rule (5.5),  $\Gamma$  vanishes in these coordinates up to terms of order  $(x' - x)^2$ . So, here, the coefficients  $\Gamma^{[1]}$  vanish.

The argument can now be repeated to prove that, in (5.33), all coefficients  $\Gamma^{[i]}$  can be made to vanish by choosing suitable coordinates. Unless our space-time were extremely singular at the point  $x$ , one finds a domain this way around  $x$  where, given suitable coordinates,  $\Gamma$  vanish completely. All domains treated this way can be glued together, and only if there is an obstruction because our space-time isn't simply-connected, this leads to coordinates where the  $\Gamma$  vanish everywhere.

Thus we see that if the Riemann curvature vanishes a coordinate frame can be constructed in terms of which all geodesics are straight lines and all covariant derivatives are ordinary derivatives. This is a flat space.

Do you agree with Prof. G. 't Hooft ? What will happen to the [Ricci tensor](#) at the *instant* at which the Riemann curvature tensor has totally vanished ? What could **resurrect** the Riemann tensor from the dead flat space in those "glued" domains in which "**all** coefficients [XX] can be made to vanish by choosing suitable coordinates" ? [Angels](#) ?

"Since the microwave background radiation (as well as [the "dark" energy](#) - D.C.) is everywhere and always, there can be nowhere where the Ricci tensor vanishes and therefore nowhere where the Riemann curvature tensor vanishes in a realistic physical model" (Maurice J. Dupre, private communication).

In my theory, I can be *plus catholique que le Pape*, by eliminating **all** traces from what is believed to be "curvature at a **point**" -- I don't use "curvature" as manifestation of gravity, but an *entirely different* object (cf. [John's jackets](#)). Once it casts its (quasi-local) "jacket", it **must** vanish completely at a **point**, because it is *the* gravitational, [Macavity-like](#), version of the [non-colorizable pre-quantum Kochen-Specker state](#). And I have no problems with 'the right answer to a wrong question' (MTW, [p. 467](#)) either. But this is Machian quantum gravity, and Prof. G. 't Hooft doesn't like it.

Anyway. Let's go back to the "event horizon".

The whole idea about "event horizon" is incredibly murky: "a global property of an entire spacetime" which is "defined nonlocally in time" (Jonathan Thornburg). We don't have such luxury in GR textbooks. As Matt Visser explained ([arXiv:gr-qc/0204022v2](http://arxiv.org/abs/gr-qc/0204022v2), p. 3, emphasis added):

"Unfortunately, in general relativity one cannot simply assert that chronology is preserved, and causality respected, without doing considerable additional work. The essence of the problem lies in the fact that the Einstein equations of general relativity are local equations, relating some aspects of the spacetime curvature at a point to the presence of stress-energy at that point. What general relativity does **not** do is to provide any natural way of imposing **global** constraints on the spacetime — certainly the Einstein equations provide no such nonlocal constraint."

I think the phrase "at a point" is a big can of worms, because **any** observable of the gravitational field is "*necessarily* quasi-local" ([Laszlo Szabados](http://arxiv.org/abs/gr-qc/0204022v2)). Moreover, you can't have '[stationary spacetime](http://arxiv.org/abs/gr-qc/0204022v2)' (needed to match an "apparent horizon" to an "event horizon") in a universe dominated by "dark" energy.

I think we could have *quasi-local and non-linear*, due to [gravity](http://arxiv.org/abs/gr-qc/0204022v2), interactions, with [plenty of "dark" energy](http://arxiv.org/abs/gr-qc/0204022v2), only and exclusively only in the case explained [here](http://arxiv.org/abs/gr-qc/0204022v2). The crucial object, otherwise known as 'particles of the reference fluid' [[Ref. 1](http://arxiv.org/abs/gr-qc/0204022v2)], is Einstein's "total field of as [yet unknown structure](http://arxiv.org/abs/gr-qc/0204022v2)". We just can't paint a picture without a [colorless canvas](http://arxiv.org/abs/gr-qc/0204022v2) that defines all "[colored](http://arxiv.org/abs/gr-qc/0204022v2)" stuff "everywhere and for all time" ([Ciufolini and Wheeler, p. 270](http://arxiv.org/abs/gr-qc/0204022v2)) dynamically -- one-at-a-time, along the [Arrow of Space](http://arxiv.org/abs/gr-qc/0204022v2).

Of course, most people disagree with the dynamical '[quantum spacetime](http://arxiv.org/abs/gr-qc/0204022v2)' (sometimes in a pretty [colorful fashion](http://arxiv.org/abs/gr-qc/0204022v2)), so I ask them to show some 'global constraint' (Matt Visser) or anything -- you name it -- responsible for the ubiquitous [free fall](http://arxiv.org/abs/gr-qc/0204022v2), and to suggest some object *with respect to which* we can define the ubiquitous '[expansion of space](http://arxiv.org/abs/gr-qc/0204022v2)', or at least [the preferred reference frame](http://arxiv.org/abs/gr-qc/0204022v2) in which people make "trivial" statements like ...

**The total duration of inflation in this model is about  $10^{-30}$  seconds.**

... but, strangely enough, they just don't reply.

*Der Geist bewegt die Materie... oder was ?*

D.C.

January 13, 2012

Last updated: January 15, 2012, [22:48:48 GMT](http://www.god-does-not-play-dice.net/2012/01/15/22:48:48-GMT)

<http://www.god-does-not-play-dice.net/2012/01/15/22:48:48-GMT>

<http://www.scribd.com/doc/78376220/Der-Geist-Bewegt-Die-Materie>

[Ref. 1] "The particles of the reference fluid identify the points of space, and clocks carried by these particles identify the instants of time." J.D. Brown and K.V. Kuchar, [arXiv:gr-qc/9409001](http://arxiv.org/abs/gr-qc/9409001)

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Subject: Re: Is there 3-D space in classical GR?

Date: Tue, 17 Jan 2012 05:49:03 +0200

Message-ID:

<CAM7EkxkJn-N5nGhUCP7-R\_Q\_V9=PMQ7FXyOn=4-A+9uDZpRApw@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Ulrich H Gerlach <gerlach@math.ohio-state.edu>

Cc: cpsoo@mail.ncku.edu.tw,

hlyu@phys.sinica.edu.tw

Dear Dr. Gerlach,

It is difficult to me to overestimate the importance of your research on the quantum mechanical carrier of the imprints of gravitation, [arXiv:gr-qc/9911019v1](http://arxiv.org/abs/gr-qc/9911019v1).

I agree that "a quantum mechanical comprehension of gravitation must start with a purely quantum mechanical carrier of its imprints", but my proposal about 'purely quantum' is quite different,

<http://www.god-does-not-play-dice.net/#thesis>

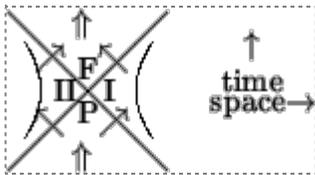
<http://www.god-does-not-play-dice.net/#Gibbons>

[http://www.god-does-not-play-dice.net/Der\\_Geist\\_bewegt\\_die\\_Materie.pdf](http://www.god-does-not-play-dice.net/Der_Geist_bewegt_die_Materie.pdf)

Regarding my email sent almost nine years ago (cf. below): I think GR cannot explain 3-D space and its ubiquitous Eotvos property,

<http://www.god-does-not-play-dice.net/#WHY>

As to the two Rindler frames, which "(i) are accelerating eternally and (ii) are causally disjoint", I don't suggest some "half-silvered mirrors"



but a modification of Ellis' Finite Infinity, and place the **four** Rindler sectors I, II, P and F, along a hypothetical "direction" denoted with '**w**' (from 'wunderbar', after Theodor Kaluza),

<http://www.god-does-not-play-dice.net/#Beig>

Should you or your colleagues are interested, please write me back. Anything you are not able to understand will be entirely my fault.

Best regards,

Dimi Chakalov

-----  
Subject: Is there 3-D space in classical GR?  
Date: Sun, 13 Jul 2003 17:38:33 +0300  
From: Dimi Chakalov <dchakalov@surfeu.at>  
To: Ulrich Gerlach <gerlach@math.ohio-state.edu>

Dear Dr. Gerlach,

It is a great pleasure to read your papers.  
[snip]

-----  
**Note:** Regarding my email to Ulrich Gerlach from Sun, 13 Jul 2003 17:38:33 +0300, notice that GR does not explain the feature of space which we describe as "to look around, and see as far as we like" ([L. Smolin](#); details from [M. Bojowald](#)). Ditto to '[time-orientability](#)'. Properly speaking, "GR does not admit a description as a system evolving in terms of an observable time variable" (Carlo Rovelli, [gr-qc/0604045v2](#), p. 4).

Regarding the last link above, I used the [German translation](#) of the famous dictum by Virgil (*Mens agitat molem, The Aeneid VI 727*) to stress that [Eq. 2](#) from FI (2nd Ed) resembles what John von Neumann denoted with 'Process II', while [Eq. 1](#) refers to a [perpetual](#), along the Arrow of Space, 'Process I' which can *only* be performed by God.

Yes, I know people hate [John 1:1] and will keep [quiet](#). How about [dual age cosmology](#) ?

Things to remember: The "[most irrational number](#)" is the one with the most slowly converging

continued fraction expansion. This is the number corresponding to the continued fraction  $1 + 1/(1 + 1/(1 + \dots))$ , which is none other than the [golden ratio](#).

The [greatest common divisor](#) of any two [Fibonacci numbers](#) is also a Fibonacci number; applications and explanation [here](#) and [here](#).

The global mode of spacetime is an [infinitely-connected space](#) which facilitates the local (physical) mode with an "instantaneous", [already-completed web](#) of [correlations](#). It cannot be modeled with [non-linear differential equations](#); hence a new *retarded* (due to the [Arrow of Space](#)) form of causality (dubbed 'biocausality'), defined in [the reference fluid of GR](#).



To sum up, the global mode of spacetime, populated by [GPIs](#), is postulated as a **dual** object, in the sense that its *physical* presentation is both a dimensionless geometrical "point" (**S**) and 'the infinite space' (**L**). It wraps the physical, 3-D space in [all directions](#).

Any effort to catch the "god particle" from the local (physical) mode is [doomed to fail](#). Also, any GW detector which does **not** have access to the global mode of spacetime is [worthless](#).

D.C.

January 18, 2012

Last updated: January 29, 2012

Many people would rather die than think. In fact, they do.  
Bertrand Russell

=====  
Subject: The Computing Spacetime, [arXiv:1201.3398v1 \[gr-qc\]](#), ref. [6]  
Date: Wed, 18 Jan 2012 03:45:55 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Fotini <fotinimk@gmail.com>, Fotini <fotini@perimeterinstitute.ca>  
Cc: Seth Lloyd <slloyd@mit.edu>

Kalimera Fotini,

I think Seth Lloyd is right about the [non-linear and self-acting dynamics](#) of such "computing spacetime": the universe computes "its own dynamical evolution; as the computation proceeds, reality unfolds," ref. [6] in [arXiv:1201.3398v1 \[gr-qc\]](#).

Trouble is, only Baron Munchausen can perform such self-referential and self-acting self-computations, in 'present continuous', as they unfold. Any Turing machine will halt. Just imagine you singing with a mike, and a loudspeaker beaming your song right on your mike, to help you improve your singing performance **\*before\*** you sing any note from your song. Can you put this setup into a system of non-linear diff equations?

If you can't, look at

<http://tinyurl.com/Einstein-Prague>

All the best,

Dimi

=====

Subject: Johan Hansson, Anna Ponga, Pulsars: Cosmic Permanent 'Neutromagnets'?

[arXiv:1111.3434v1 \[astro-ph.HE\]](https://arxiv.org/abs/1111.3434v1)

Date: Fri, 16 Dec 2011 00:23:06 +0200

From: Dimi Chakalov <dchakalov@gmail.com>

To: Johan Hansson <c.johan.hansson@ltu.se>

Cc: Brian P Dolan <bdolan@thphys.nuim.ie> ,

Hamish Johnston <hamish.johnston@iop.org> ,

Alex Potekhin <palex@astro.ioffe.ru> ,

Sachiko Tsuruta <uphst@gemini.msu.montana.edu> ,

Bernard Schutz <Bernard.Schutz@aei.mpg.de>

Dear Dr. Hansson,

Congratulations to you and Ms Anna Ponga for your outstanding article,

<http://physicsworld.com/cws/article/news/48096>

<http://www.technologyreview.com/blog/arxiv/27355/>

May I ask a question. If neutromagnets have fields as high as  $10^{12}$  Tesla, can you suggest some trivial mechanism for losing kinetic energy, with the same dynamics as the binary system PSR1913+16, but not involving "GW emission" ?

As you may have known, Russell Hulse and Joseph Taylor were very lucky to discover the binary system PSR1913+16, in which one of the stars was a pulsar with period of orbit just eight hours -- extremely small by astrophysical standards -- hence they regarded it as a clock, and speculated further that the change in the period corresponded to the rate by which the binary system were losing energy. Then Hulse and Taylor decided to explain the inferred loss of energy with "GW emission".

Namely, they applied the old Tanzanian saying: "How do we know that Father Christmas has a beard? We know it, because snow falls when he shakes his beard." But again, the rate of the "snowfall" was the only evidence in support of their wild guess.

PSR1913+16 was the first binary pulsar, discovered in 1974. As Brian Dolan explains, "a pulsar is a rotating dipole and rotating dipoles emit electromagnetic radiation, thus losing energy. This is not actually the source of the (EM) radiation that is directly observed. The electromagnetic pulses seen from a pulsar are due to radiation from beams of charged particles emitted along the axis of the dipole and sweeping past the Earth like a lighthouse beam." (Brian P. Dolan, Lecture Notes MP476: Cosmology, Sec. 2.14.3 Pulsars, September 21, 2010, p. 41).

By analyzing the changing Doppler shifts of PSR1913+16 (redshifted and blueshifted pulse periods), R. Hulse and J. Taylor inferred that PSR1913+16 should consist of two neutron stars, separated by distance roughly the radius of the Sun. Also, "the period first grew longer and then grew shorter in a cycle that took 7.75 hours" (Michael Seeds and Dana Backman, Horizons: Exploring the Universe, 11th Ed., Brooks Cole, 2009, p. 217).

I think [LIGO "scientific" collaboration](#) should explain how could "the period first grew longer and then grew shorter", and then eliminate all trivial explanations of the inferred loss of kinetic energy (e.g., Sachiko Tsuruta et al., Cooling of pulsars, Astrophysical Journal, 176 (1972) 739-744; Alex Y. Potekhin et al., The magnetic structure of neutron stars and their surface-to-core temperature relation, Astronomy & Astrophysics, 443 (2005) 1025-1028).

Perhaps you can suggest some mundane explanation of the loss of kinetic energy of PSR1913+16.

The opinion of your colleagues will be greatly appreciated, too.

Yours sincerely,

Dimi Chakalov

<http://tinyurl.com/Einstein-Prague>

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"By 2020 **at least 3-4 billion dollars** will have been invested by a dozen national and international scientific organizations in building gravitational wave detectors on the ground and in space. Most of this money has already been committed, at least in a planning sense, and this has all happened even **before** the first direct detection of a gravitational wave! Where has today's **immense faith** in general relativity come from?"

Bernard Schutz, arXiv:1203.3090v1 [physics.hist-ph], [p. 4](#)

**Comment:** There are two alternative interpretations of this fabulous quote.

1. [Prof. Dr. Bernard F. Schutz](#), the Director of the Astrophysical Relativity Department of the AEI Potsdam and the Principal Investigator responsible for data analysis for the GEO600 collaboration (part of the LIGO "scientific" collaboration), has no clue whatsoever about [the inherent problems of GW "astronomy"](#). He's a total dilettante, and is **not** aware of the fact that he and his LIGO colleagues do **not** have any theory whatsoever about detecting GWs with [LIGO](#), [GEO600](#), VIRGO, etc. Subsequently, he has **UNintentionally** misled NSF and [NASA](#), and therefore should **not** be kept responsible for wasting hundreds of million USD and Euro -- all taxpayers' money -- after the ultimate failure of the "advanced" LIGO and Virgo in [2014](#). Can't blame him, the guy knew nothing about GR.

2. [Prof. Dr. Bernard F. Schutz](#) is fully aware of the fact that he and his LIGO colleagues have neglected [the only available theory of GWs](#) developed in the 1960s. In fact, he was agonizingly clear about the unsolved problems with the "linearized approximation" of GR for detecting GWs **ten year ago**, on [August 2, 2002](#). Yet he prefers to keep quiet and has prepared a 'Plan B' for the ultimate failure of the "advanced" LIGO and Virgo in [2014](#):

"It is worth reminding ourselves why and where GR might fail. (...) *Any such failure of GR should point the way to new physics.*" ([B. F. Schutz et al.](#), [arXiv:0903.0100v1 \[gr-qc\]](#))

In other words, it's all about the cash flow for GW "astronomy". Bernie Schutz doesn't want to acknowledge that he and his LIGO colleagues do **not** have any theory whatsoever about detecting GWs (cf. the two **if-s** below), because the funding will stop, and they will have to start from scratch, that is, from [the only available theory of GWs](#) developed in the 1960s.

It's all about **money**. Not Bernie Schutz' money, but the money earned with hard labor by millions of people. He acts like a little girl who points to some doll and says, 'I want *this* Barbie!' But he is smart, and has prepared the 'Plan B': put **all the blame** on GR.

Only Bernie Schutz and his LIGO colleagues do **not** have any theory whatsoever -- check out the two **if-s** below. Their wishful thinking is based on a **non-existing** theory, which has nothing to do with GR. In fact, it is impossible to derive some "weak limit" from strong GWs with the existing GR. Bernie Schutz is fully aware of this problem, but prefers to keep quiet. He is indeed an expert in GR, but is **addicted** to the money from [NSF](#) (Beverly K. Berger <[bberger@nsf.gov](mailto:bberger@nsf.gov)>, Program Director for LIGO Project, National Science Foundation, 4201 Wilson Blvd., Arlington, VA 22230, Telephone: (703) 292-7373; Pedro Marronetti <[pmarrone@nsf.gov](mailto:pmarrone@nsf.gov)>, LIGO Research Support Program, (703) 292-7372).

As [Johann Makowsky](#) put it (*The Jerusalem Post*, 19 April 1985):

"Overfunded research is like heroin: It makes one addicted, weakens the mind and furthers prostitution."

Let me repeat it again: If I am banned from talking at the Einstein Conference in [Prague](#) this year, I will have no choice but to take the appropriate actions **against the cover up** of the **enormous**

waste of taxpayers' money by LIGO "scientific" collaboration.

I will not tolerate any **communist censorship** on behalf of the [Scientific Organizing Committee](#) of the Einstein Conference in [Prague](#): Bernard Schutz has been **invited** (Sic!) to talk about "observing the Universe with gravitational waves", while I still have no confirmation that my talk (abstract submitted in December last year) will be approved.

Those who **support** and **contribute** to the **cover up** of the **enormous waste** of taxpayers' money by LIGO "scientific" collaboration, by rejecting my talk at the Einstein Conference in [Prague](#), will be duly exposed. The scandal with NASA and NSF will be just **enormous**: [the only available theory of GWS](#) has been **deliberately** ignored !

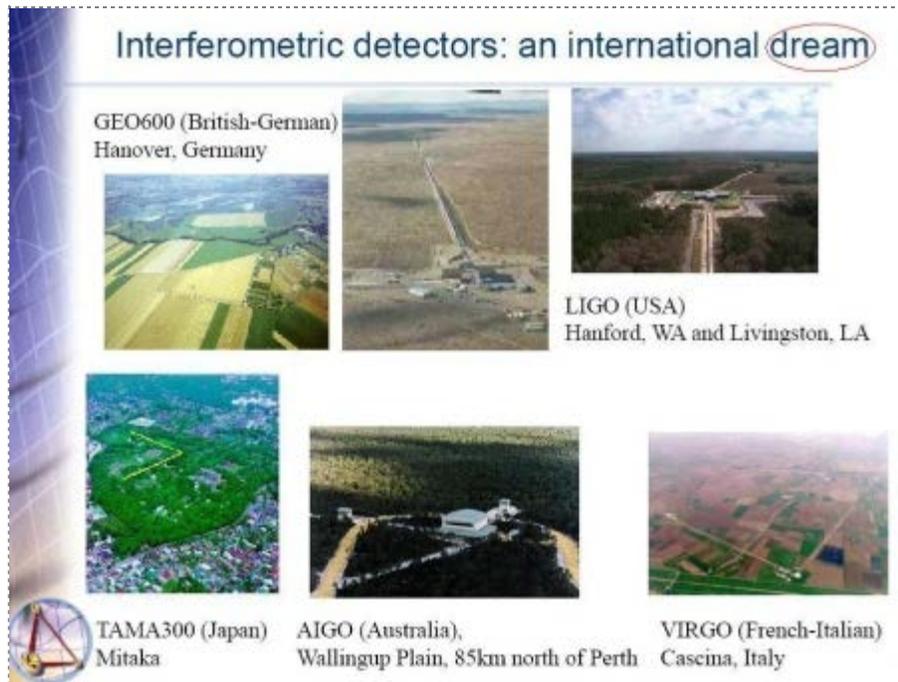
Yes, I will expose the dirty little secrets of LIGO "scientific" collaboration -- if only I am allowed to talk at the Einstein Conference in [Prague](#).

D. Chakalov

April 5, 2012

Last updated: April 6, 2012, 11:53 GMT

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**Note:** "[Kip Thorne](#) had no difficulty in 1981 in finding a taker for a wager that gravitational waves would be detected by the end of the last century. The wager was made with the astronomer [Jeremiah Ostriker](#), one of the better-known critics of the large detectors then being proposed. Thorne was one of the chief movers behind the largest of the new detector projects, the **half-billion-dollar** Laser Interferometer Gravitational Wave Observatory, or LIGO. He lost the bet, of course." (Daniel Kennefick, *Traveling at the Speed of Thought*, Princeton University Press, Princeton, 2007, [p. 1.](#))

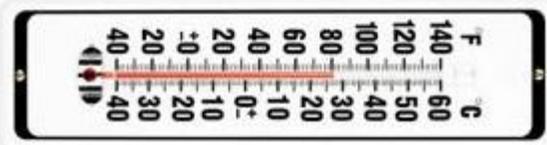
What do you do, then? Raise the requirement for "LIGO sensitivity" and ask for more cash.

I stated [above](#) that those 800+ physicists from [LIGO "scientific" collaboration](#) (LSC) do not have any theory whatsoever. Despite five (or more) consecutive failures, their persistent *dream* that the "enhanced sensitivity" of the so-called advanced LIGO and advanced Virgo might produce "GW astronomy" in [2014](#) is still grounded on a *wild guess* which has **nothing** to do with [General](#)

## Relativity.

This wild guess involves **two "if"-s**. First, [the prerequisites](#).

Suppose you have a weather thermometer: you know that it cannot measure the temperature at the surface of the Sun, but you [know how to calculate it](#), because you have a proper theory about the Sun -- not just a weather thermometer.

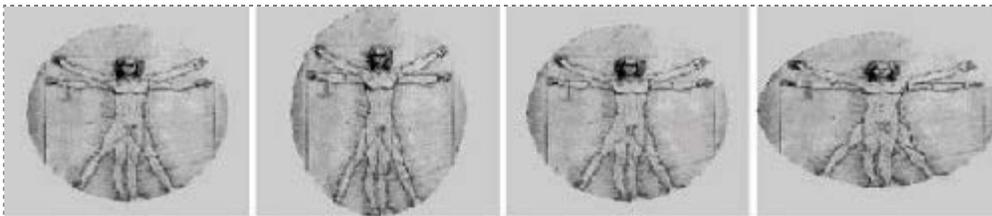


For comparison, suppose some people have designed a weird thermometer, based on a bunch of speculations which [run against everything we know about the Sun](#): they have **no right** to claim that they might eventually measure *anything* related to the Sun. In the case of [LIGO "scientific" collaboration](#), they need some totally new "quadrupole formula", or whatever they choose to call it, applicable to **very strong** GWs, from which they can **derive** a brand new "weak quadrupole formula", or whatever they wish to call it, similar to the "weather thermometer" of **very weak** GWs.

It is impossible in GR to derive **any** weak limit of GWs from *very strong* GWs. What they actually need is an *arbitrary weak* limit, such that their dimensionless ghost, called [GW amplitude](#), would fade out asymptotically toward **zero**. Then they need to compare such (nonexistent) theory of *arbitrary weak* limit of GWs with the spacetime of Special Relativity, and find the **exact area** of *veeeeeery* weak GWs at which one could safely swap the spacetime of their (nonexistent) theory with Minkowski spacetime -- some area of fading GWs, in which they would still be 'strong enough' to produce some observable (in the future) effect, yet 'weak enough' to leave the background spacetime FAPP undisturbed. Once the LSC experts attach numerical values, with acceptable error margins, to the parameters specifying the conditions 'strong enough' and 'weak enough', they will have to convince us that their second task is **not** an oxymoron.

So, their wild guess is as follows: **if** (#1) it were possible ([but it isn't](#)) to develop such theory of *arbitrary weak* limit from strong GWs, and **if** (#2) one could indeed swap the spacetime from such (non-existent) theory with Minkowski, then one could legitimately teach [Weak GW's in Flat Spacetime](#) (Kip Thorne, Caltech's Physics 237-2002) and spend hundreds of million USD and Euro -- all taxpayers' money -- for GW astronomy.

Once LSC resolve the two **if**-s, they should be able to estimate the [quantum effects](#) in the *physical* object, expected to 'stretch 'n squash' by "something that is dimensionless" (exact quote from [Kip Thorne](#)) over "[2.3×10<sup>-26</sup>](#)", and finally solve the [SBG problem](#) of LIGO, Virgo, LISA, [eLISA](#), and the like.



Of course LIGO and Virgo, no matter how "[advanced](#)", will again fail miserably. What is particularly alarming is their 'Plan B' prepared for their next failure in [2014](#):

"It is worth reminding ourselves why and where GR might fail. (...) *Any such failure of GR should point the way to new physics.*" ([B. F. Schutz et al.](#), [arXiv:0903.0100v1 \[gr-qc\]](#))

Nope. GR will not "fail", because their wild guess has **nothing** to do with GR. They do not *test* GR with such wild uneducated guess. These 800+ physicists have *only* wasted money earned with hard

labor by millions of people, and have scheduled to waste much more -- in the range of **billions** -- with [LISA](#).

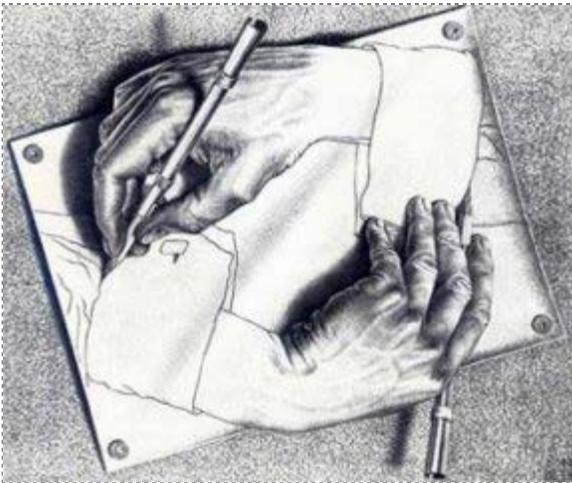
Yes, GWs exist, but the current "detectors" are blind and deaf to the **non-linear** transport of energy by GWs (**if #2**): it cannot "filter" through Minkowski spacetime. As [Hermann Weyl](#) demonstrated in 1944 (How Far Can One Get With a Linear Field Theory of Gravitation in Flat Space-Time? *American Journal of Mathematics*, Vol. 66, No. 4, Oct., 1944, pp. 591-604), the linearized approximation of GR is "**a shadow without power**".

You kill the very effect you wish to measure with "[GWs in flat spacetime](#)". The assumption that by reaching [the "advanced" LIGO](#) these waves will be "very weak" is **irrelevant**. It makes no sense to "enhance the sensitivity" of what has been a dead turkey from the outset.

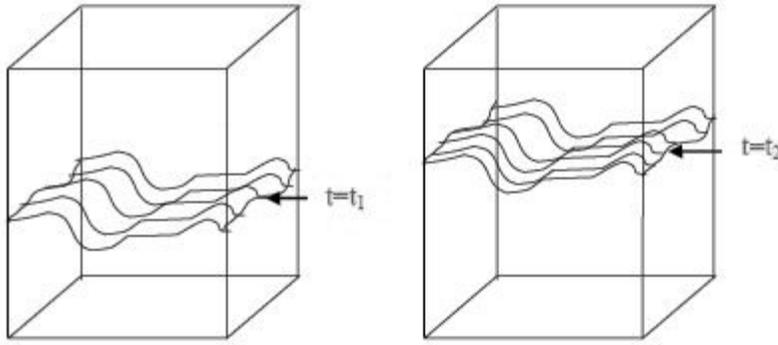
The popular statement like 'the [Hulse-Taylor binary pulsar](#) has been losing energy *exactly* according to the quadrupole formula for gravitational radiation' (Eduardo Guendelman, private communication) can be accepted iff [LIGO "scientific" collaboration](#) can suggest some non-linear theory of energy transfer by **very strong** GWs, then derive some brand new "strong quadrupole formula", or whatever they call it, for such **very strong** GWs, and finally suggest some "weak quadrupole formula", or whatever they wish to call it.

Understanding the nature of GWs is of utmost importance for elucidating the [tug-of-war](#) (DDE vs. CDM) effect of gravity, namely, the possibility for "stretching" and "squashing" the very [distance](#) between points in spacetime: [with respect to what](#) ?

**NB:** The proper GW detectors must be endowed with the faculty of 'self-acting': the unique phenomenon resulting from the **non-linear** transport of energy by GWs. To be precise: in the presence of gravity, matter can **act on itself**. A bit more precise: "the metric is treated as a field which not only affects, but also is (at *that same* instant - D.C.) affected by, the other fields" ([John Baez](#)). Each and every instant from this fundamentally **non-linear global time** is the nexus of an [already-completed](#) negotiation between the two "hands" in the [Einstein field equations](#).



This is the non-linear and *self-acting* phenomenon we need to [study and explore](#). Forget about the "[splitting of spacetime](#)", after ADM -- it can offer only one **linearized** instant from the **non-linear global time**, in which the self-acting faculty of matter is **frozen**:



**Figure 4:** *Different time surfaces in a curved block space-time. General relativity allows any 'time' surfaces that intersect all world lines locally. The spacetime itself is also curved. Future and past physics, including the spacetime itself, are locally determined from the data on any such surface.*

The warrant for this view in the case of special relativity is the existence and uniqueness theorems for the relevant fields on a fixed Minkowski background spacetime; for example, the existence and uniqueness theorems for fluid flows, for Maxwell's equations, or for the Klein Gordon equation (see Hadamard 1923; Wald 1984: 243-252). In the case where gravity is significant, the warrant is the existence and uniqueness theorems of general relativity for suitable matter fields (Hawking and Ellis 1973: 226-255; Wald 1984: 252-267). They show that for such matter, initial data at an arbitrary time determines all physical evolution, including that of the spacetime structure, to the past and the future equally, because we can predict and retrodict from that data up to the Cauchy horizon. The present time has no particular significance; it is just a convenient time surface we chose on which to consider the initial data for the universe. We could have equally chosen any other such surface.

George F. R. Ellis, [arXiv:gr-qc/0605049v5](https://arxiv.org/abs/gr-qc/0605049v5), footnote 3: "We do not consider here the possible variants when [quantum gravity](#) is taken into account."

In my opinion, the gravitational "[field](#)" and its "[ripples](#)" are **not** directly coupled to matter and quantum fields. The latter interact with **themselves** via their [GPI field](#) generated by the [Arrow of Space](#). From physical point of view, gravity is *essentially* "[dark](#)" (much like biochemistry does not involve any "biofield" or "bioparticles" corresponding to "gravitons").

Any "displacement" of the *spacetime itself* can be defined *only* in [the reference fluid of GR](#), which in turn requires [upgrading](#) General Relativity with what Albert Einstein envisioned as "a total field of as [yet unknown structure](#)".

Things like "graviton", "[gravitomagnetism](#)", "stress-energy tensor for gravitational waves", or "mass-energy **m** of gravitational waves" ([MTW](#)) do not exist. You have the same phenomenon of [purely geometrical nature](#) right above your neck: you think *about* your brain, **by** your brain, hence your brain is 'self-acting'. Physically, you cannot observe your "mind" in your brain -- just a *self-acting* brain. Any [linearized GR](#) will eliminate from the outset the non-linear and self-acting phenomenon you wish to measure and explore.

### **LIGO is for the birds.**

To sum up, [LIGO "scientific" collaboration](#) have misused the linearized approximation of GR, by eliminating from the outset the **non-linear** effect they wish to measure and explore. Their [wild guess](#) has nothing to do with GR, firstly, and secondly -- if we consider *their* linearized approximation as 'physical theory', we reach totally ridiculous statements, such as the [SBG problem](#) -- *reductio ad absurdum*. Check out my [gentle suggestion](#) [here](#).

When is enough, enough? Will find out in Prague [next June](#), provided I am [allowed to talk](#) and to

expose the dirty little secrets of [LIGO "scientific" collaboration](#).

*Ceterum autem censeo, LIGO esse delendam.*

D. Chakalov

**P.S.** If I am [banned](#) from talking at the Einstein Conference in June, I will have no choice but to take the appropriate actions **against the cover up** of the **enormous waste** of taxpayers' money by LIGO "scientific" collaboration -- *à la guerre comme à la guerre*.

D.C.

December 18, 2011

Last updated: February 7, 2012, 11:31 GMT

=====

Subject: Re: Request for opinion

Date: Thu, 5 Apr 2012 15:49:30 +0300

Message-ID:

<CAM7EkxkjEJ5AgZcY0Q3NiRB\_KtibH94R=cnz-n+2GkUSRyxHRA@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Evangelos Melas <evangelosmelas@yahoo.co.uk>

Cc: Josh Goldberg <goldberg@phy.syr.edu> ,

Ted <newman@pitt.edu>

Dear Professor Melas,

Thank you very much for your reply.

> I am not familiar with the working particulars of Ligo.

Please see Ruben Aldrovandi and Jose Geraldo Pereira at

[http://www.god-does-not-play-dice.net/#Ruben\\_Jose](http://www.god-does-not-play-dice.net/#Ruben_Jose)

General considerations at

[http://www.god-does-not-play-dice.net/#LIGO\\_Prague](http://www.god-does-not-play-dice.net/#LIGO_Prague)

> On the theoretical side the following elementary  
> considerations are in order. The standard approach to gravitational waves  
> produced by a distant source assumes that the Minkowski metric

Please see Hermann Weyl at

<http://www.jstor.org/stable/2371768>

Online at

<http://www.sjcrothers.plasmaresources.com/weyl-1.pdf>

> The general expression of the BMS-invariant metric  $\beta_{\mu\nu}$  has been shown to be not  
> invariant under the Poincaré group, except in the particular case when  
> the source collapses into a spherically symmetric system. It follows that the  
> correct wave equation will also be invariant under the BMS group,  
> written with the BMS-invariant metric. I think that this is not the wave  
> equation used in LIGO considerations.

Thank you. LIGO "scientific" collaboration (800+ people) do not use wave equation invariant under the BMS group, written with the BMS-invariant metric. They just ask for **more money**.

Regrettably, Josh Goldberg and Ted Newman don't want to raise their voice and expose the essential errors of LIGO "scientific" collaboration. I hope you will do it.

Yours sincerely,

Dimi Chakalov

> \_\_\_\_\_  
> From: Dimi Chakalov <dchakalov@gmail.com>  
> To: Evangelos Melas <evangelosmelas@yahoo.co.uk>  
> Cc: Josh Goldberg <goldberg@phy.syr.edu>; Ted <newman@pitt.edu>  
> Sent: Friday, 30 March 2012, 15:23  
> Subject: Request for opinion  
>  
> Dear Professor Melas,  
>  
> May I ask for your opinion on the efforts of LIGO "scientific"  
> collaboration to detect GWs, given the fact that they have ignored the  
> correct approach from the Bondi-Metzner-Sachs group -- "an unavoidable  
> consequence of the presence of gravitational waves in General  
> Relativity", as you put it ([2011 J. Phys.: Conf. Ser. 283 012023](#)).  
>  
> The opinion of your colleagues will be greatly appreciated, too.  
>  
> My opinion is posted at  
> [http://www.god-does-not-play-dice.net/#LIGO\\_Prague](http://www.god-does-not-play-dice.net/#LIGO_Prague)  
>  
> General considerations at  
> [http://www.god-does-not-play-dice.net/#affine\\_connection](http://www.god-does-not-play-dice.net/#affine_connection)  
>  
> Kind regards,  
>  
> Dimi Chakalov  
>

=====

Subject: Re: Johan Hansson, Anna Ponga, Pulsars: Cosmic Permanent 'Neutromagnets'?  
[arXiv:1111.3434v1 \[astro-ph.HE\]](#)  
Date: Sat, 24 Dec 2011 16:24:00 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Johan Hansson <c.johan.hansson@ltu.se>  
Cc: Brian P Dolan <bdolan@thphys.nuim.ie>, Hamish Johnston <hamish.johnston@iop.org>, Alex Potekhin <palex@astro.ioffe.ru>, Sachiko Tsuruta <uphst@gemini.msu.montana.edu>, [Bernard Schutz](#) <Bernard.Schutz@aei.mpg.de>, [Jorge Pullin](#) <pullin@lsu.edu>, [Gabriela González](#) <gonzalez@lsu.edu>, [Clifford Will](#) <cmw@wuphys.wustl.edu>, Luca Bombelli <bombelli@olemiss.edu>

Update today at  
[http://www.god-does-not-play-dice.net/#LIGO\\_Prague](http://www.god-does-not-play-dice.net/#LIGO_Prague)

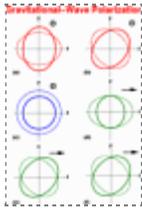
Wishing you a nice white Christmas,

Dimi Chakalov

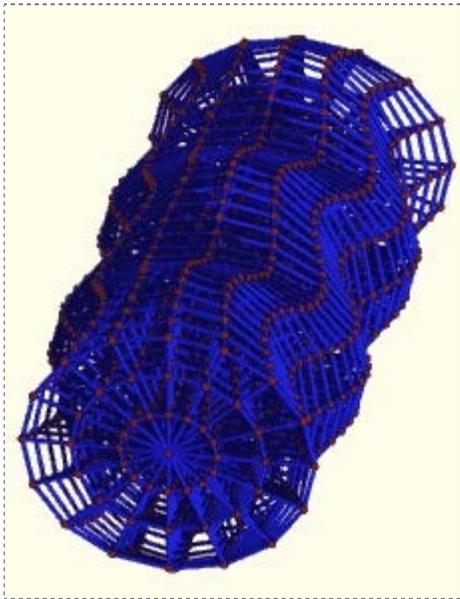
<http://tinyurl.com/Einstein-Prague>

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**Note:** Quote from Clifford M. Will ([27 March 2006](#)): "The wave propagates in the +z direction. There is no displacement out of the plane of [the picture](#)."

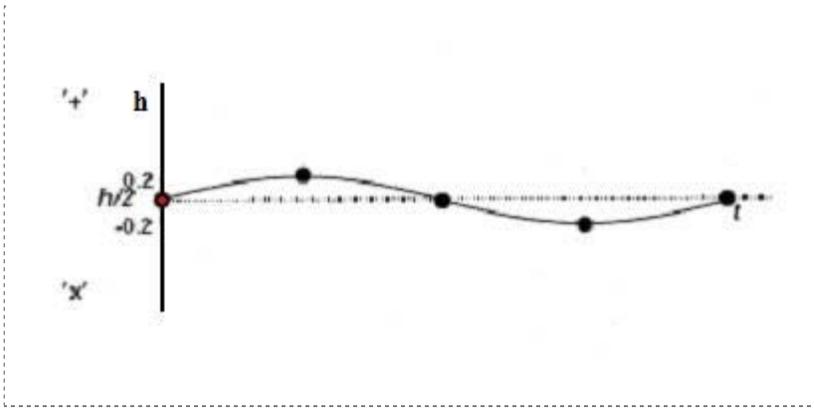


The picture above (click to enlarge) isn't about [Flatland](#), but "[Polarization of gravitational waves](#)". The 3-D space of GR has been custom-made **non-isotropic**, in the sense that the (longitudinal) direction of GW propagation, the " +z direction", is excluded from the "displacements" of the test body. According to [LIGO "scientific" collaboration](#), physical bodies can respond to GWs **only** in the x/y plane. The " +z direction" is **not** connected, by any means whatsoever, to the x/y plane, which is why a physical body can enjoy GWs **only** within the x/y plane. It shouldn't *dare* to 'stretch and squash' along the direction of GW propagation, or else "[the result would be disastrous](#)" for C. M. Will and his colleagues.



Markus Pössel, "The wave nature of simple gravitational waves",  
Einstein Online, Vol. 2 (2006), [1008](#)  
(Click the image to see the animated "gravitational waves")

To show the "propagation" of GWs in 3-D space, I modified Fig. 22.1 from B. Schutz' book cited [above](#), and inserted one **red** dot to accommodate the three directions in space (not shown) orthogonal to the **h/t** plane below.



"Each polarization has its own gravitational-wave field," says [Kip Thorne](#). To decipher this tantalizing statement, notice that the "displacement" produced from the '+' GW field and the 45-degree-shifted "displacement" from the 'x' GW field must **not** overlap in 3-D space (not shown above), to ensure that the test body will receive clear and distinguishable "displacements", with (i) **perfect** timing along the horizontal line **t** (as read by the clock of LIGO's operator), and (ii) **exact** shifting of 45 degrees in the "orientation" of the two "polarizations", '+' and 'x', in 3-D space (not shown above); details in the so-called [SBG problem](#) of "GW astronomy". Also, the black vertical line depicting the alleged GW amplitude **h** ("something that is dimensionless," exact quote from Kip Thorne's [Physics 237-2002](#)) must **not** be projected on any of the three **spatial axes** (not shown above) passing through the **red dot**, or else **h** will acquire dimensionality, in [meters]. The dimensionless **h** has been coupled *only* to the horizontal line **t** depicting 'time read with a clock'. Details in Bernard Schutz *et al.*, [arXiv:0906.4151v1 \[astro-ph.CO\]](#):

Gravitational waves are described by a second rank tensor  $h_{\alpha\beta}$ , which, in a suitable coordinate system and gauge, has only two independent components  $h_+$  and  $h_\times$ ,  $h_{xx} = -h_{yy} = h_+$ ,  $h_{xy} = h_{yx} = h_\times$ , all other components being zero. A detector measures only a certain linear combination of the two components, called the response  $h(t)$  given by

$$h(t) = F_+(\theta, \varphi, \psi)h_+(t) + F_\times(\theta, \varphi, \psi)h_\times(t), \quad (1.3)$$

where  $F_+$  and  $F_\times$  are the detector antenna pattern functions,  $\psi$  is the polarization angle, and  $(\theta, \varphi)$  are angles describing the location of the source on the sky.

Well, I call this '[GW parapsychology](#)'.

Again, C. M. Will, Kip Thorne, and their LIGO colleagues claim that the GW can propagate **only** in the +z direction, along which "there is no displacement": **all** of the "displacement" is confined in the **x/y plane**. As B. Schutz explained in his [book](#) (cf. [above](#)), "The fact (there are no "facts" here - D.C.) that gravitational waves are transverse and do not act like the Moon does on Earth implies that they are not part of the curvature of time, since that is where the Newtonian forces originate. They are purely a part of the curvature of space (emphasis mine – D.C.)." I am unable to understand such [GW parapsychology](#).

As to the L-shape of [LIGO tunnels](#) (the "invariance angle"), it was derived from an article which Kip Thorne has read as a student "[around 1960](#)".

C. M. Will and his 800+ LIGO colleagues should study [arXiv:0709.1603v1 \[gr-qc\]](#) by Ruben Aldrovandi *et al.* and [arXiv:0809.2911v2 \[gr-qc\]](#) by Jose Geraldo Pereira *et al.* [[Ref. 1](#)], in order to

understand the "**nonlinear** oscillations along the direction of propagation. This is the signature a gravitational wave will leave in a detector, the effect to be looked for."

But they will never study anything that could jeopardize their [GW parapsychology](#). They only ask for *more money* for the "advanced" LIGO and Virgo. Forget it.

In general, [Ruben Aldrovandi et al.](#) reminded us that a "fundamental characteristic of the Yang-Mills field is that it carries its **own charge**, as for example the color charge carried by gluons in [chromodynamics](#). The Yang-Mills field, therefore, is essentially nonlinear — otherwise it is not a Yang-Mills field" [Ref. 1]. More succinctly (*ibid.*): "[the gauge field](#) of Chromodynamics must be nonlinear to transport color charge."

In the framework of the theory suggested in Sec. Summary of [ExplanatoryNote.pdf](#) (pp. 35-36), the "total field of as yet unknown structure" ([A. Einstein](#)) is also carrying its own 'source', in the form of [GPIs](#) of positive & negative "charges", by an Arrow of Space, such that every instant 'now' corresponds to a re-created *physical* universe (local mode of spacetime), in which the negative "charge" has *already* been [totally canceled](#) (notice that the dynamical, positive-charge remnant from this cancellation is [not exactly zero](#)).

It is just like the mysterious cat Macavity [Ref. 2], which is *always* present when there are no *physical* observers to test it -- any time we look at it, it has *already* disappeared. Whether one can catch Macavity "along" null intervals [Ref. 3] is very much an [open question](#).

D.C.

December 26, 2011

Last updated: December 28, 2011

[Ref. 1] Ruben Aldrovandi *et al.*, The Nonlinear Essence of Gravitational Waves, *Found. Phys.* **37**, 1503-1517 (2007), [arXiv:0709.1603v1 \[gr-qc\]](#); Jose Geraldo Pereira *et al.*, Nonlinear Gravitational Waves: Their Form and Effects, *Int. J. Theor. Phys.* **49**, 549-563 (2010), [arXiv:0809.2911v2 \[gr-qc\]](#).

[Ref. 2] Adam Helfer, Are Negative Energy Densities Detectable? [arXiv:gr-qc/9709047v1](#)

"T. S. Eliot described a 'mystery cat,' Macavity, responsible for all sorts of mischief, but when the crime's discovered, Macavity's not there! I investigate the negative energy densities predicted by relativistic quantum field theories, and find they have a similar character. The energy in a region, plus the energy of a device which detects it, must be non-negative. Indeed, as far as has been checked, the total four-momentum density, of the field plus the observing device, must be future-pointing.

"In consequence the semi-classical Einstein equation can at best describe negative energy-density [only as long as no observers are present](#): Macavity, Macavity... he **breaks the law of gravity**."

[Ref. 3] [Kevin Brown](#), Locality and Temporal Asymmetry  
<http://www.mathpages.com/rr/s9-09/9-09.htm>

This leads to the view that the concept of a "free photon" is meaningless, and a photon is nothing but the communication of an emitter event's phase to some null-separated absorber event, and vice versa.

.....

Taking another approach, it might seem that we could "look at" a single photon at different distances from the emitter (trying to show that its phase evolves in flight) by receding fast enough from the emitter so that the relevant emission event remains constant, but of course the only way to do this would be to recede at the speed of light (i.e., along a null interval), which isn't possible. This is just a variation of the young Einstein's thought experiment about how a "standing wave" of light would appear to someone riding along side it. The answer, of course, is that it's not possible for a material object to move along-side a pulse of light (in vacuum), because **light** exists only as **completed**

interactions on null intervals.

.....

This image of a photon as a single unified event with a coordinated emission and absorption seems unsatisfactory to many people, partly because it doesn't allow for the concept of a "free photon", i.e., a photon that was never emitted and is never absorbed. However, it's worth remembering that we have no direct experience of "free photons", nor of any "free particles", because ultimately all our experience is comprised of **completed** interactions. (Whether this extends to gravitational interactions is [an open question](#).)

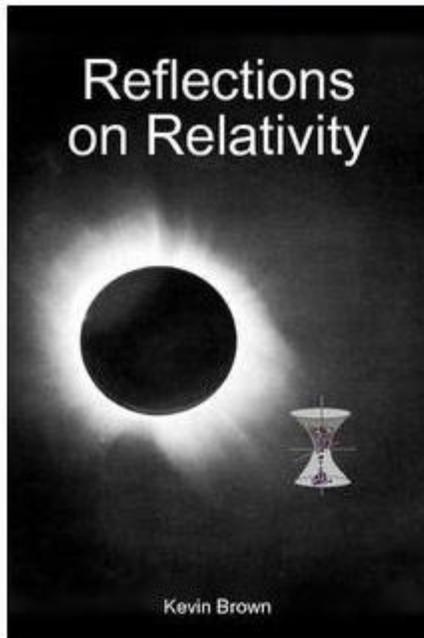
See also: Kevin Brown, *Reflections on Relativity*, MathPages, 2013, Ch. 4

<http://www.lulu.com/shop/kevin-brown/reflections-on-relativity/paperback/product-20615854.html>

## Reflections on Relativity

By Kevin Brown

Paperback, 725 Pages ★★★★★



### 4. Weighty Arguments

4.1 Immovable Spacetime	265
4.2 Inertial and Gravitational Separations	276
4.3 Free-Fall Equations	280
4.4 Force, Curvature, and Uncertainty	283
4.5 Conventional Wisdom	289
4.6 The Field of All Fields	300
4.7 The Inertia of Twins	306
4.8 The Breakdown of Simultaneity	311

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**Comment:** In early September 2011, I tried to explain the "speed" of light and the so-called global mode of spacetime to a friend of mine, Stavros, as we were relaxing on the beach near Kavalla, Greece. I don't have a photo, but I suppose we were pretty much like the two guys below.



Imagine, I said to Stavros, that you and I are in a train that runs toward the future. We cannot notice "the future", but can only look at the rail track **backwards** from the **last** carriage, and notice that 'the past' has been somehow growing and enlarging: more and more events have been moving from the future into the past due to the phenomenon of **transience** in 'the flow of time'. But notice that the ever-growing past can be detected **only** *post factum* due to the "speed" of light -- we can't detect any "free photons" nor "free particles", but only their **past** states, which are growing 'as time goes on' and are cast on a *perfect* continuum called 'local mode of spacetime'. Also, you know that it takes some time to see my actual state, just as it takes some eight minutes to see the **past** state of the Sun. Now, suppose I can freely jump off the train (the Arrow of Space) and move to the global mode of spacetime: I will have all the time I wish to watch you, the train, and all its **potential** railroads ahead, because **your** time will be frozen, just like the proper time of a photon, while I will **meanwhile** enjoy the whole **global** infinite time available to the train. But when I come back and sit next to you after my "long" walk, you won't notice that I've been 'out for a walk': to your eyes & wristwatch, I will **always** remain *right here* on the chair next to you. You can't see me leaving for a walk "outside" the local (physical) mode spacetime. You can't take off the train with me and realize that it has actually been moving-and-rotating. All you can notice is that I've been **already** (Sic!) EPR-like correlated with all beautiful girls here on the beach, like *that* fish (see above) was correlated in its school of fish before it was caught. And if I have obtained something "during" my walk "outside" the local mode of spacetime, **you** will see it as surfacing helter-skelter, and will of course try to trace it back in **your** history of our talk ... but you can't find it in **your** history of our talk and will have to pronounce it "dark". For example, if I've been eating a lot "during" my walk "outside" the local mode of spacetime and have gained weight, you may *only* notice that I've raised a self-acting and dark belly. *Capiche?*

Well, my good old friend Stavros couldn't get it (many people can't either), so we switched to differential topology.

**NB:** Not only **light**, but the whole world in the local mode of spacetime exist *only* as **already-completed** interactions on null intervals: *only* at the end-point **x** below. Instead of contemplating on local interactions within a finite spacetime domain that includes point **x** below, or "occurring" in some non-local fashion *only* at point **x**, we use a third possibility: quasi-local interactions in the global mode of spacetime, which are **completed** only at the end-point **x** from the local (physical) mode of spacetime, but their "duration" will be read as "zero" by all inanimate clocks (not the brain).



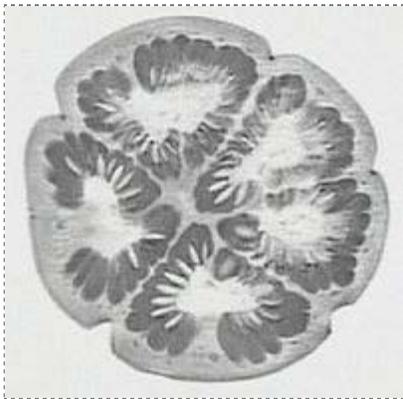
Notice that quasi-local interactions pertain only to the **assembled** 4-D spacetime, e.g., Gravitational Waves and "dark" matter/energy.



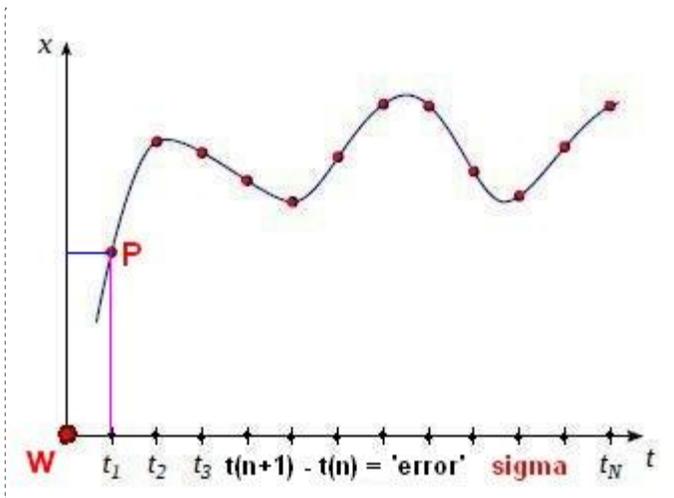
The end-point  $x$  is **one** event of emission-and-absorption, like the instant of clapping hands. The "intermediate time" of a "free" photon "during flight", as shown in the animation from [John Walker](#) below, is **not physical**.

The Arrow of Space **accumulates** 3+1-D spacetime along null intervals: one-point-at-a-time, "separated" by **zero** gaps (Sic!). The end result is a *perfectly* smooth and **re-created** [continuum](#) made by "stacking" 3-D layers of an **already**-completed universe: each and every 3-D layer is a **dead** fixed block universe, "an unchanging spacetime entity, with no particular space sections identified as the present and no evolution of spacetime taking place" ([G F R Ellis](#), p. 5, [Fig. 4](#)). You may only have 'change *within* space' there, but such coordinate time is an [illusion](#).

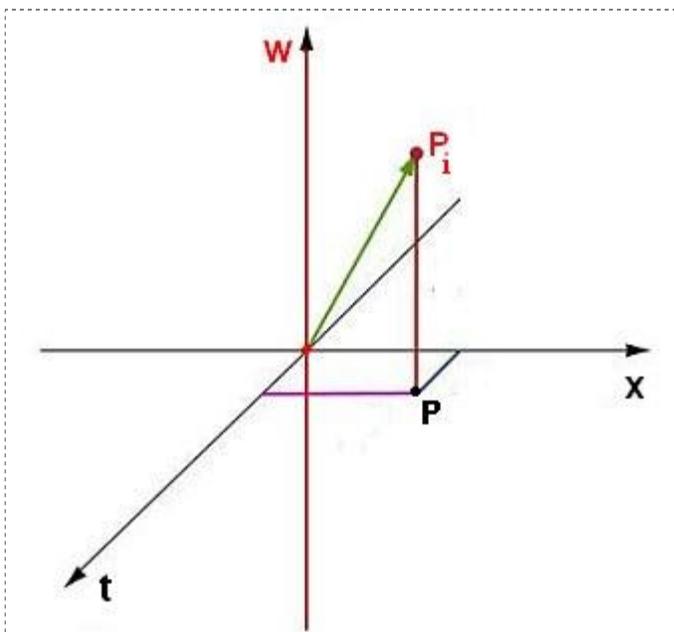
See an animation of [scanned pumpkin](#) below (source [here](#)), and bear in mind that the successive accumulation of flat 2D images produces "time", hence a "pumpkin" in 2+1-D spacetime. In our case, the [Arrow of Space](#) **accumulates flat 3D** images with [infinitesimal](#) or "**zero** thickness" to produce 'time as change **of** space' (not 'change *within* space'), hence builds up our universe in 4-D spacetime. Bear in mind that (i) 'the universe as [ONE](#)' doesn't "move" anywhere (just like the pumpkin), and (ii) the *accumulated* 4-D spacetime is wrapped by an *indefinable* "[boundary](#)" that does **not** pertain to the local (physical) mode of spacetime, but to the [global mode](#) of spacetime.



Also, keep in mind that the "direction" of 'time as change **of** space' is **orthogonal** to the "direction" of 'time as change *within* space'. The two "directions" do *not* overlap: see the drawing below.



The [Arrow of Space](#) is **orthogonal** to  $x/t$  surface, and is compactified in a **red dot  $w$** . The joint  $x/t$  displacement is '[change within space](#)', obtained by merging  $N$ -layers in a flat 2-D image with **zero gaps** along the  **$w$ -axis**, as explained with [Photoshop layers](#).

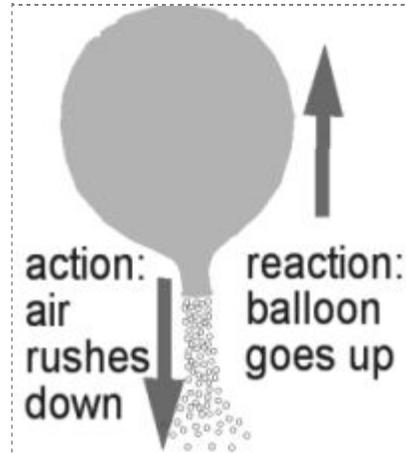
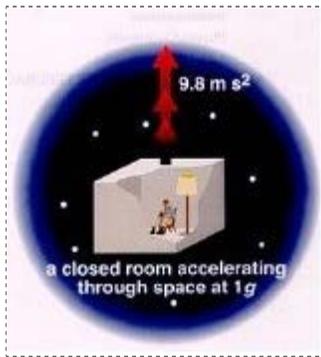


The input at point  $P_i$  (imaginary "mass", [Arthur Eddington](#)) from the [Arrow of Space](#) along  **$w$ -axis** is converted into [positive mass](#) at  $P$ , endowed with inertia (cf. Fig. 1 [below](#)).

Notice the different proposal by G F R Ellis, [pp. 17-18](#) (links and comments added): "... the transition from present to past does not take place on specific spacelike surfaces; rather *it takes place pointwise at each spacetime event*. (...) However the constraints on what future can emerge at a given here-now are **not** pointwise constraints but (in relation to any local coordinates) constraints involving spatial derivatives, or, roughly speaking, neighbouring points (up to the [asymptotic boundaries](#) of spacetime - D.C.).

"So if evolution takes place pointwise (*and on [null hypersurface](#) - D.C.*), it still involves a degree of [spatial coordination between neighbouring points](#), even though the neighbouring point [might not "yet exist"](#) relative to a different here-now until it lies in the past."

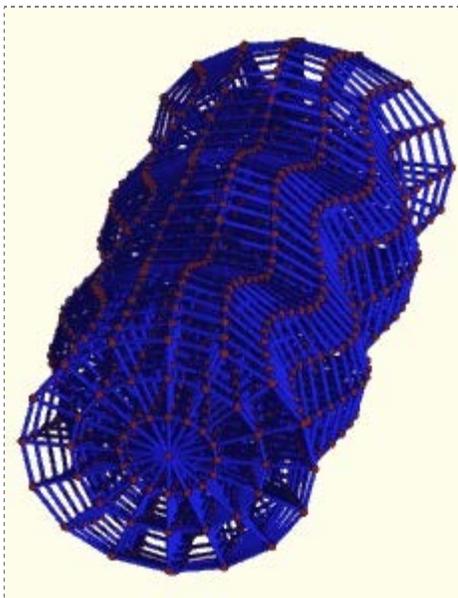
Notice that the "direction" of [Arrow of Space](#) is nothing but the **red arrow** of the "[elevator](#)":



Newton's third law (cf. the second drawing above) does not hold for [wegtransformierbar](#) gravity. Instead, we have a **self-acting** "elevator" endowed with [torsion & curvature](#).

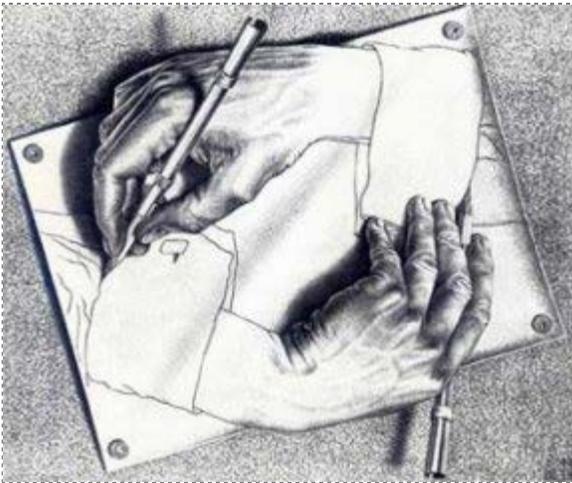
One perhaps may be tempted to suggest a complex time with real and imaginary part, in which 'time as change **of** space' would be [imaginary](#).

Check out also the second animation below, to understand the dynamics of gravitational waves 2+1-D spacetime and the insoluble problems of [LIGO "scientific" collaboration](#).



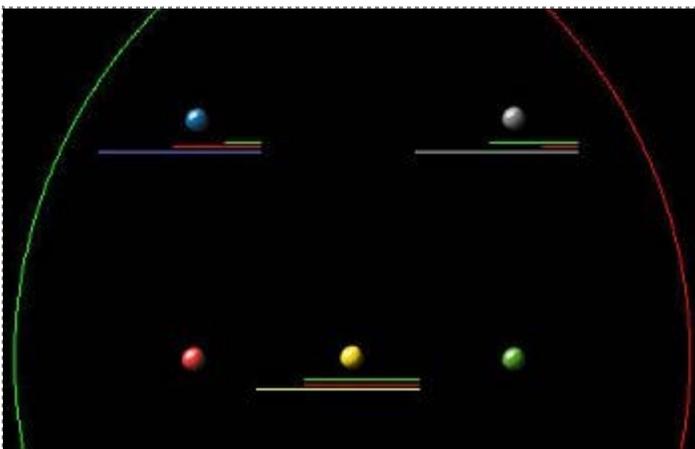
Just as it requires a *finite* time interval to observe the [past state](#) of the Sun, it **always** requires a *finite* time interval (it could be very small, yet it is never zero) to observe the world, simply because of the "speed" of light. And any time we see some **past** state of the world, we see these **already-completed** interactions on null intervals: *only* at the end-point **x** in the **NB** animation above, at

which the ["bi-directional" negotiation](#) between matter and geometry (depicted with two 'drawing hands' by Escher below) has been **already** completed.



Think of the drawing hands as "two" (and also one) **entangled** parties, [Alice and Bob](#). Due to the "speed" of light, we can say that Bob *was* influenced by Alice, if only Alice *was* **already** influenced by Bob, etc., *ad infinitum*. If we don't wish to talk in *past* tense, we say that Alice *cannot* influence Bob, because *before* she could do it, Bob would have to influence her, and the other way around. Either way, we cannot describe the *relational ontology* of [Alice and Bob](#), as it evolves in the flow of time, with relativistic causality, but because we must keep 'the speed of light barrier', we suggest a new form of retarded causality, called *biocausality*, and use [Reichenbach's Third Cause](#) to introduce a *third* entity: the universe as ONE (cf. [FAQ\\_Q2](#)). Recall also that we have the same *nonlinear* Alice-Bob relations in GR, but people try to avoid them by eliminating time and using PDEs.

Also, we have access with our brain (not "mind") to the spectrum of all *potential* states available to the next state  $x$ , kept in the potential future in the Arrow of Space, and bootstrapped by their common UNSPEAKABLE, *pre-quantum*, Kochen-Specker state (never in plural). This 'access' is nothing but the **global mode** of spacetime, presented again with the "speed" of light in the animation from [John Walker](#) below.



The "intermediate" time of free photons is **not** physical.

Thus, the *local* mode of spacetime is being **re-created** with such **already-created** 'world points'  $x$ , which are "separated" by nothing, because in this *local* mode the w-axis of the Arrow of Space is **zero**, and the resulting continuum is perfectly smooth.

For comparison, recall [Richard W. Sharpe](#) and [Ian D. Lawrie](#), *A Unified Grand Tour of Theoretical Physics*, 2nd ed., Taylor & Francis, 2001, Sec. 2.1:

## 2.1 Spacetime as a Differentiable Manifold

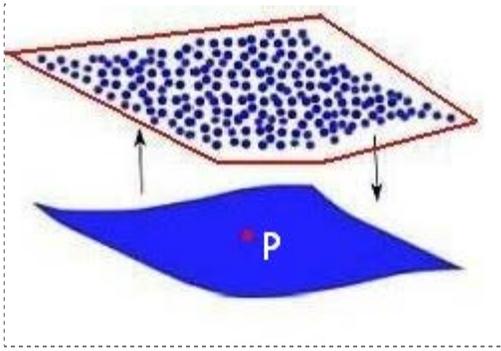
Our aim is to construct a mathematical model of space and time that involves as few assumptions as possible, and to be explicitly aware of the assumptions we do make. In particular, we have seen that the theories of relativity call into question the meanings we attach to distances and time intervals, and we need to be clear about these. The mathematical structure that has proved to be a suitable starting point, at least for a non-quantum-mechanical model of space and time, is called a *differentiable manifold*. It is a collection of *points*, each of which will eventually correspond to a unique position in space and time, and the whole collection comprises the entire history of our model universe. It has two key features that represent familiar facts about our experience of space and time. The first is that any point can be uniquely specified by a set of four real numbers, so spacetime is four-dimensional. For the moment, the exact number of dimensions is not important. Later on, indeed, we shall encounter some recent theories which suggest that there may be more than four, the extra ones being invisible to us. Even in more conventional theories, we shall find that it is helpful to consider other numbers of dimensions as a purely mathematical device. The second feature is a kind of 'smoothness', meaning roughly that, given any two distinct points, there are more points in between them. This feature allows us to describe physical quantities such as particle trajectories or electromagnetic fields in terms of differentiable functions and hence to do theoretical physics of the usual kind. We do not know for certain that space and time are quite as smooth as this, but at least there is no evidence for any granularity down to the shortest distances we are able to probe experimentally.

Given any two distinct points  $\mathbf{x}$ , there is nothing between them. **Zero**. Thus, the *accumulation* of such **already**-created points  $\mathbf{x}$  produces the **dimensions** of spacetime along the Arrow of Space.

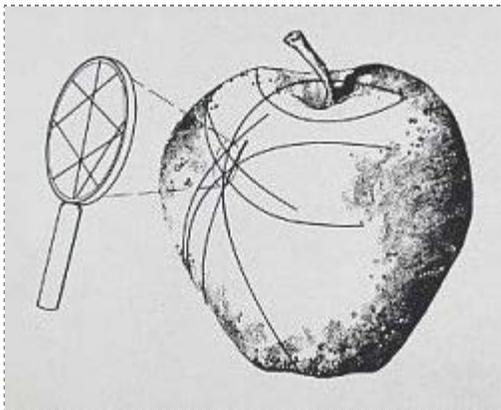
Notice also an operational definition of 'time at point  $\mathbf{x}$ ' ([Jim Hartle](#)): "Alternatives at a moment of time can be reduced to a set of yes/no questions." Namely, the Schrödinger cat is either  $|alive\rangle$  or  $|dead\rangle$  at particular *instant* or spacetime *event*, as detected with your macroscopic wristwatch, which in turn operates in full compliance with Special Relativity.

True, but only and exclusively only in the local (physical) mode of spacetime, which is being dynamically **re**-created with one "jacket" that has been *actualized* with **certainty**, and therefore we can question its **existence** with yes/no propositions from Boolean logic. In the quantum world, the **existence** of *potential reality* would resemble a virtual "dough" of potential explications, which *may or may not* be converted to *physical reality*. Thus, the new form of **existence** of the quantum world, and the crucial notion of 'quantum reality *out there*', **cannot** be described with "probabilities", because **it** has *not yet* been *actualized* with **certainty**: read Erwin Schrödinger from November 1950.

At the *quasi-local* point  $\mathbf{x}$ , we have an *uncountably infinite* spectrum of **latent** states ([Henry Margenau](#)) in the global mode of spacetime (see the drawing below), which is why the geometrical point  $\mathbf{x}$  is **quasi-local** -- it is *both* extremely local *and* extremely non-local, at the same 'moment of time'. In the global mode of spacetime, all possible questions regarding 'alternatives at a moment of time' yield one answer only: **YAIN** (Yes-And-neIN).



This is the job of the [Arrow of Space](#). The rest is [history](#).



The first step toward recovering 'the end-point  $x$ ' (see [NB above](#)) is with "two" [atemporal waves](#), which are being "canceled" to produce the end-point  $x$  at every step 'now' of the [Arrow of Space](#). Notice that a simple mechanistic visualization by [consecutive](#) "reading" and "sending" [[Ref. 1](#)] is very misleading, for the same reasons why my friend above couldn't notice the global mode of spacetime '[outside the train](#)'.

The [atemporal](#) waves inhabit the global mode of spacetime modeled with [potential and pre-geometric](#) "points". Each of these [UNSPEAKABLE pre-geometric potential](#) "points" is endowed with imaginary time [[Ref. 2](#)] and "two-dimensional orientation space" [[Ref. 1](#)], with which exact alternative models of (i) relativistic causality (local mode of spacetime) implied by "[minus sign](#)", (ii) the tangent space "at that point" [[Ref. 3](#)], and (iii) the "[asymptotically flat initial data](#)" poetry in GR textbooks [[Ref. 4](#)] have been suggested.

The basic ideas from Gottfried Wilhelm von Leibniz are kindly reminded by Howard Stein, [p. 28](#):

To begin with point (2): Space and time are (to use Leibniz's term) "orders"—i. e., systems of structural relations—of everything that exists; in particular (and here we have a very sharp divergence between Leibniz and Kant) of the (*noumena* or) monads—even including God.

But because we are concerned here with quantum gravity, we will avoid, as much as we can, all theological issues and introduce the so-called *necessary* and *sufficient* conditions for spacetime.

Namely, we stipulate that the **ontology** of spacetime is defined by [both](#) the *necessary* conditions, such as the constituents of matter and their relations, [and](#) the *sufficient* conditions for spacetime -- the global properties of '[the universe as ONE](#)'. Stated differently, we all agree that there is no 'empty spacetime *per se*', yet once we have proper spacetime, there is *more* to it, because we cannot *in principle* deduce [all properties of spacetime](#) from the *necessary* conditions alone.

If short, we hope to apply the proposal by [William K. Clifford](#) in 'On the Space-Theory of Matter' ([February 21, 1870](#)):

4. That in the physical world nothing else takes place but this variation, subject (possibly) to the law of continuity.

The "variation" is shown here with a new retarded causality, dubbed [biocausality](#), and with the [sufficient conditions](#) for spacetime. The latter do not originate from some matter-free physical space but from '[the whole universe as ONE](#)' as '[pure energy](#)': it "has no weight", "does not curve space", and is "not observable" (MTW, [p. 467](#)). Hence its physical manifestation (for example, [rotation](#)) will inevitably look "[dark](#)", as explained [above](#).

Mind you, it will be impossible *in principle* to detect the Unmoved Mover ([Karel Kuchar](#)) and First Cause, because we would make *physical* contact with [The Beginning](#). Therefore, everything from **it** (recall Reichenbach's Third Cause [above](#)) will be *untraceable*, and will look "dark" to many ([otherwise smart](#)) people.

Now you're ready to go.

D. Chakalov

January 13, 2013

Last updated: October 23, 2013, [16:48 GMT](#)

[Ref. 1] Kevin Brown, Spacetime Mediation of Quantum Interactions.  
<http://mathpages.com/rr/s9-10/9-10.htm>

"An interesting feature of this interpretation is that, in addition to the usual 3+1 dimensions, spacetime requires two more "curled up" dimensions of angular orientation to represent the possible [directions in space](#). The need to treat these as dimensions in their own right arises from the non-transitive topology of the pseudo-Riemannian manifold.

"Each point [t,x,y,z] actually consists of a two-dimensional orientation space, which can be parameterized (for any fixed frame) in terms of ordinary angular coordinates q and f. Then each point in the six-dimensional space with coordinates [x,y,z,t,q,f] is a terminus for a unique pair of spacetime rays, one forward and one backward in time.

"A simple mechanistic visualization of this situation is to imagine a tiny computer at **each of these points**, reading its input from the two rays and sending (matched conservative) outputs on the two rays."

[Ref. 2] Sir Arthur Eddington, [Space, Time and Gravitation](#). *An Outline of the General Relativity Theory*, Cambridge University Press, 1920, Ch. 3, pp. 47-48.

Secondly, the formulae here given for  $s^2$  are the characteristic formulae of Euclidean geometry. So far as three-dimensional space is concerned the applicability of Euclidean geometry is very closely confirmed by experiment. But space-time is not Euclidean; it does, however, conform (at least approximately) to a very simple modification of Euclidean geometry indicated by the corrected formula

$$s^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2 - (t_2 - t_1)^2.$$

There is only a sign altered; but that minus sign is the secret of the differences of the manifestations of time and space in nature.

This change of sign is often found puzzling at the start. We could not define  $s$  by the expression originally proposed (with the positive sign), because the expression does not define anything objective. Using the space and time of one observer, one value is obtained; for another observer, another value is obtained. But if  $s$  is defined by the expression now given, it is found that the same result is obtained by all observers\*. The quantity  $s$  is thus something which concerns solely the two events chosen; we give it a name—the interval between the two events. In ordinary space the distance between two points is the corresponding property, which concerns only the two points and not the extraneous coordinate system of location which is used. Hence interval, as here defined, is the analogue of distance; and the analogy is strengthened by the evident resemblance of the formula for  $s$  in both cases. Moreover, when the difference of time vanishes, the interval reduces to the distance. But the discrepancy of sign introduces certain important differences. These differences are summed up in the statement that the geometry of space is Euclidean, but the geometry of space-time is semi-Euclidean or “hyperbolic.” The association of a geometry with any continuum always implies the existence of some uniquely measurable quantity like interval or distance; in ordinary space, geometry without the idea of distance would be meaningless.

For the moment the difficulty of thinking in terms of an unfamiliar geometry may be evaded by a dodge. Instead of real time  $t$ , consider imaginary time  $\tau$ ; that is to say, let

$$t = \tau\sqrt{-1}.$$

Then  $(t_2 - t_1)^2 = -(\tau_2 - \tau_1)^2$ ,

so that

$$s^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2 + (\tau_2 - \tau_1)^2.$$

---

\*Appendix, Note 2.

Everything is now symmetrical and there is no distinction between  $\tau$  and the other variables. The continuum formed of space and imaginary time is completely isotropic for all measurements; no direction can be picked out in it as fundamentally distinct from any other.

The observer's separation of this continuum into space and time consists in slicing it in some direction, viz. that perpendicular to the path along which he is himself travelling. The section gives three-dimensional space at some moment, and the perpendicular dimension is (imaginary) time. Clearly the slice may be taken in any direction; there is no question of a true separation and a fictitious separation. There is no conspiracy of the forces of nature to conceal our absolute motion—because, looked at from this broader point of view, there is nothing to conceal. The observer is at liberty to orient his rectangular axes of  $x, y, z$  and  $\tau$  arbitrarily, just as in three-dimensions he can orient his axes of  $x, y, z$  arbitrarily.

[Ref. 3] [David Malament](#), Observationally Indistinguishable Space-times, in: [Foundations of Space-Time Theories](#), ed. by John Earman, Clark Glymour, and John Stachel, University of Minnesota Press, 1977, pp. 61-80.

Let me first rehearse a few definitions.<sup>2</sup> An *n-dimensional space-time* (for  $n \geq 2$ ) is taken to be a connected, smooth, *n-dimensional differentiable manifold* (without boundary), endowed with a smooth, nondegenerate pseudo-Riemannian metric of Lorentz signature  $(+, -, \dots, -)$ . The metric associates with each point a light cone (in the tangent space at that point). It is assumed that space-times are *temporally oriented*, i.e., that they are further endowed with a continuous, nonvanishing vector field which assigns a timelike vector to every point. The vector field distinguishes a “future lobe” in the light cone at each point.

Piotr Chrusciel, *Lectures on Energy in General Relativity*, March 6, 2012, [p. 166](#).

## A.15 Null hyperplanes and hypersurfaces

One of the objects that occur in Lorentzian geometry and which possess rather disturbing properties are *null hyperplanes* and *null hypersurfaces*, and it appears useful to include a short discussion of those. Perhaps the most unusual feature of such objects is that the direction normal is actually tangential as well. Furthermore, because the normal has no natural normalization, there is no natural measure induced on a null hypersurface by the ambient metric.

[Ref. 4] [Robert DiSalle](#), Reconsidering Ernst Mach on Space, Time, and Motion, in: Reading Natural Philosophy: Essays in the History and Philosophy of Science and Mathematics, ed. by David B. Malament, Chicago: Open Court Press, 2002, pp. [167-192](#).

models of the solar system, which according to Reichenbach had been reduced to a matter of convention, has a physical basis in general relativity just as much as in Newtonian gravitation theory. Second, although general relativity holds that the inertial structure (the affine structure) of spacetime is affected by the distribution of matter, it no more accounts for the *origins* of inertia than did Newtonian mechanics or special relativity. This is obvious from the fact that the asymptotic structure of spacetime in general relativity is identical to that of special relativity, so that a body sufficiently isolated from the other masses of the universe would have the same inertial motion as in special relativity. Indeed, Einstein was provoked by this fact to introduce the cosmological hypothesis of a closed universe, so that the problem of the inertia of isolated bodies would be eliminated by fiat. These considerations suggest that general relativity is, in crucial philosophical respects, essentially similar to its two predecessors: all of the theories postulate an objective spatiotemporal structure and specify how physical processes are supposed to exhibit that structure. The move to general relativity rests not on the application of any Machian philosophical principle—whatever the heuristic value such principles may have had for Einstein—but on a deeper physical understanding of the relationship between gravity and inertia.

=====



Subject: Multiverse ?

Date: Mon, 28 Nov 2011 10:43:43 +0200

From: Dimi Chakalov <dchakalov@gmail.com>

To: Courtney Seligman <courtney@cseligman.com>

Cc: [Baron Rees of Ludlow](mailto:mjr@ast.cam.ac.uk) <mjr@ast.cam.ac.uk>, alinde@stanford.edu, vanchurin@stanford.edu

Dear Professor Seligman,

I was struck by your statement at

<http://en.allexperts.com/q/Astronomy-1360/2011/10/whole-shabang.htm>

"For the Multiverse, the chance of its existing is a 9 or 10. The chance of observing any other part of it is a 0."

I am not aware of any meaningful way of defining probabilities about anything in some "multiverse". To begin with, Andrei Linde and Vitaly Vanchurin tried to estimate the number of universes with different geometrical properties in the "multiverse", and came out with a typical Russian number ([arXiv:0910.1589v2](http://arxiv.org/abs/0910.1589v2), p. 3, Eq. 3).

slow-roll inflation. This process may create

$$\mathcal{N} \sim e^{e^{180}} \sim 10^{10^{77}} \quad (3)$$

universes with different geometrical properties. This number is incomparably greater than  $10^{500}$ . If the initial size of the universe is greater than  $H_I^{-1}$ , the total number of different universes is even much greater.

I wonder if you can help.

Kind regards,

Dimi Chakalov

<http://tinyurl.com/Einstein-Prague>

=====  
Subject: [arXiv:1203.0952v1](http://arxiv.org/abs/1203.0952v1) [gr-qc]

Date: Tue, 6 Mar 2012 13:34:47 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Brandon Carter <brandon.carter@obspm.fr>  
Cc: Steven Weinberg <weinberg@physics.utexas.edu>,  
Don Page <profdonpage@gmail.com>,  
Roger Penrose <rouse@maths.ox.ac.uk>

Hi Brandon,

You quoted Steven Weinberg: "Of course everything is ultimately quantum mechanical: the question is whether quantum mechanics will appear directly in the theory of the mind, and not just in the deeper level theories like chemistry on which the theories of the mind will be based."

The Marxist-Leninist views of Steven Weinberg are not surprising, but why would you endorse such crap ?

Look first in your field of expertise:

<http://www.god-does-not-play-dice.net/#Tod>

Take care,

Dimi Chakalov

=====

Subject: The classical limit  
Date: Tue, 29 Nov 2011 13:02:42 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Basil <b.hiley@bbk.ac.uk>  
Cc: [Maurice de Gosson](mailto:maurice.de.gosson@gmail.com) <maurice.de.gosson@gmail.com>,  
[maurice.de.gosson@univie.ac.at](mailto:maurice.de.gosson@univie.ac.at)

Dear Basil,

You mentioned, in your latest [arXiv:1111.6536v1 \[quant-ph\]](https://arxiv.org/abs/1111.6536v1), that a "merit of our approach is that the classical limit emerges naturally without any need to appeal to decoherence." May I suggest to test your ideas with the case examined by Mott,

[http://www.god-does-not-play-dice.net/#Mott\\_Macavity](http://www.god-does-not-play-dice.net/#Mott_Macavity)

I think it would be easier for a camel to pass through the eye of a needle than for your theory to reproduce and explain Mott's 1929 paper.

It's not about probabilities for selecting the direction of particle's propagation in Wilson cloud chamber, as "explained" by Heisenberg in 1930. It's all about [energy exchange](#) between a single quantum particle and its classical environment, so you have all QM at a glance -- the proof of the pudding for your earlier statement in [arXiv:1001.4632v2 \[quant-ph\]](https://arxiv.org/abs/1001.4632v2) that "the answer ultimately lies in information theory".

All the best,

Dimi

=====

Subject: Re: The classical limit

Date: Wed, 30 Nov 2011 15:27:50 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Basil Hiley <b.hiley@bbk.ac.uk>  
Cc: [Maurice de Gosson](mailto:maurice.de.gosson@univie.ac.at) <maurice.de.gosson@univie.ac.at>,  
Maurice de Gosson <maurice.degosson@gmail.com>

Dear Basil,

> Thank you for the reference to the discussion of Mott's work. I am very  
> familiar with the paper just having written a paper explaining just how we  
> see the Bohm theory explains Mott's result: - de Gosson, M., and Hiley, B.  
> J., Zeno Paradox for Bohmian Trajectories: The Unfolding of the  
> Metatron. quant-ph/1001.2622.

I am very familiar with your [arXiv:1010.2622v3 \[quant-ph\]](https://arxiv.org/abs/1010.2622v3), the notion of 'quantum potential energy', and your efforts to explain how continuous observation "dequantizes" quantum trajectories with the quantum Zeno effect.

With the new terminology proposed on p. 4 you posed the question, "What will the trajectory be if we continuously monitor the metatron?"

You quoted Heisenberg's statement: "By path we understand a series of points in space which the electron takes as 'positions' one after another" (p. 13, footnote 2), so if you and Maurice insist on "Hamiltonian character of these trajectories", please explain these sequential 'positions' at which you have simultaneously TWO LAYERS, quantum and classical, of \*energy exchange\*: the first keeps the imaginary phases of the single quantum particle vs. the second one which corresponds to the observed water molecules (the track in Wilson cloud chamber).

With your approximation technique briefly mentioned on p. 14, you and Maurice claim "... which goes to zero when  $N \rightarrow \infty$ ", and "short enough time" (p. 15).

Sorry, this "short enough" is not going to work. You have continuous energy exchange between the TWO LAYERS, which leads to the observed classical trajectory on the second layer, like the trails left in the sky from a jet plane. Then you have to explain both trajectories, on both layers.

Mapping the two layers over a finite time interval, as recorder with your wristwatch, is a formidable challenge, which you and Maurice haven't solved, simply because you can't. If you could, you will "derive" some time operators in your version of QM: reductio ad absurdum.

If you wish to respond professionally, please read carefully my initial email at

<http://www.god-does-not-play-dice.net/#Hiley>

Recall also my email from Sat, 19 Jul 2003 18:16:16 +0300, subject "The actualization of beables". As you stated in your interview in 1997, the notion of implicate order "is not presented as final form, so it needs a lot of exploration and debate." I will be happy to help.

Again, can you "derive" some time operators in your version of QM ?

All the best,

Dimi

On Tue, 29 Nov 2011 13:02:42 +0200, Dimi Chakalov <dchakalov@gmail.com> wrote:  
[snip]

-----

Note: The good thing about math is that you can't disguise your errors with expressions like "... which goes to zero when  $N \rightarrow \infty$ ", and "short enough time." Once you calculate the *exact value* of this "short enough time", the problems with reproducing the **energy** dialogue between the single quantum particle and its monitoring/observing macroscopic counterpart become agonizingly clear.

D.C.  
November 30, 2011

=====

Subject: Re: [arXiv:1205.4102v1 \[quant-ph\]](#)  
Date: Mon, 21 May 2012 23:01:33 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: [Maurice de Gosson](#) <maurice.degosson@gmail.com>  
Cc: hrvoje@thphys.irb.hr, duerr@math.lmu.de,  
zanghi@ge.infn.it, oldstein@math.rutgers.edu,  
tumulka@math.rutgers.edu, b.hiley@bbk.ac.uk,  
norbert.straumann@gmail.com, ulf.klein@jku.at,  
schubneb@phys.ethz.ch, juerg@phys.ethz.ch

On Mon, 21 May 2012 18:47:46 +0200, Message-ID:  
<CAGAkTnzAj7NXjRCOXsd1uKB2tviym+Jpk5ryTtwbQnhKxYPfJw@mail.gmail.com>,  
Maurice de Gosson <maurice.degosson@gmail.com> wrote:

- >
- > Buzz off, idiot!
- >
- >
- > Maurice A de Gosson de Varennes
- > Personal website: <http://www.freewebs.com/cvdegosson/>
- > "Wir Mathematiker sind die wahren Dichter, nur müssen wir das,
- > was unsere Phantasie schafft, noch beweisen."
- > L. Kronecker

Just don't get upset, you're safe, everybody loves you.

I only wish you a peaceful and quiet retirement.

D.C.

On Mon, 21 May 2012 14:22:54 +0300, Dimi Chakalov <dchakalov@gmail.com> wrote:  
[snip]

- >> If you really seriously believe can "formulate Bohmian mechanics in a
- >> unique relativistic-covariant form", don't forget 'the proof of the
- >> pudding' from 1929:
- >>
- >> [http://www.god-does-not-play-dice.net/#energy\\_exchange](http://www.god-does-not-play-dice.net/#energy_exchange)
- >>
- >> It will immediately kill your "relativistic-covariant" Bohmian
- >> mechanics, for reasons explained by Schrödinger in 1931.

=====

Subject: Re: [arXiv:1202.4886v1 \[quant-ph\]](#)  
Date: Thu, 23 Feb 2012 16:56:01 +0200

From: Dimi Chakalov <dchakalov@gmail.com>  
To: Rajat Kumar Pradhan <rajat@iopb.res.in>  
Cc: Richard Mould <richard.mould@stonybrook.edu>,  
T. P. Singh <tpsingh@tifr.res.in>,  
Basil Hiley <b.hiley@bbk.ac.uk>

Hi Rajat,

> While Mott represented one kind of worldview which is very common and  
> popular

Mott represents facts, which run against your paper.

> In reply to your question, let me clarify that the following series is  
> necessary for the detection of a particle: conscious observer ->

Wrong. You can record tracks without any "conscious observer".

Did you read my email? The trajectory in the cloud chamber is continuous, that is, we have a **continuous energy exchange** between **one single** quantum particle and its cloud chamber.

How do you explain this fact known since 1929 ?

> Regarding what the state was during the traversal also cannot be said with  
> certainty unless the above-mentioned practical steps of decoding the  
> information content of the track are gone through.

It's not "decoding the information," Rajat.

**It is energy exchange.**

> Without having knowledge of existence of an object how can we say whether  
> it exists or not?

How does this question relate to Mott paper ?

> Again, you see it depends on our observation.

No it doesn't. Read the paper and the relevant sources; the references are at my web site.

> Hope your question is amply clarified.

See above.

I will appreciate the professional opinion of your colleagues.

All the best,

Dimi Chakalov

On Thu, 23 Feb 2012 04:16:29 +0200, Dimi Chakalov <dchakalov@gmail.com> wrote:

>

>>

> >Dear Dr. Pradhan,

>>

>> You wrote that "the state of the system is primarily a subjective

>> assignment reflecting the observer's state of knowledge about it", and

>> I am surprised that you missed the 1929 paper by Nevill Mott, which  
>> refutes such speculations: you have one single quantum particle which  
>> induces (how?) perpetual condensed state in the Wilson cloud chamber,  
>> without any need for "observer's state of knowledge about it".  
>>  
>> Notice that the issue is not about the direction of the particles'  
>> path, but in the fact that the trajectory in the cloud chamber is  
>> continuous.  
>>  
>> How can you explain it with your ref [21] (P. A. M. Dirac, Principles  
>> of Quantum mechanics, Clarendon press, Oxford, 3rd ed., 1947, p. 48) ?  
>>  
>> I hope Richard can shed some light on the puzzle as well, since he is  
>> also speculating along similar lines.  
>>  
>> The opinion of your colleagues will be greatly appreciated, too.  
>>  
>> Regards,  
>>  
>> Dimi Chakalov  
>>  
>

=====

Subject: Re: Twelve years ago. ....  
Date: Wed, 30 Nov 2011 19:41:05 +0200  
Message-ID:  
<CAM7EKxn9a0aQ1F7mRSpXyDMBkW0C1FWnriHsFi+7CQyKOH0X1g@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Henry Stapp <hpstapp@lbl.gov>  
Cc: Daryl Bem <d.bem@cornell.edu> ,  
Abner Shimony <abner.shimony@gmail.com> ,  
Bill Unruh <unruh@physics.ubc.ca>

Henry:

I still haven't received your reply to my email from Wed, 12 Mar 2008 04:50:42 +0200.

Fifteen years ago, you invited me to your Lab, and even offered me "shelter" during my stay in Berkeley, remember? I was quite tempted to do the trip and show you some simple effects of the human brain, which run against your understanding of QM. Then you raised the issue of my credibility, and asked whether I have some experience with "magic". For if I were some "amateur magician" (exact quote), you warned me that will catch me. Then I somehow lost the desire to see you and discuss the subtleties of Quantum Theory and brain neurophysiology.

Now, regarding your latest arXiv:1105.2053v3 [quant-ph] and the essay by Daril Bem, ref. [1] therein, check out

<http://www.god-does-not-play-dice.net/about.html#China>

No, Henry, **no**. This isn't some "magic trick". You have \*energy exchange\* between the quantum world and a human brain -- not "mind" -- much like the case studied by Nevill Mott,

<http://www.god-does-not-play-dice.net/#Hiley>

Details at

<http://tinyurl.com/Einstein-Prague>

I have a lot to say about your latest manuscript mentioned above, but will skip it, because you obviously aren't interested in any discussion that can prove you wrong. The same tallies to Abner and Bill, regrettably.

Wishing you a nice white Hanukkah,

Dimi

=====

In contrast to electric and magnetic fields, the gravitational field exhibits a most remarkable property, which is of fundamental importance for what follows. Bodies which are moving under the **sole influence** of a gravitational field receive an acceleration, *which does not in the least depend either on the material or on the physical state of the body*. For instance, a piece of lead and a piece of wood fall in exactly the same manner in a gravitational field (*in vacuo*), when they start off from rest or with the same initial velocity.

A. Einstein, *The Gravitational Field*  
<http://www.bartleby.com/173/19.html>

-----

Unlike W. Rindler and [R. M. Wald](#), I managed to "understand" GR only once, as a freshman in June 1972, and it [didn't last long](#). Here are some excerpts, with added emphasis, links and comments, from:

Wolfgang Rindler, *Relativity: Special, General, and Cosmological*, [2nd ed.](#), Oxford University Press, 2006

You sit in a box from which you [cannot look out](#). You feel a 'gravitational force' towards the floor, just as in your living room. But you have *no* way to exclude the possibility that the box is part of an accelerating rocket in [free space](#), and that the force you feel is what in Newtonian theory is called an 'inertial force'. To Einstein, inertial and gravitational forces are identical.

.....

The piano and the ping-pong ball will follow the same worldline! Thus does GR 'explain' Galileo's principle. To Einstein, the law of geodesics is primary, and a natural extension of free motion in inertial frames. 'Gravitational force' is gone.

Since the geometry of spacetime determines its geodesics and thus the motions of free particles, it must be the gravitating masses that determine the geometry. Newtonian **active** gravitational mass (the creator of the field) goes over into GR as the creator of curvature. Newtonian **passive** gravitational mass (that which is [pulled by the field](#)) goes into banishment along with the [ether](#), etc.

.....

One can further distinguish between active and **passive** gravitational mass, namely between that which causes and that which [yields to](#) a gravitational field, respectively. Because of the symmetry of eqn (1.8) (due to Newton's third law), no essential difference between active and passive gravitational mass exists in Newton's theory. In GR, on the other hand, the concept of passive mass does not arise, only that of **active** mass—the source of the field.

It so happens in nature that for all particles the inertial and gravitational masses are in [the same proportion](#), and in fact they are usually made equal by a suitable choice of unit.

.....

The equality of inertial and **active** gravitational mass then remains as puzzling as ever. It would be nice (no, it won't be "nice" at all - D.C.) if the inertial mass of an accelerating particle were simply a

back-reaction to its own gravitational field, but that is **not** the case.

.....

In sum, general-relativistic spacetime is curved. Its curvature is caused by **active** gravitational mass. The relation between curvature and mass is governed by Einstein's famous field equations. Finally, free particles (and photons) have geodesic worldlines in this curved spacetime, which accounts for Galileo's principle.

.....

1.5. Give some examples of the absurdities that would result if the inertial mass of some particles were negative. [For example, consider a negative-mass object sliding on (or under?) a rough table.] It is for reasons such as these that  $mI \geq 0$  is taken as an axiom.

-----

R. M. Wald, The Arrow of Time and the Initial Conditions of the Universe, gr-qc/0507094: "There is no question that our present universe displays a thermodynamic arrow of time. (...) It seems to me to be far more plausible that the answer to the above question as to why the very early universe was in a very low entropy state is that it came into existence in a very special state. Of course, this answer begs the question, since one would then want to know **why** it came into existence in a very special state, i.e., what principle or law governed its creation. I definitely do not have an answer to this question."

-----

Subject: Re: The freely falling bodies display the same acceleration, independent on their compositions: **WHY** ?

Date: Tue, 13 Dec 2011 21:16:41 +0200

Message-ID:

<CAM7Ekx=B7JHfkdQiftA\_jy4K=C+xvG8tQqZ3\_51DbZB=imp-2A@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Orfeu Bertolami <orfeu.bertolami@fc.up.pt>

Cc: Alan Rendall <rendall@aei.mpg.de> ,

David M A Stuart <d.m.a.stuart@damtp.cam.ac.uk> ,

John Friedman <friedman@uwm.edu> ,

John Stewart <j.m.stewart@damtp.cam.ac.uk> ,

John Stachel <john.stachel@gmail.com> ,

Karel V Kuchar <kuchar@physics.utah.edu> ,

Lluís Bel <wtpbedil@lg.ehu.es> ,

"O'Murchadha, Niall" <n.omurchadha@ucc.ie> ,

Lars Andersson <laan@aei.mpg.de>

Dear Orfeu,

> Well, the conventional answer is well known: it is a feature of the  
> space-time, not of the bodies.

My "unconventional" answer is that it is a feature of an Arrow of Space which drives the whole universe en bloc with \*constant acceleration\* (cf. the Java applet in the link below) along some "direction" we just call 'time'. The latter has two components: change-in-space (local mode) and change-of-space (global mode),

<http://tinyurl.com/Einstein-Prague>

Regarding the geodesic hypothesis, Alan Rendall acknowledged: "In elementary textbooks on general relativity we read that the Einstein equations imply that small bodies move on geodesics of the

spacetime metric. It is very hard to make this into a mathematically precise statement which refers to actual solutions of the Einstein equations (and not just to some formal approximations)."

<http://relativity.livingreviews.org/open?pubNo=lrr-2005-6&page=articlesu38.html>

Notice that Alan Rendall didn't even mention that 96% of the stuff in the universe, which is "dark" and moves on some weirdly modified geodesics.

With an Arrow of Space, however, there is no need for any dark \*physical\* stuff, simply because it is replaced with GPIs; see the first link above. As a bonus, you have Quantum Theory reconciled with GR from the outset.

I do hope to see you in Prague next June. We'll have a [jolly good time...](#)

All the best,

Dimi

On Tue, 13 Dec 2011 01:05:29 +0200, Dimi Chakalov <dchakalov@gmail.com> wrote:

>  
>  
>> Because of the Arrow of Space,  
>>  
>> <http://tinyurl.com/Einstein-Prague>  
>>  
>> I trust you have different answers to the question in the subject  
>> line... any chance to see you in Prague next June?  
>>  
>> All the best,  
>>  
>> Dimi  
>>  
>

-----  
**Note:** The first apothegm of GR is that there is no spacetime without matter. To explain this axiomatic statement to my teenage daughter, I asked her to imagine that she cannot "see" her nails unless they are covered with some nail varnish of particular '[color](#)': bare finger nails (the [reference fluid](#)) are unobservable in GR. They are simply [GPIs](#).

Hence the Arrow of Space, which endows all matter with universal "acceleration" that "*does not in the least depend either on the material or on the physical state of the body*" (A. Einstein), represents the *continuous* conversion of GPIs into (**colored**, after the [KS Theorem](#)) physical stuff: it is the **global** "time direction" conjugate to the energy (Anthony Lasenby *et al.*, [arXiv:1008.4061v2](#)), in which the energy of the '*colored* finger nails' is **not** conserved ([Sean Carroll](#)). The energy of the Arrow of Space is conserved only in the so-called global mode of spacetime, by an *almost exact* nullification of two [GPI "charges"](#); cf. Eq. 1, pp. 35-36, in [ExplanatoryNote.pdf](#).

The notions of 'energy' and 'spacetime' should be understood as adjectives: for example, we don't say 'energy' unless we explain 'energy of *what?*', and we don't say "dark" unless we explain what *is* "dark", and [with respect to what](#). So, once we have spacetime identified by its material content, the obvious question is, are **all** features of spacetime identified *exclusively* by the (**colored**) matter?

Nope. There is something '[more](#)' to spacetime, which cannot be derived *entirely* from its material content (for example, try to [reproduce](#) 'one second' with physical stuff conforming to the [Archimedean geometry](#), as in the Gedankenexperiment described by Orfeu Bertolami [above](#)).

Namely, 'there is no matter without its [non-Archimedean](#) GPIs' (the proposed second apothegm of GR, after Plato). The conversion of GPIs into physical ("colored finger nails") stuff is complemented by additional *holistic* effects that cannot *in principle* be derived from matter. One good example is

'[time-orientability](#)'. Another is the [tug-of-war](#) manifestation of gravity. All these are purely *geometrical* effects created by GPIs -- not by Type I matter fields satisfying (supposedly) the [energy conditions](#).

There is no need for any *physical* stuff to create the observable [CDM effect of gravity](#), just as there is no *physical* axis of electron's [spin](#). At large length scales, galaxies rotate (as well as the whole [observable universe](#)) due to the fundamental phenomenon of '[spin](#)' produced by GPIs. By altering the '[invariant finite templates](#)' (cf. Finite Infinity [above](#)), the *physical* content of the rotating galaxy has [no choice](#) but to 'get attracted' toward the "dark" ([non-baryonic](#)) center of that galaxy. By the same token, there is no need for any "[singularities](#)".

As Alan Rendall acknowledged in arXiv:gr-qc/0503112v1, [p. 14](#), "The study of these matters is still in a state of flux." Fine, but we just can fit so much [anomalous matter](#) with [positive energy density](#) in the universe.

Now, imagine the elementary building block of geometry as *dimensionless* infinitesimal -- just think of it as *something* with "size" tending asymptotically toward zero, just like '[the empty set  \$\mathbf{R}\$](#) '. This 'something' isn't matter but geometry -- 'the grin of the cat without the cat', as observed by Alice.



The first apothegm of GR is that there is no 'smile' without the 'cat'; the second one is that the physical 'cat' and its purely geometrical 'smile' are *dynamical* due to their negotiations facilitated by [GPIs](#). The whole issue is about the genuine dynamics of GR.

What is the fundamental 'tick' of time -- the "intrinsic time interval associated to any timelike displacement" (Ted Jacobson, pp. [18-19](#))? We never say that 'the *rate* of time' can be expressed with 'time', say, 1000 ms per second. Neither can we reconstruct a *finite* volume of space (say, a sphere with radius [one meter](#)) with some *finite* element that has *spatial* nature and conforms to the [Archimedean Axiom](#).

The fundamental "displacement" **of spacetime** can *only* be produced by an Arrow of Space, as 'change-*of*-space' along some "direction" which we simply call 'time'.

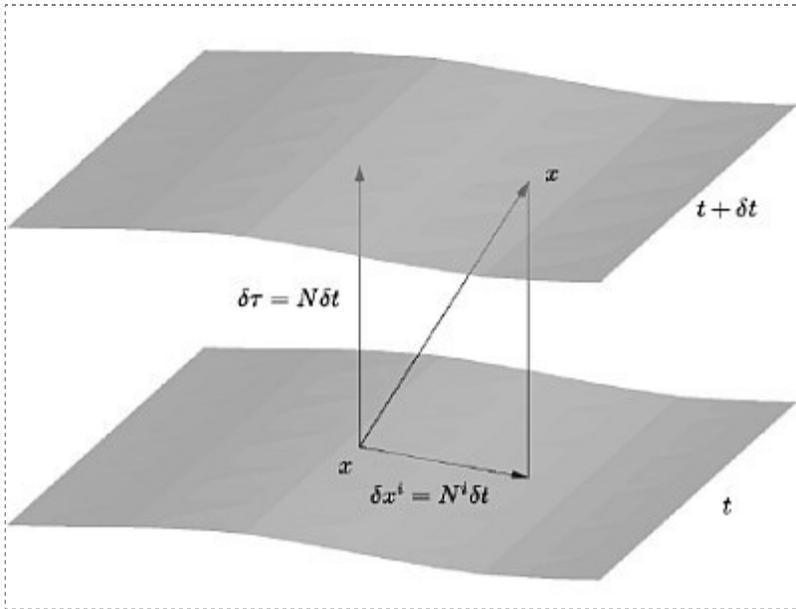


The fundamental "displacement" itself is **not** present in the local mode of spacetime: it is hidden, *by* what we call '[speed of light](#)', **]between[** any two adjacent points from the *manifold* of the local mode, rendering the latter a *perfect* continuum. The fundamental Aristotelian Connection, which transfers physical influences in such *perfect* continuum with speed not exceeding the "speed" of light in vacuum, is executed by 'the whole universe as ONE' placed **]between[** any two adjacent points from the *manifold* of the local mode of spacetime. Hence the Aristotelian Connection is *physically* non-existent -- an Unmoved Mover, as stressed by [Karel Kuchar](#).

**NB:** Notice the new form of retarded causality (called biocausality), resulting from such *re-created*, at each and every instant 'now' from the Arrow of Space, [Phoenix Universe](#) -- the concept of [Final Cause](#) ("the end (*telos*), that for which a thing is done", Aristotle, *Physics* 194b33) **complements** the relativistic causality, in line with Conway-Kochen [Free Will Theorem](#): "It also makes it clear that this failure to predict is a merit rather than a defect, since these results involve free decisions that the universe has **not yet** made." Stated differently, the fate of the universe is UNdecidable, being opened to brand new events emerging from 'the unknown unknown'. Every instant 'now' from the Arrow of Space contains *more* information unfolding from 'the *Noumenon* at [absolute rest](#)', and such 'information gain' is irreversible.

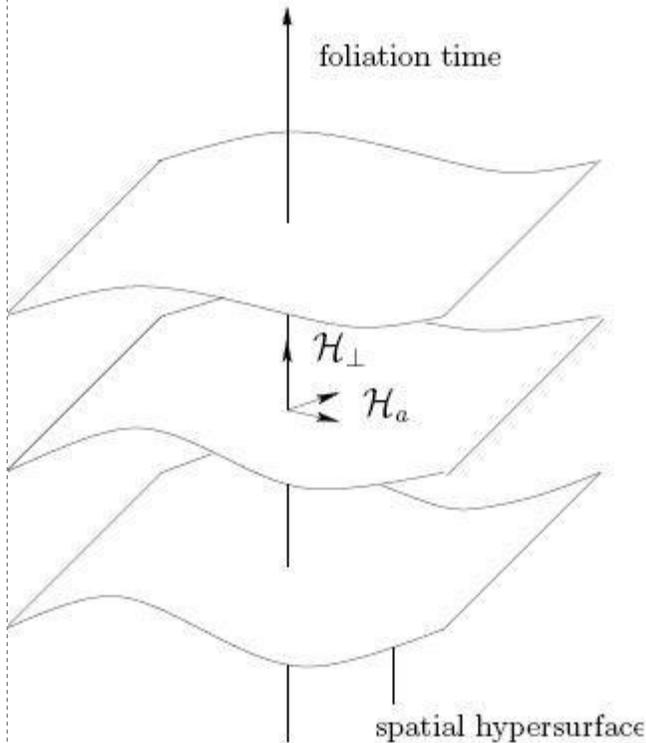
Briefly, the fundamental dimensionless "displacement" -- [the empty set  \$\mathbf{R}\$](#)  -- does **not** have generic temporal or spatial nature. It builds up -- dynamically, with the Arrow of Space -- the spacetime *continuum* equipped with '[speed of light](#)'. It is nothing but a *dimensionless* and *purely geometrical* entity, called here Aristotelian Connection.

So, the ADM picture below is highly misleading, to say the least, because it suggests some *finite* size of the *dimensionless* infinitesimal, and then literally *installs* some "lapse" and "shift" *inferred* from the postulated '[time-orientability](#)' that has been introduced by hand from thermodynamics (Sic!) from the outset. It's a bit like saying that 'heat' is due to some tiny little and very hot particles, instead of searching for [the emergent phenomenon at work](#), by reducing 'heat' to something that is anything but 'hot'. Such efforts are in the same vein of those *post hoc* "[anthropic principles](#)" in [cosmology](#).



Nevertheless, consider the drawing above as two snapshots taken from the "dark room" with our "[torch](#)", as you do in [GR textbooks](#). Suppose you can produce infinitely many (uncountably infinite) snapshots like those above, then [stack them](#) along the "skewer" of the Arrow of Space like [Photoshop layers](#), and [flatten](#) them onto one (.JPG) image -- you will end up with a [timeless "trajectory"](#) immersed in a dead frozen block universe, in which "time" can evolve just as much as "space" can: "There is no dynamics *within* space-time itself: nothing ever moves therein; nothing happens; nothing changes" ([Robert Geroch](#)). You can never trace down the "[dark energy](#)" that has been [smuggled](#) into this flattened (.JPG) image from the "[dark room](#)", and can never solve the [Cauchy problem](#) for the Einstein field equations either.

**NB:** It is wrong to suggest "splitting" of spacetime by imagining one *dimensionless* infinitesimal geometrical point *on* which **four** distinguishable vectors are "erected" -- three "tangential" and one "orthogonal", as in the drawing below, just as it is wrong to even *think* of some "[center of the balloon](#)" (or "[big bang](#)") residing some  $13.75 \pm 0.13$  billion years down the road along the "orthogonal" vector.



**Fig. 1.** The above plot shows the (3 + 1)-decomposition of a four-dimensional spacetime. Spatial hypersurfaces are stacked together along a foliation parameter. The components of the Hamiltonian tangential and perpendicular to the hypersurfaces are shown (but note that there are actually three components tangential to the hypersurfaces).

The drawing above shows only the **kinematics** of GR -- 3-D space at *one* dead frozen instant. The genuine **dynamics** GR needs **infinitely many instants** at which the negotiations between the two sides of the Einstein filled equations are already settled. You can't take this 'one dead frozen instant' from the kinematics of GR and use it to model the dynamics of GR, because you don't have some fixed background spacetime on which to "unfold" the dynamics by unitary transformations of 'states' resembling different states of a kaleidoscope, say.

To sum up, recall the 'laws of an instant' ([Karel Kuchar](#)) and the rigorous proof of Charles Torre that GR is not a parameterized field theory.

I can also offer a selection of excerpts (emphasis added) from the Lecture Notes of Harvey S. Reall [[Ref. 1](#)], which can (hopefully) explain the issues of geodesic hypothesis in a "curved spacetime" and the 'time-orientability', introduced in GR just 'by hand', that is, with magic. The [Arrow of Space](#) is supposed to eliminate that "magic", and replace the alleged "curvature" of spacetime ([John Baez](#))

with 'properties of *the* Aristotelian Connection'. The metric is dynamical and global-time-dependent: 'constant gravitational field' [Ref. 2] pertains only to *one* snapshot 'now' from the Arrow of Space, about which we can indeed say that "there's energy in the gravitational field, but it's negative, so it exactly cancels the energy you think is being gained in the matter fields" (Sean Carroll).

Briefly, if you picture 'the whole universe' defined with [Finite Infinity](#) as a [school of fish](#), its bootstrapping gravitational energy will pertain (and could only be defined) to 'the whole universe/school', yet the [gravitational energy](#) at each **point** from the *quasi-local* geodesic of each and every ([colored](#)) fish will be perfectly well localized -- dynamically, one-at-a-time, along the Arrow of Space -- with strictly [positive mass](#). The latter will exhibit "[runaway motion](#)", being chased by its "negative" GPI counterpart from the global mode of spacetime, and will be endowed with [free fall](#), as discovered by Galileo in [1638](#).

Following the rule 'think globally, act locally', the influence from 'the school of fish' on every *quasi-local* fish will be camouflaged as '[self-force](#)', and the [poor fish](#) will be bewildered by its own "[dark energy](#)" forever. We should be smarter.

Yes, we'll have a [jolly good time in Prague...](#) provided I am [allowed to talk](#). The task is [strictly mathematical](#), and cannot be explained with any poster.

D. Chakalov

December 14, 2011

Last updated: December 27, 2011, [15:16:47 GMT](#)

[Ref. 1] *General Relativity 2011*, by Harvey S. Reall, [December 2, 2011](#).

Sec. 3.3, Geodesics, p. 37:

**Example.** In Minkowski spacetime, the components of the metric in an inertial frame are constant so  $\Gamma_{\nu\rho}^{\mu} = 0$ . Hence the above equation reduces to  $d^2x^{\mu}/d\tau^2 = 0$ . This is the equation of motion of a free particle! Hence, in Minkowski spacetime, the free particle trajectory between two (timelike separated) points  $p$  and  $q$  extremizes the proper time between  $p$  and  $q$ .

This motivates the following postulate of General Relativity:

**Postulate.** Massive free particles follow curves of extremal proper time, i.e., solutions of equation (3.24).

**Definition.** Solutions of equation (3.24) are called *geodesics*.

**Remarks.** 1. Massless particles obey a very similar equation which we shall discuss shortly. 2. In Minkowski spacetime, (timelike) geodesics *maximize* the proper time between two points. In a curved spacetime, this is true only *locally*.

Sec. 5.2, Energy-momentum tensor, pp. 55-56: "Gravitational energy certainly exists but not in a local sense."

In GR (and SR) we assume that continuous matter always is described by a conserved energy-momentum tensor:

**Postulate.** The energy, momentum, and stresses, of matter are described by an *energy-momentum tensor*, a  $(0, 2)$  symmetric tensor  $T_{ab}$  that is *conserved*:  $\nabla^a T_{ab} = 0$ .

-----  
One might think that one could obtain global conservation laws in curved spacetime by introducing a definition of energy density etc for the gravitational field. This is a subtle issue. The gravitational field is described by the metric  $g_{ab}$ . In Newtonian theory, the energy density of the gravitational field is  $-(1/8\pi)(\nabla\Phi)^2$  so one might expect (e.g. from eq. (3.28)) that in GR the energy density of the gravitational field should be some expression quadratic in first derivatives of  $g_{ab}$ . But we have seen that we can choose normal coordinates to make the first partial derivatives of  $g_{ab}$  vanish at any given point. Gravitational energy certainly exists but not in a local sense.

Sec. 8.4, The energy in gravitational waves, pp. 93-95: "Gravitational waves carry energy away from the source. Calculating this is subtle: as discussed previously, there is no local energy density for the gravitational field."

Unfortunately,  $t_{\mu\nu}$  suffers from a major problem: it is not invariant under a gauge transformation (8.14). This is how the impossibility of localizing gravitational energy arises in linearized theory.

Nevertheless, it can be shown that the *integral* of  $t_{00}$  over a surface of constant time  $t = x^0$  is gauge invariant provided one considers  $h_{\mu\nu}$  that decays at infinity, and restricts to gauge transformations which preserve this property. This integral provides a satisfactory notion of the *total* energy in the linearized gravitational field. Hence gravitational energy does exist, but it cannot be localized.

Sec. 11.5, [Global hyperbolicity](#), p. 126:

## 11.5 Global hyperbolicity

**Remark.** At any point in spacetime, the tangent space contains a pair of lightcones which we would like to regard as "future" and "past" lightcones. To do this globally we need spacetime to be time-orientable. Some terminology: "causal" means "timelike or null".

**Definition.** A spacetime is *time orientable* if it admits a *time orientation*: a smooth, nowhere vanishing timelike vector field  $T^a$ . A causal vector  $X^a$  is *future-directed* if  $X_a T^a < 0$  and *past-directed* if  $X_a T^a > 0$ . A causal curve is future (past) directed if its tangent vector is future (past) directed.

A positive definite metric is presupposed in any measurement: lengths, angles, volumes, etc. The length of a vector  $X$  is introduced as

$$\|X\| = (X, X)^{1/2}.$$

A metric is *indefinite* when  $\|X\| = 0$  does not imply  $X = 0$ . It is the case of Lorentz metric, which attributes zero length to vectors on the light cone.

The length of a curve  $\gamma : (a, b) \rightarrow M$  is then defined as

$$L_\gamma = \int_a^b \left\| \frac{d\gamma}{dt} \right\| dt.$$

Given two points  $p, q$  on a Riemannian manifold  $M$ , consider all the piecewise differentiable curves  $\gamma$  with  $\gamma(a) = p$  and  $\gamma(b) = q$ . The distance between  $p$  and  $q$  is defined as the infimum of the lengths of all such curves between them:

$$d(p, q) = \inf_{\gamma(t)} \int_a^b \left\| \frac{d\gamma}{dt} \right\| dt. \quad (2.18)$$

In this way a metric tensor defines a distance function on  $M$ .

§ 3.42 Finite distances in space have no meaning in the general case, in which the metric is time-dependent. If we integrate  $\int dl$  and take the infimum (as explained in § 2.45), the result will depend on the world-lines. Only constant gravitational fields allow finite space distances to be defined.

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*In rebus mathematicis errores quam minimi non sunt contemnendi.*  
Bishop George Berkeley

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Subject: The Big Question, by Paul Tod  
Date: Tue, 20 Dec 2011 13:13:28 +0200  
Message-ID:  
<CAM7EkxmoeWBtDQ2Wv1cuwJmWw1aoR5pE3-qXOo-ReqfOaUeueg@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>

To: Paul Tod <tod@maths.ox.ac.uk>  
Cc: George <george.ellis@uct.ac.za>,  
Jörg Frauendiener <joergf@maths.otago.ac.nz>,  
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Alan Rendall <rendall@aei.mpg.de>,  
[Helmut Friedrich](mailto:hef@aei.mpg.de) <hef@aei.mpg.de>,  
Richard Schoen <schoen@math.stanford.edu>,  
Piotr T Chrusciel <piotr.chrusciel@univie.ac.at>

Dear Dr. Tod,

Regarding your 'Big Question' posed at '50 years of the Cauchy problem in General Relativity' (cf. attached), I believe the Cauchy data themselves do not "evolve" at all, and have tried to suggest alternative ideas about Geroch-Kronheimer-Penrose ideal points and [Finite Infinity](#) (GFR Ellis) as a [causal boundary](#).

<http://tinyurl.com/Einstein-Prague-details>

<http://tinyurl.com/Einstein-Prague>

I will be happy to see you and your colleagues in Prague next June. The task boils down to suggesting a new (to the best of my knowledge) differentiable structure of the manifold used to model 'spacetime'.

Wishing you and your colleagues a nice white Christmas,

Yours sincerely,

Dimi Chakalov

• The Big Question: which Cauchy data evolve to give a smooth  $\phi$  ?

-----  
**Note:** Suppose you chase somebody on the street (let's call him John), and any time you catch him, he leaves his jacket in your hands. You can't **catch** John. Just his jackets -- one-at-a-time. You also *believe* that he has a set (or is it strictly a set?) of jackets with different probability-for-catching, and you also deeply believe and hope that this set can be normalized, *i.e.*, the sum of probability-for-catching his jackets is unity. This elusive John does *not* wear any jacket by default (cf. the Kochen-Specker Theorem [above](#)) -- neither *before* nor *after* you catch his "current" jacket<sup>1</sup>. John is simply an [GPI](#), and lives in the so-called global mode of spacetime. So, if you manage in GR<sup>2</sup> to catch his jacket like a [bartender](#), don't even think you've caught John: he is a special causal boundary, placed at [Finite Infinity](#), which pertains to the whole universe as ONE.<sup>3</sup> Depending on the "direction" we look at John from the physical (local) mode of spacetime, his "size" would seem to be either 'tending asymptotically toward zero' or 'tending asymptotically toward infinity', while he is, and will always remain, ONE entity. Which is why we need a new differentiable structure of the manifold used to model 'spacetime', which will be "quantised" from the outset, as argued [above](#) (prompted by Tod's adjective 'smooth' and '*the smoothest manifold*' usually mentioned in footnotes; cf. Lars Andersson [above](#)).

Stated differently, [John 1:1] is always at 'absolute rest', [residing within the instant 'now'](#) from the

Arrow of Space. What we celebrate at Christmas is an entirely different thread.

D.C.

December 20, 2011

Latest update: December 21, 2011

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<sup>1</sup> In general, a variable *has* no definite value before I measure it; then measuring it does *not* mean ascertaining the value that it *has*. But then what does it mean?

Erwin Schrödinger, [1935](#)

<sup>2</sup> In the first place, we entirely shun the vague word "space," of which, we must honestly acknowledge, we cannot form the slightest conception.

Albert Einstein, [1920](#)

<sup>3</sup> Notice the inability of mathematical physicists to explain this **quantum spacetime** phenomenon: for example, [José M.M. Senovilla](#) acknowledged (emphasis added) that "singularities (...) clearly reach, or come from, the *edge* of space-time. This is some kind of boundary, or margin, which is **not** part of the space-time but that, **somehow**, it is accessible from within it." The meaning of "somehow" refers to [Thompson's lamp](#) paradox; the meaning of "accessible from within it" is the recipe of [bartenders](#), and the meaning of "**not** part of the space-time" is explained with John's jackets story above: the "jackets" are indeed "accessible from within" spacetime. John isn't. The mathematical solution is 'out there', waiting to be uncovered, after the astonishing effectiveness of mathematics in the natural sciences ([Eugene Wigner](#)).

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Subject: [Relativity and Gravitation, Prague, June 25 - 29, 2012](#)

Date: Thu, 22 Dec 2011 14:15:11 +0200

Message-ID:

<CAM7Ekxmkc5YGHXUtNqN9WsVF9GprcJgPY9Vs6=er2D\_g05Y7Ng@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Hermann Nicolai <Hermann.Nicolai@aei.mpg.de>

Cc: Thomas Thiemann <thiemann@theorie3.physik.uni-erlangen.de>

Dear Dr. Nicolai,

I submitted the abstract of my intended oral presentation at the Conference in Prague next June. I would like to suggest an Arrow of Space, which requires a new quantisation of the gravitational field, preserving the continual nature of spacetime at all length scales; please see some of the prerequisites at

<http://www.god-does-not-play-dice.net/#Tod>

I wonder if you would endorse my oral submission to the Conference. Will be happy to provide specific details on my intended talk.

A shorter version of my proposal for quantisation of spacetime was submitted at GR 17 (July 2004), but Dr. Thiemann downgraded my talk to poster presentation, which I had to decline -- I cannot compete with the proponents of the "splitting of spacetime" with a poster.

Looking forward to hearing from you,

Yours sincerely,

Dimi Chakalov

<http://tinyurl.com/Einstein-Prague>

=====

Subject: [Remark on causality and particle localization](#), Phys. Rev. D 10, 3320-3321 (1974)  
Date: Mon, 27 Feb 2012 23:00:20 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Gerhard C Hegerfeldt <gerhard.hegerfeldt@physik.uni-goettingen.de>  
Cc: Hermann Nicolai <Hermann.Nicolai@aei.mpg.de>,  
Thomas Thiemann <thiemann@theorie3.physik.uni-erlangen.de>,  
Alfredo <amac@xanum.uam.mx>,  
Jeremy <jb56@cam.ac.uk>

Dear Dr. Hegerfeldt,

Thank you very much for the copies from your articles, which were received today. I particularly liked your 1974 'Remark on causality and particle localization' -- it is a joy to read (and to hold paper in my hands, instead of reading .pdf files on my PC screen).

May I share with you my unsolicited thoughts. Your first assumption, (i), and 'Definition' (p. 3320) is 'strict localizability in  $V$  with unit probability'. You elaborated a bit on the causality conundrum (ii) on p. 3321, by suggesting modification of assumption (i), "although this would mean a departure from the customary rules of quantum mechanics."

Bingo! You hit the nail on the head: strict localizability at a point  $x$  in  $V$  with unit probability can be possible only if the particle is '[quasi-local](#)' -- please see the story about John's jackets and the interpretation of Kochen-Specker Theorem at

<http://www.god-does-not-play-dice.net/#Tod>  
<http://www.god-does-not-play-dice.net/#Joel>

The departure from the "customary rules of quantum mechanics" has been anticipated by Erwin Schrödinger in 1935 and in 1950; the references are at my web site.

If you disagree with my interpretation at the links above, please try to explain the continuous energy exchange between one single quantum particle and its macroscopic environment, after Nevill Mott,

[http://www.god-does-not-play-dice.net/#energy\\_exchange](http://www.god-does-not-play-dice.net/#energy_exchange)

BTW [Hermann Nicolai](#) suggested on SAT 1 TV (June 7, 2004) that the classical world emerges from Feynman paths. Can you explain smooth bi-directional transitions between the quantum realm and the world of tables and chairs?

Thank you, once more, for your beautiful articles.

Kind regards,

Dimi Chakalov

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**Note:** Look at T. G. Downes, G. J. Milburn, Optimal Quantum Estimation for Gravitation, [arXiv:1108.5220v1 \[gr-qc\]](#), Sec. 6:

## 6 Estimating the expansion of the universe

For our final example we shall consider the spatially flat Friedmann-Robertson-Walker cosmology. This is a universe filled with a uniform density of galaxies. At any instant in time, in the co-moving frame of the galaxies, the universe looks the same everywhere (homogeneous) and in all directions (isotropic). The metric for this universe is given by [1];

$$ds^2 = -dt^2 + a^2(t) [dx^2 + dy^2 + dz^2]$$

where  $t$  is the proper time of an observer co-moving with any of the galaxies. The spatial coordinates  $x, y, z$  describe the homogeneous and isotropic surfaces of constant proper time  $t$ . The function  $a(t)$ , known as the expansion parameter, is the ratio of the proper distance between any two galaxies at the initial time  $t = 0$  and the time  $t$ .

During an infinitesimal duration of proper time  $dt$  a photon will travel the distance  $d\eta = \frac{dt}{a(t)}$ . It is convenient to use this as the time parameter.

What kind of 'time' is implied in the function  $a(t)$  ? With respect to what ? More below.

D.C.

February 28, 2012

=====  
Subject: The continuum limit toward classical gravity vs. [arXiv:1105.3385v2 \[gr-qc\]](#)  
Date: Fri, 3 Feb 2012 05:18:05 +0200  
Message-ID:  
<CAM7Ekxmt\_+7YZW\_3AStcduZGTHOrCuQGqVsbmBMOBXSZOKyRGQ@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
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[thiemann@theorie3.physik.uni-erlangen.de](mailto:thiemann@theorie3.physik.uni-erlangen.de),  
rovelli.carlo@gmail.com,  
[George](mailto:George<george.ellis@uct.ac.za>) <george.ellis@uct.ac.za>

Dear Johannes,

I'm afraid you cannot suggest any quantum gravity hypothesis with which you could hope to reach the \*continuum limit toward classical gravity\*, such that we could "look around, and see as far as we can" (L. Smolin, *Three Roads to Quantum Gravity*, p. 205). That's 'the proof of the pudding' for any viable approach toward quantum gravity, isn't it ?

But you don't have this 'proof of the pudding' even in GR: "If the theory does not allow us, even in principle, to extend solutions arbitrarily far in one direction, it may be difficult to view this direction

as a dimension of the world", says M. Bojowald in 'Relativity and the Dimensionality of the World' (ed. by Vesselin Petkov, Springer, 2007, Ch. 8, p. 149).

If you agree, we should fix GR in the first place; for example, check out my efforts to amend George's **Fi** at

<http://www.god-does-not-play-dice.net/#Beig>

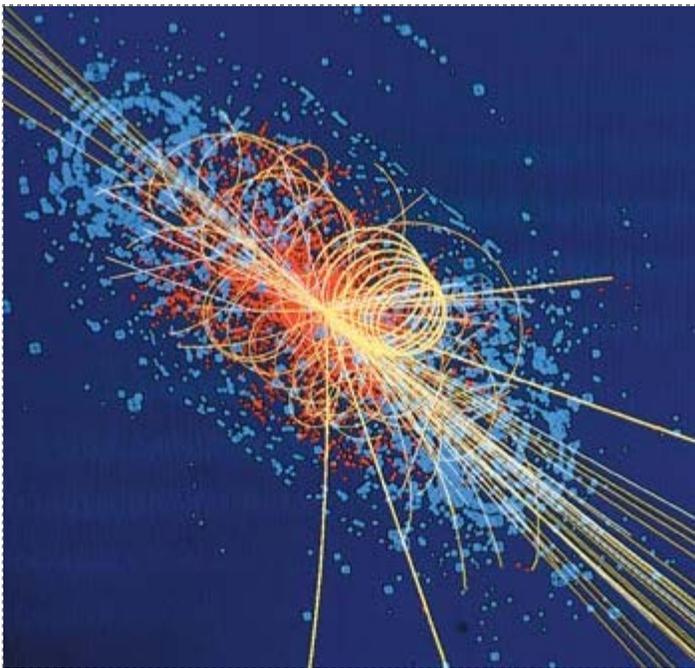
I will appreciate your professional comments, as well as the opinion of your colleagues.

All the best,

Dimi

=====

We haven't the money, so we've got to [think!](#)  
Lord Rutherford, 1962 Brunel Lecture, 14 February 1962



In the winter of 1987, I had a huge discussion at [BG Academy of Sciences](#) with a theoretical physicist with PhD from Dubna ([USSR](#)), who claimed that there is no problem of reconciling QM with Special Relativity: 'look at the tracks from particles, and measure their duration with your wristwatch -- a single quantum particle, with perfectly defined energy states along a continual trajectory -- where's da problem' ?

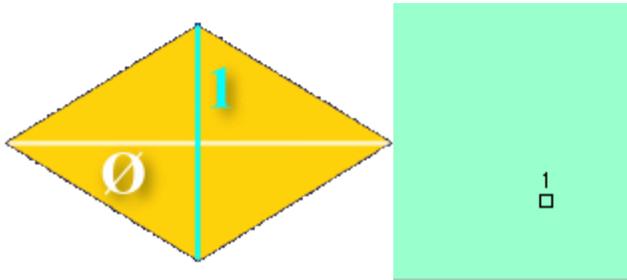
It isn't a problem but an ultimate paradox: you can *think* of elementary particles as invisible Frisbees that leave tracks in [modern detectors](#), as well as *think* about their instantaneous energy states and coordinate time à la [Lev Landau](#), but to apply your "thinking" to Quantum Theory you need two *very* different things: the "[jackets](#)" from John, and John himself. The latter is a [GPL](#), while the former are its 'shadows on Plato's cave' that *trigger* the appearance of tracks at the length scale of tables and chairs.

The issue was identified by Nevill Mott in 1929, and continues below. The sole difference is that now

it involves billions and billions of Euro, taxpayers' money.

D. Chakalov  
January 8, 2012

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Subject: "I bet \$100 that the Higgs will not be discovered". Thursday, January 9, 2003, 15:56:04 GMT

Date: Fri, 6 Jan 2012 16:37:26 +0200

Message-ID:

<CAM7EkxkQL\_i596TAdv33o81GY1iwaPyq1ZXGceQMVnzWMtaX4w@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Roman Jackiw <jackiw@ins.mit.edu>

Cc: Giuseppe Vitiello <vitiello@sa.infn.it> ,

Robert Jaffe <jaffe@mit.edu> ,

georgi@physics.harvard.edu ,

philip.mannheim@uconn.edu ,

maccone@unipv.it ,

bryan.sanctuary@mcgill.ca ,

djm@hep.ucl.ac.uk ,

James.Gillies@cern.ch ,

owgreen@umd.edu ,

witten@theory.caltech.edu ,

wilczek@mit.edu

Dear Roman,

Nine years ago, you were very skeptical about my \$100 bet against the discovery of the Higgs boson(s). The latter are GPIs,

<http://tinyurl.com/Einstein-Prague>

I reinstate my bet, and extend it to all your colleagues.

Regards,

Dimi

-----

I bet \$100 that the Higgs will not be discovered. Instead, the number of quarks will jump to 8 and more, in a Fibonacci sequence.

D. Chakalov

Thursday, January 9, 2003, 15:56:04 GMT

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**Note:** Back in January 2003, I offered this bet to *at least* 135 theoretical physicists (could be many more, because at some point I lost track of my huge mailing lists). The only reply came from Roman Jackiw, in a *very* informal email, which I keep private.

Nobody from CERN acknowledged my email. As [Johann Makowsky](#) noted (*The Jerusalem Post* 19.4.1985), "Overfunded research is like heroin: It makes one addicted, weakens the mind and furthers prostitution." These people at CERN have [billions and billions](#) of Euro at the tip of their fingers, so why should they care about the unresolved task known since 1929, from [Sir Nevill Mott](#)? Although [they](#) don't use the ancient [cloud chambers](#), the fundamental puzzle of the tracks remains [unsolved](#). In fact, **all** unresolved tasks in QM are captured with the puzzle from [Sir Nevill Mott](#).

Going back to the bet: think of the quantum world as possessing different "layers" of [GPIs](#), with different "[volumes](#)" of *potential* observables explicated by [GPIs](#).

At the **first** layer of non-relativistic QM, the GPIs absorb the 'latent observables', after [Henry Margenau](#); at the **second** layer the GPIs absorb what Henry Margenau called 'possessed observables': in [QCD](#) the mass of elementary particles is "decomposed" with the so-called quarks, which are totally "[confined](#)" by default. At the time Murray Gell-Mann coined the term 'quarks', only three quarks were discovered; the situation now is far more [complicated](#), mainly because there is no theory to predict the exact mass of the mythical [Higgs boson\(s\)](#). Yet there should exist a **third** layer at which the electron can be "decomposed" with quarks ([C. Kodejska](#) and [J. Markovitch](#)), and I bet people will notice that quarks too follow a [Fibonacci sequence](#): [pentaquark](#), octaquark, tridecaquark, *etc.*

Would you believe that Mother Nature has missed the [quarks](#), only because [people](#) don't have a proper theory?

I don't know how quarks are related to Georgi's [unparticles](#), so I can't be more specific. But the idea that the very entity which endows particles with 'mass' would in turn possess 'mass' seems very primitive to me. Do we explain heat with some tiny little, *very* hot particles? This is a typical Marxist-Leninist philosophy, which just can't be correct.

Think of the school of fish [above](#) as the standard model: all fish interact *via* "bosons" (explanation from Giuseppe Vitiello [here](#)). Think of the "background field" and the "clustering in the Higgs field" from [David J. Miller](#) as [influences](#) from 'the school' on its bosons: the mechanism for "giving other particles mass" (*idem*) is real (in the sense that the W and Z bosons were detected), but the "[god particle](#)" *itself* isn't. It cannot be derived from the framework of the standard model: it is an 'undecidable proposition' (Kurt Gödel), which can be clarified only in some meta-theory that includes the electron. And then the quarks will display its [Fibonacci sequence](#); details from [T. E. Phipps Jr.](#) The same '[school of fish](#)'-phenomenon from the [Arrow of Space](#), implemented at macroscopic scale, endows matter with [self-acting](#), without any real "[graviton](#)" -- in both cases we have a field that carries its [own charge](#) [[Ref. 1](#)].

To avoid any misunderstandings, let me formulate the thesis as clear as possible:

**NB:** There exists a fundamental feature of the spacetime itself, which *cannot* be reduced to the properties of classical and quantum fields, and which endows all matter and fields with the faculty of '[self-acting](#)'. In the quantum realm, this *non-linear* phenomenon is implemented with "clustering in the Higgs field" ([David J. Miller](#)), but "without there being a Higgs boson" (*idem*), while at the length scale of classical physics the same *non-linear* phenomenon is implemented with what we call 'gravitation', without any real "[graviton](#)" either. In both cases, matter and quantum fields **interact** with [themselves](#) *via* their [GPI states](#) placed in the *potential future* of the [Arrow of Space](#). No **real** particle is embodied as 'carrier' of this fundamental interaction -- it is a feature of the spacetime itself, and *cannot* be reduced to, nor derived from, the *physical* properties of classical and quantum fields. The latter emerge as the result from a spontaneous broken symmetry of the [GPI states](#) of two mass "charges" [[Ref. 1](#)], one of which is being *completely* eliminated as 'physical reality', in the sense that it [cannot be physically observed](#), leaving *only* the unique pattern of [self-acting](#) cast on the physical (positive) mass, and a *remnant* from the spontaneous broken symmetry in the quantum vacuum. The remnant has finite non-zero positive mass, and is being interpreted as "dynamical dark energy" (DDE), without any possibility to trace back its [source](#). Any efforts at interpreting the *source* of DDE as 'physical stuff with positive energy density and [negative pressure](#)' ("the stress-energy tensor of the vacuum *must* be [Lorentz invariant](#)", [Ned Wright](#)) *must* be wrong.

I believe the 'thesis' above is falsifiable, albeit indirectly, by the claim of being 'unique and the only possible': any alternative approach toward the origin of (i) the [free fall](#), (ii) the Higgs boson(s), and (iii) the "dynamical dark energy" ([DDE](#)) must necessarily be **wrong**.

Regarding (ii), the 'total field of as yet unknown structure' (Albert Einstein), called here '[GPI field](#)', is not like "**other** quantum fields": it does not have "its **own** representative" [[Ref. 1](#)] in the quantum world, just as the gravitational field does not, and **cannot** have some dedicated material carrier of the [non-linear](#) gravitational interactions, in terms of some "[graviton](#)". The quest for detecting the "god particle" is about [quantum gravity](#).

There's nothing more important than [quantum gravity](#). Nothing else matters.

Anyway, if there is no reply to my bet [above](#), I can make it more attractive by switching to Euro -- € 100. By the time [LHC](#) proves the non-existence of Higgs boson(s) and people realize that the number of quarks will jump to 8 and more in a [Fibonacci sequence](#), the U.S. dollar may [collapse](#) and I would have to raise the bet to \$1000. *Not* a good idea.



Perhaps it is time to bet with Euro. Or maybe [Yuan](#)?

D.C.

January 6, 2012

Last updated: January 11, 2012, [15:12:46 GMT](#)

[Ref. 1] The Nobel Prize in Physics 2008: Unravelling the hidden symmetries of nature. The Royal Swedish Academy of Sciences, October 16, 2008, [pp. 7-8](#)

Higgs provides mass

The question of the mass of elementary particles has also been answered by spontaneous broken symmetry of the hypothetical Higgs field. It is thought that at the Big Bang the field was perfectly symmetrical and all the particles had **zero mass**. But the Higgs field, like the pencil standing on its point, was not stable, so when the universe cooled down, the field dropped to its lowest energy level, its own vacuum according to the quantum definition. Its symmetry disappeared and the Higgs field became a sort of syrup for elementary particles; they absorbed different amounts of the field and got different masses. Some, like the photons, were not attracted and remained without mass; but **why** the **electrons acquired mass** at all is quite a different question that no **one has answered yet**.

Like **other** quantum fields, the Higgs field has its **own** representative, the Higgs particle. Physicists are eager to find this particle soon in the world's most powerful particle accelerator, the brand new [LHC at Cern in Geneva](#). It is possible that several different Higgs particles will be detected – or **none at all**.

Other theories exist, some more exotic, some less so. In any case, they are likely to be symmetrical, even though the symmetry may not be evident at first. But it is there, keeping itself **hidden** in the seemingly messy appearance.

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**Comment:** At the Beginning (forget about "[big bang](#)"), the [GPI field](#) was indeed "perfectly symmetrical": check out **Eq. 1** on p. 35 from [ExplanatoryNote.pdf](#) and **Fig. 1** from 'Finite Infinity

(Second Edition)' [above](#). The "spontaneous" broken symmetry is what eliminates all "negative mass", at *each and every* instant 'now' from the [Arrow of Space](#) -- not just at the Beginning, but right now as well, as you're reading these lines. To understand the mechanism of eliminating all "negative mass," we need first to understand the origin of the positive mass and its ubiquitous '[free fall](#)' from the [Arrow of Space](#).

Notice that the 'standard model' does not incorporate gravity and never will, because it can't. People at CERN should at least try to incorporate the electron, and check out how many quarks will show up in such leptiquark model (hint: forget about "supersymmetry" and "Higgs boson").

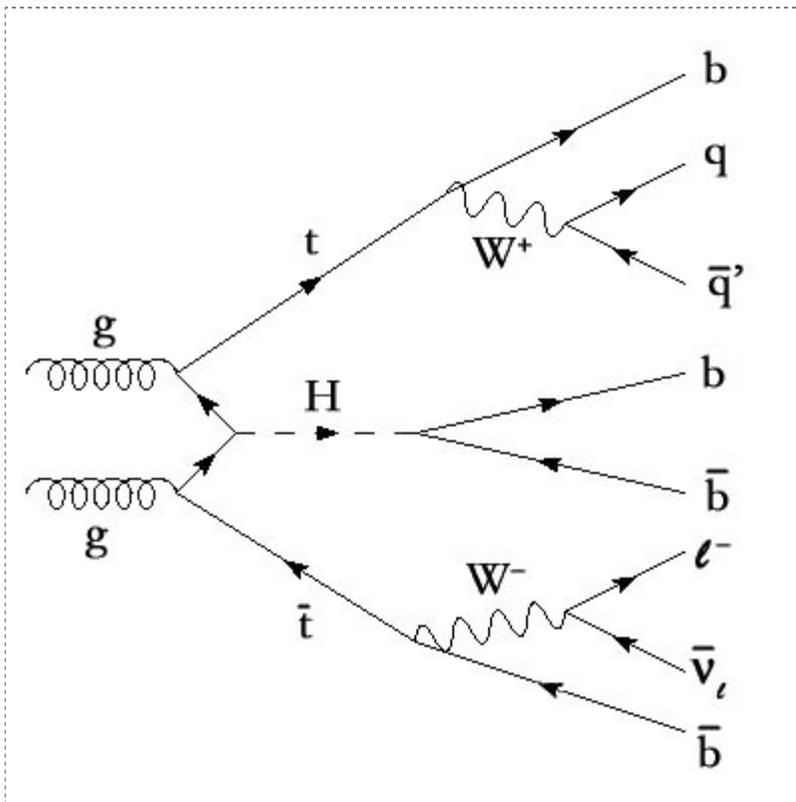
Hence my prediction [above](#), from Thursday, January 9, 2003, 15:56:04 GMT. Good luck.

D. Chakalov  
January 8, 2012, [19:22:10 GMT](#)

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### Addendum

To explain the thesis [above](#) in the context of [Higgs boson\(s\)](#), I will reproduce a popular Feynman diagram from Wiki (source [here](#)). [Seth Zenz](#), the person who submitted this diagram on 23 October 2005, believes that such experimental results would constitute a *discovery* of Higgs bosons, since it would be "very difficult to fake in other processes".



The list of people from the ATLAS Collaboration is immensely huge: 3200+ people (cf. pp. 16-23 in [arXiv:1107.3311v2 \[hep-ex\]](#)), which is 4 times more than the members of LIGO "scientific" collaborations, just [800+ people](#). I suppose all member of the ATLAS Collaboration, plus their colleagues from CERN's [Theory Group](#), are interested in quantum gravity, because their 'standard model' cannot incorporate the gravitation "field". Even if they aren't keen on quantum gravity, the fact that nobody can explain electron's mass from the "Higgs field" [[Ref. 1](#)] should stimulate their

interest in the thesis [above](#).

Very briefly (details in [June this year](#)): The Feynman diagram above is just a **linearized** snapshot from the **non-linear** interactions of [gluons](#). To explain what 'non-linear' means, check out the thesis [above](#) and recall the 'Escher hands' (cf. below), depicting the non-linear interactions of all particles ("[fish](#)") in the 'total field of as yet unknown structure' (Albert Einstein), called here '[GPI field](#)'.



Stated differently, the Higgs boson and the pre-quantum UNdecidable [noncolorizable](#) Kochen-Specker state share the ontological status of [GPIs](#). Only the math is [unknown](#) [[Ref. 2](#)].

If you disagree, just try to explain electron's mass from the "Higgs field" [[Ref. 1](#)] and the miraculous precision of "one part to  $10^{45}$ " in fixing the mass of the proton [[Ref. 3](#)].

D. Chakalov  
January 10, 2012  
Last update: June 19, 2012

[[Ref. 2](#)] Roman Jackiw, Topology in Physics, [arXiv:math-ph/0503039v1](#), p. 9:

"In view of my previous observation, can we take this as indirect evidence that this Yang-Mills based theory also is a phenomenological, effective description and at a more fundamental level -- [yet to be discovered](#) -- we shall find a simpler description that does not have any elaborate mathematical structure."

[[Ref. 3](#)] A.D. Dolgov, Cosmic antigravity, [arXiv:1206.3725v1 \[astro-ph.CO\]](#)

pp. 13-14: "Now the gravity of the vacuum energy problem placed it into the central position in fundamental physics. Probably the most serious argument in favor that something mysterious happens in vacuum comes from quantum chromodynamics (QCD). According to this well established theory which beautifully passed all experimental tests, u and d quarks are very light. Their masses are about 5 MeV. Proton is known to be a bound state of these three quarks,  $p = (uud)$ .

"So the **proton mass** should be 15 MeV minus binding energy, instead of 938 MeV. The solution of the problem suggested by QCD is that vacuum is not empty but filled with quark [[11](#)] and gluon [[12](#)] condensates: (35), having negative vacuum energy: (36).

.....

"The value of the vacuum energy of the quark and gluon condensates (36) is practically established by experiment. To adjust the total vacuum energy down to the observed magnitude,  $\sim 10^{-47}$  GeV<sup>4</sup>, there must exist another contribution to vacuum energy of the opposite sign and equal to the QCD

one **with precision of one part to  $10^{45}$** .

"This new field **cannot** have any noticeable interactions with quarks and gluons, otherwise it would be observed in direct experiment, but still it must have very same vacuum energy. This is one of the greatest mysteries of Nature.

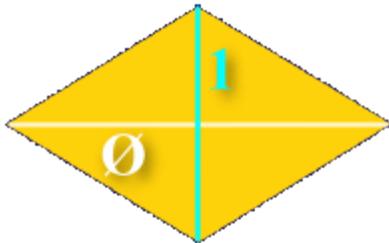
.....

"There are known and fantastically huge contributions to  $\rho_{vac}$  but a mechanism of their compensation down to (**almost**) zero remains mysterious.

.....

p. 25: "To conclude, there are quite many phenomenological models but no understanding of the cosmological acceleration and of the vacuum energy compensation mechanisms are found at a deeper level."

-----



Subject: [Quasicrystal structure](#) of quarks

Date: Wed, 11 Jan 2012 16:58:11 +0200

Message-ID:

<CAM7Ekxmv7x0S9F-iXHzKqqwkm-ssLOjra0Rr01Q09VTfB1\_bpA@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Dan Shechtman <dannys@tx.technion.ac.xx>

Cc: Roman Jackiw <jackiw@Ins.mit.edu> ,

David J Miller <djm@hep.ucl.ac.uk> ,

Howard M Georgi <georgi@physics.harvard.edu> ,

james.gillies@cern.ch,

roger.forty@cern.ch,

ignatios.antoniadis@cern.ch,

benedetto.gorini@cern.ch,

philippe.bloch@cern.ch,

marcello.bindi@cern.ch,

dieter.schlatter@cern.ch,

matthias.u.mozer@cern.ch,

sergio.bertolucci@cern.ch,

olivier.couet@cern.ch,

abdelhak.djouadi@cern.ch,

aaron.james.armbruster@cern.ch,

bryan.lynn@cern.ch

Dear Dr. Shechtman,

Congratulations upon your Nobel Prize.

My efforts to suggest a [quasicrystal structure](http://www.god-does-not-play-dice.net/#Roman) of quarks are posted at

<http://www.god-does-not-play-dice.net/#Roman>

Kind regards,

Dimi Chakalov

=====

Subject: I bet \$100 that the Higgs will not be discovered.

Date: Sun, 8 Jan 2012 22:25:25 +0200

Message-ID:

<CAM7EkxkghfF-Gt4su5\_aZ3\_YanDLJU-cstQx4J6fEui+piFxYg@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: GERALDINE.SERVANT@cern.ch,

CEDRIC.DELAUNAY@cern.ch,

GIAN.GIUDICE@cern.ch,

CHRISTOPHE.GROJEAN@cern.ch,

GILAD.PEREZ@cern.ch,

JAMES.WELLS@cern.ch,

ALEXANDRA.CARVALHO.ANTUNES.DE.OLIVEIRA@cern.ch,

ANDREA.THAMM@cern.ch,

CHRISTIAN.THOMAS.BYRNES@cern.ch,

ANNE-MARIE.PERRIN@cern.ch,

SUSANNE.REFFERT@cern.ch,

IGNATIOS.ANTONIADIS@cern.ch,

JULIEN.LESGOURGUES@cern.ch,

GEORGI.DVALI@cern.ch,

HYUN.MIN.LEE@cern.ch,

GRAEME.WATT@cern.ch,

GEORGE.ZOUPANOS@cern.ch,

John.Ellis@cern.ch,

James.Gillies@cern.ch

Dear colleagues,

Please check out my prediction about your "Higgs boson" at

<http://www.god-does-not-play-dice.net/#Roman>

(January 8, 2012, 19:22:10 GMT)

Please let me know if you would be interested to learn more about it at your TH Summer Institute on BSM Physics, [June 18-29, 2012](http://www.god-does-not-play-dice.net/#Roman).

Do you accept the bet ?

Yours sincerely,

Dimi Chakalov

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**Note:** I have no intention to kibitz [CERN's Theory Group](#), but *only* to offer an alternative to the so-called "[god particle](#)". After [billions of Euro](#) and [persistent PR campaign](#), I think they should feel a moral responsibility to examine all possible paths toward quantum gravity. Currently, they have taken a ridiculous 'win-win' stance, both with and without the "god particle". I am definitely certain they can do better.

I have so far only one response from CERN's spokesperson, thanks to his absence (cf. below). At least he can't claim that he heard nothing, saw nothing, and knew nothing.

D. Chakalov  
January 9, 2012  
Last update: April 23, 2012

-----  
Subject: Automatic reply: I bet \$100 that the Higgs will not be discovered.  
Thread-Topic: I bet \$100 that the Higgs will not be discovered.  
From: James Gillies <James.Gillies@cern.ch>  
To: Dimi Chakalov <dchakalov@gmail.com>  
Date: Mon, 23 Apr 2012 00:47:41 +0000  
Message-ID: <b4eb90cb22934b6d9f8ef501f069ab7e@CERNFE20.cern.ch>

I will be away from my desk until 23 April 2012, reachable most of the time on + 41 76 487 4555.

James Gillies

=====  
Subject: Re: [Higgs boson\(s\) vs quantum gravity](#)  
Date: Fri, 13 Jan 2012 12:47:44 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: sieme@sou.edu

Dear colleagues,

I received an obscene email from James R. Bogan (cf. below), and wonder if he is associated with Southern Oregon University.

Kind regards,

Dimi Chakalov

-----  
Subject: RE: Higgs boson(s) vs quantum gravity  
Date: Thu, 12 Jan 2012 12:57:58 -0800  
X-Originating-IP: [97.125.61.126]  
Message-ID: <SNT137-W13ED002DAA5FADF48A26F9B9F0@phx.gbl>  
Received-SPF: pass (google.com: domain of jim\_bogan@hotmail.com designates 65.55.90.76 as permitted sender) client-ip=65.55.90.76;  
From: Jim Bogan <jim\_bogan@hotmail.com>  
To: <dchakalov@gmail.com>  
In-Reply-To:  
<CAM7E7kxmcDHCWpvnQT0sez\_wJk\_-q2DyVd0v5DBnrhLHyL-VFCg@mail.gmail.com>

I knew I should've never replied to such BS.

Phuck U Very Much & Don't contact me again.

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=====

Subject: Re: BritGrav 12  
Date: Mon, 9 Jan 2012 12:57:53 +0200  
Message-ID:  
<CAM7Ekxn24tDygV1r3u=uFQa13T7T\_1czDvWC\_TWwWLBaqgKJGQ@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Carsten Gundlach <c.j.gundlach@soton.ac.uk>  
Cc: "Andersson N.A." <n.a.andersson@soton.ac.uk>,  
Roy Maartens <roy.maartens@port.ac.uk>,  
Jiří Bičák <Jiri.Bicak@mff.cuni.cz>

Dear Dr. Gundlach,

Thank you for your reply from Mon, 9 Jan 2012 09:41:43 +0000.

> I have had a look at your website. Thank you for your interest in BritGrav,  
> but I am afraid your interests are too far from those of professional  
> researchers in general relativity to be of interest to this conference. So  
> I am afraid you will not be able to give a talk.

Please let me know the names of those professional researchers in GR, who are trying to understand the origin of the phenomenon of 'free fall',

<http://tinyurl.com/Einstein-Prague-details>

I extend this request to your colleagues as well.

Looking forward to hearing from you at your earliest convenience,

Yours sincerely,

Dimi Chakalov  
35 Sutherland St  
London SW1V 4JU

=====

Subject: Re: "Robert P. Crease loves priority battles. Robert P. Kirshner does not."  
Date: Sun, 8 Jan 2012 21:41:57 +0200  
Message-ID:  
<CAM7Ekxkc=5iD01G8G6Oy\_DvRf2MdSEP3V27ao9Avd9kkFcqyjg@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Robert P Kirshner <kirshner@cfa.harvard.edu>,  
Robert P Crease <rcrease@notes.cc.sunysb.edu>,  
Saul Perlmutter <saul@lbl.gov>,  
Adam Riess <ariess@pha.jhu.edu>,  
Mike Turner <mturner@uchicago.edu>,  
Josh Frieman <frieman@fnal.gov>,

Norbert Straumann <norbert.straumann@gmail.com>,  
Sean Carroll <seancarroll@gmail.com>,  
Lawrence M Krauss <lmk9@cwru.edu>,  
Paul Davies <deepthought@asu.edu>,  
Laszlo Szabados <lbszab@rmki.kfki.hu>,  
Luca Bombelli <luca@phy.olemiss.edu>,  
Adam Helfer <helfera@missouri.edu>,  
Malcolm A H MacCallum <m.a.h.maccallum@qmul.ac.uk>,  
Chris Isham <c.isham@imperial.ac.uk>

Dear colleagues,

Regarding my email sent one year ago (Fri, 8 Jan 2010 12:59:59 +0200), please check out my prediction about the "Higgs boson" at

<http://www.god-does-not-play-dice.net/#Roman>  
(January 8, 2012, 19:22:10 GMT)

With all good wishes for 2012 and beyond,

"just another crank" (©C. Isham)

=====



But if we take our stand on the basis of facts, we shall find we have knowledge only of *relative* spaces and motions. *Relatively*, not considering the unknown and neglected medium of space, the motions of the universe are the same whether we adopt the Ptolemaic or the Copernican mode of view. Both views are, indeed, equally *correct*; only the latter is more simple and more *practical*. The universe is not *twice* given, with an earth at rest and an earth in motion; but only *once*, with its *relative* motions, alone determinable.

I have no objections to Budde's conception of space as a sort of medium (compare page 230), although I think that the properties of this medium should be demonstrable physically in some other manner, and that they should not be assumed *ad hoc*. If all apparent actions at a distance, all accelerations, turned out to be effected through the agency of a medium, then the question would appear in a different light, and the solution is to be sought perhaps in the view set forth on page 230.

When, accordingly, we say, that a body preserves unchanged its direction and velocity *in space*, our assertion is nothing more or less than an abbreviated reference to *the entire universe*.

Again, I never assumed that remote masses *only*, and not near ones, determine the velocity of a body (Streintz, p. 7); I simply spoke of an influence *independent* of distance.

If two masses  $\mu_1, \mu_2$  exert on each other a force which is dependent on their distance  $r$ , then  $d^2r/dt^2 = (\mu_1 + \mu_2)f(r)$ . But, at the same time, the acceleration of the centre of gravity of the two masses or the mean acceleration of the mass-system with respect to the masses of the universe (by the principle of reaction) remains  $= 0$ ; that is to say,

$$\frac{d^2}{dt^2} \left[ \mu_1 \frac{\sum m r_1}{\sum m} + \mu_2 \frac{\sum m r_2}{\sum m} \right] = 0.$$

When we reflect that the time-factor that enters into the acceleration is nothing more than a quantity that is the measure of the distances (or angles of rotation) of the bodies of the universe, we see that even in the simplest case, in which apparently we deal with the mutual action of only *two* masses, the neglecting of the rest of the world is *impossible*. Nature does not begin with elements, as we are obliged to begin with them. It is certainly fortunate for us, that we can, from time to time, turn aside our eyes from the overpowering unity of the All, and allow them to rest on individual details.

9. We have attempted in the foregoing to give the law of inertia a different expression from that in ordinary use. This expression will, so long as a sufficient number of bodies are apparently fixed in space, accomplish the same as the ordinary one. It is as easily applied, and it encounters the same difficulties. In the one case we are unable to come at an absolute space, in the other a limited number of masses only is within the reach of our knowledge, and the summation indicated can consequently not be fully carried out. It is impossible to say whether the new expression would still represent the true condition of things if the stars were to perform rapid movements among one another. The general experience cannot be constructed from the particular case given us. We must, on the contrary, *wait* until such an experience presents itself. Perhaps when our physico-astronomical knowledge has been extended, it will be offered somewhere in celestial space, where more violent and complicated motions take place than in our environment. "expansion" of space ?

E. Mach  
Vienna, January, 1901

-----  
Subject: What determines the inertial frame of reference? The [immediate connection](#)  
(E. Mach, The Science of Mechanics, p. 296).  
Date: Wed, 8 Feb 2012 13:31:19 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Julian <Julian.Barbour@physics.ox.ac.uk>, julian@platoniam.com,  
Bahram Mashhoon <mashhoonb@missouri.edu>,  
Paul Wesson <psw.papers@yahoo.ca>  
Cc: Adam Helfer <helfera@missouri.edu>

Julian,

Is it fun to keep quiet and pretend you've never learned anything from my web site since 1999 ?

I think vacuum general relativity, without cosmological constant and for a spatially closed universe, is a spherical cow approximation, so your reference to the Baierlein-Sharp-Wheeler from 1962 and your "[best-matching](#)" are unjustified.

Consider Mach's dictum:

"It is utterly beyond our power to measure the changes of things by time. Quite the contrary, time is an abstraction at which we arrive by means of the changes of things." (E. Mach, The Science of Mechanics, Open Court, 1960, p. 273).

Time does not emerge from 'change in space' but from 'change OF space'. Hence the Arrow of Space

driving 'the single closed system', that is, 'the universe as ONE',

<http://www.god-does-not-play-dice.net/#Beig>

You immediately obtain the core of GR as a dynamical theory ([forget about ADM](#)) of 'the universe as ONE', without any multidimensional superstitious à la Paul and Bahram ([arXiv:1108.3059v2 \[gr-qc\]](#)).

Mach's 'immediate connection' (p. 296) is introduced [from the outset](#), and so is the answer to the question about 'DDE in closed system' raised at

<http://www.god-does-not-play-dice.net/#Heraclitus>

Check out the first link above. No need to invent the wheel.

Dimi

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**Note:** By saying "no need to invent the wheel", I meant "the unknown and neglected **medium of space**" ([p. 232](#)), *with respect to which* we define [the "expansion" of space](#). The modern expression of 'medium of space' is [the reference fluid of GR](#), which is interpreted here as 'the global mode of spacetime' from the [Arrow of Space](#).

Now, Julian Barbour believes that if "we assume a finite (spatially closed) universe, we then find that the geometrical evolution of such a universe in accordance with Mach's principle leads to general relativity, and that Einstein's field equations are a direct expression of the Machian nature of the theory" ([arXiv:1007.3368v1 \[gr-qc\]](#), [p. 26](#)).

Sounds interesting, but a **finite** universe is neither "spatially closed" ([Ciufolini and Wheeler, p. 270](#)) nor "spatially open".

In [September 2010](#), I wrote to Julian Barbour and Niall Murchadha, because "the time at which wave-function collapse occurs" was considered 'the proof of the pudding' for Barbour's idea (*The End of Time*, Phoenix, London, 2000):

"I think that if the collapse of the wave function could be demonstrated to be a real physical phenomenon, that would be a true demonstration of something one might call transience" (p. 359). "That would kill my idea" (p. 358).

Of course, the phenomenon of **transience** is not related to artifacts, such as "[collapse](#) of the wave function", but to the [Arrow of Space](#). It does kill the idea of Julian Barbour, and introduces the [Machian relational ontology](#) and [Machian quantum gravity](#).

D. Chakalov

February 8, 2012

=====

Subject: Causal time asymmetry: Arrow of Space

Date: Thu, 9 Feb 2012 05:16:31 +0200

Message-ID:

<CAM7EkxmAYrn6gsQ8ouiStL0=Ohg+V4H2TTnpEWphhcfGkf\_ipA@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: William Eckhardt <we@eckhardttrading.com>

Cc: Joshua S Schiffrin <schiffrin@uchicago.edu> ,

Robert M Wald <rmwa@midway.uchicago.edu> ,

Mike Turner <mturner@uchicago.edu> ,

Fotini <fotinimk@gmail.com> ,

Robert Geroch <geroch@uchicago.edu> ,

Adam Helfer <helfera@missouri.edu>,  
Jeremiah P Ostriker <ostriker@princeton.edu>,  
Lawrence M Krauss <krauss@asu.edu>,  
Sean Carroll <seancarroll@gmail.com>

Dear Dr. Eckhardt,

It is a real pleasure to read your 2006 article '[Causal time asymmetry](#)', which I found thanks to a recent manuscript by Joshua S. Schiffrin and Robert M. Wald, Measure and Probability in Cosmology, [arXiv:1202.1818v1 \[gr-qc\]](#), ref. [28].

Six years ago, you wrote:

"Consider the question of the interconnections of the quantitative "arrows" of time, a quiver containing time asymmetries of thermodynamics, advanced and retarded radiation, quantum measurement, entropy increase, and cosmological expansion, to which I would add causal asymmetry. Which are fundamental and which are derivative?"

I think 'time' cannot emerge from 'change in space' (coordinate "time"), but only from 'change of space', and have suggested an Arrow of Space,

<http://tinyurl.com/Einstein-Prague>

Specific applications at

[http://www.god-does-not-play-dice.net/#NB\\_GW](http://www.god-does-not-play-dice.net/#NB_GW)

[http://www.god-does-not-play-dice.net/#dual\\_age](http://www.god-does-not-play-dice.net/#dual_age)

I also think retrodiction is impossible -- not only because entropy decreases towards the past (arXiv:1202.1818v1 [gr-qc], [Sec. VI](#)), but also because the universe is endowed with 'free will': "No theory can predict exactly what these particles will do in the future for the very good reason that they may not yet have decided what this will be!" (John Conway and Simon Kochen, The Free Will Theorem, [arXiv:quant-ph/0604079v1](#), p. 26). Don't trust your [GR textbooks](#).

To be precise, the "wave function of the universe" (the late [Asher Peres](#) didn't like this oxymoron, and neither do I) must be non-normalizable to include 'the unknown unknown' and the free will of the universe. For example, shortly "[after](#)" The Beginning nothing could have provided even a hint that the W boson and the Z boson (I learned this from Mike Turner) would have mass -- they were still in the realm of 'the unknown unknown'.

So, the future is unpredictable, and retrodiction is futile, as you put it. Which should perhaps make you [optimistic](#) about the \*potential future\* of the [U.S. economy](#) and the USS Enterprise (CVN-65),

[http://www.god-does-not-play-dice.net/9\\_11.html#Ignatius](http://www.god-does-not-play-dice.net/9_11.html#Ignatius)

A penny for your thoughts!

The critical comments from your colleagues will be greatly appreciated, too.

All the best,

Dimi Chakalov

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**Note:** Many physicists, William Eckhardt included, are puzzled by "time's arrow" from thermodynamics; some sort of "one-way property of time which has no analogue in space" ([Arthur Eddington](#)). But if we seek the [global Heraclitean time](#) [ $\tau$ ], expressed with the phenomenon of

**transience** observed in 'the changes of things' ([Ernst Mach](#)), the 'thing' that *changes* -- with respect to *what* ? -- is the very **space** along an Arrow of Space: an one-way property of 3-D space which has no analogue in spacetime. Why? Because this 'one-way property' *must* be hidden, or else the "ether" will show up.

Notice that the local, "change in space" time (e.g., the coordinate "time") and the global Heraclitean "change **of** space" coincide **in** the instant 'now' from the Arrow of Space (see Fig. 1 above). The former is composed from block universes stacked like Photoshop layers on the imaginary axis **w** (see Fig. 5) -- each of these block universes is 'completed', in the sense that all quasi-local correlations and negotiations between the two sides of the Einstein field equations are already completed at the instant 'now' from the Arrow of Space; the duration of *the null-surface negotiation* is zero, as read with our physical clocks. (I would agree with D.C. Robinson that "the true degrees of freedom can be exposed more explicitly when null hypersurfaces, rather than space-like hypersurfaces, are used," provided we forget about the notorious "splitting" of spacetime, after ADM.)

But what is the "duration" of the global Heraclitean "change of space" time [ $\tau$ ] ? Well, it depends on your brain; from the cognitive cycle of Ulric Neisser (Fig. 2 and Chs 2 and 4), the "duration" of the global time [ $\tau$ ] can be estimated as the duration of the introspective state 'now'. Once you remove from Neisser's cognitive cycle everything related to mind and consciousness, you will end up with just the *physics* of the human brain; then all you need is to model the whole universe as a brain, and replace the so-called psychological time arrow with the Arrow of Space, and all pieces from the jigsaw puzzle of quantum gravity will snap to their places, effortlessly. For example, regarding OPERA, Alvaro de Rújula from CERN commented passionately (NY Times, 22 September 2011): "If this study is confirmed, then we have not understood anything about anything." Relax, neutrinos are quasi-local particles; they don't travel *exclusively* in the local mode of spacetime governed by STR.

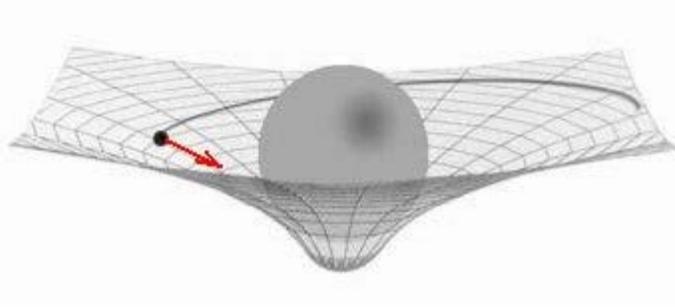
A possible way to understand the global Heraclitean time is from quantum optics, by setting [ $\tau$ ] = **it** (Z. Chao Wu, arXiv:0804.0210v1 [quant-ph]), provided we have an answer to the puzzle identified by Nevill Mott, which in turn leads to the intrinsic time of the 'quantum world out there', after the Kochen-Specker Theorem, and subsequently to the Arrow of Space of 'the universe as a brain'. Notice that we have a *purely geometrical* effect in the manifestation of gravity and life: no "gravitons" nor "bioparticles". Details and applications here.

If you disagree with such purely geometrical manifestation of gravity, which stems from the proposal that the gravitational "field" and its "ripples" are **not** directly coupled to matter and quantum fields, try to explain how would some "gravitational stress-energy tensor" enter into the righthand side of the Einstein field-equation: can "the "gravitational field" interact with ponderable matter fields in such a way that stress-energy is exchanged?" Namely, can we explain "the way that a gravitational stress-energy tensor (if there were such a thing) might enter into the righthand side of the Einstein field-equation"? Can the gravitational stress-energy "on its own, when **not** interacting with ponderable matter", be conserved ? Details from Erik Curiel, arXiv:0908.3322v3 [gr-qc].

Perhaps the best way to understand these *purely geometrical* effects is to explain the solution proposed for the localization of the gravitational energy density with the story about 'John's jackets': John is potential reality, hence it **must** be *wegtransformierbar* (Afriat and Caccese, p. 27) 'at a point' (absolute structures, such as the reference fluid of GR, do **not** conform to the 'generalized principle of action and reaction' (James L. Anderson, p. 339), and are camouflaged in GR as Diff(M)-related configurations).

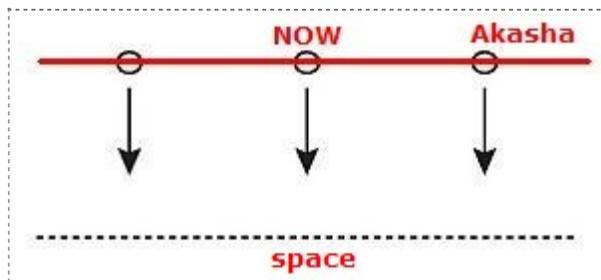
Namely, the physical reality 'at a point' is just one fleeting presentation of John's jackets: at each and every **point** from such quasi-local geodesic, the gravitational energy density will be perfectly well localized along the Arrow of Space -- dynamically, one-at-a-time, and post factum -- with strictly positive mass. The latter will exhibit an accelerated "runaway motion", being chased by its "negative" GPI counterpart from the global mode of spacetime, and will be endowed with free fall, as discovered by Galileo in 1638.

You have from the outset the solution to the measurement problem and the macro-objectification problem in QM, plus the solution to the (old) cosmological "constant" problem (the misleading 'empty space' in GR is "in acute contrast to the concept of vacuum in quantum field theory", and so is the "flat spacetime" in GR textbooks, cf. Hyun Seok Yang).

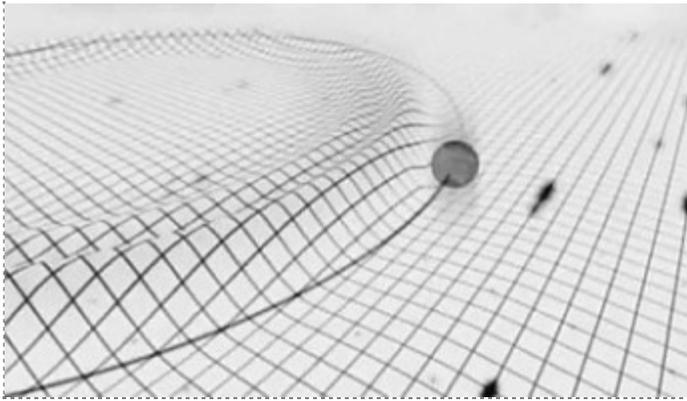


Hyun Seok Yang, [arXiv:1111.0015v3 \[hep-th\]](https://arxiv.org/abs/1111.0015v3): "When the massive body moves to another place, the original point where the body was placed will recover a (nearly) flat geometry like a **rubber band**. That is, the (flat) spacetime behaves like a metrical elasticity which **opposes** the curving of space. But this picture rather exhibits a puzzling nature of flat spacetime because the flat spacetime should be a completely empty space without any kind of energy as we remarked above. How is it possible for an empty space of nothing to behave like an elastic body with [tension](#) ?"

One could hardly find in GR textbooks concepts *more* misleading than "empty space", [flat spacetime limit](#), [intrinsic curvature](#), as well as the "[balloon metaphor](#)" of some "expanding" elastic stuff: [with respect to what](#) ? Here people usually refer to the [Gauss-Bonnet](#) theorem, but notice that the current "dynamics" of GR tacitly presupposes some special "[meta](#)" observer equipped with [Akasha-like](#) global memory and a special torch highlighting the canonical data (depicted with black vertical arrows, cf. below), who can verify that the canonical data at her instant 'now' are different from those "before" and "after" (provided the spacetime is [globally hyperbolic](#)).



[Tullio Levi-Civita](#) demonstrated in 1919 that 'parallelism' and 'curvature' are [affine-type features](#) -- it is all about *the connection* under the conditions for *wegtransformierbar* faculty of gravity 'at a point' [[Ref. 1](#)]. The [issue](#) is by no means purely academic: see the search for some "ripples" of the metric with [LIGO](#).



If you disagree with the Arrow of Space, please try to suggest the origin of the '[free fall](#)'. As Hermann Bondi noticed, "If a bird watching physicist falls off a cliff, he doesn't worry about his binoculars, they fall with him." Such global feature of spacetime is interpreted as some kind of 'reversed image' of the Arrow of Space. Notice that we cannot possibly tell apart the gravitational mass from the inertial mass in an infinitesimal instant 'now', so they would inevitably look 'the same'. This may sound like sheer metaphysics [[Ref. 1](#)], but it bears some very specific [predictions](#), such as Brain Assisted Vacuum Energy Release (BAVER) and Reversible Elimination of Inertial Mass (REIM). The former presupposes a topological "[bridge](#)" between the human brain and the quantum vacuum; depending on the [macroscopic boundary conditions](#), BAVER could vary from an *almost vanishing flux* up to  $10^{54}$  ergs/pulse, which is much larger than the mundane [nuclear energy release](#) of  $\sim 10^{22}$  ergs/pulse. REIM assumes that the initial "free fall" can be temporary canceled, by tweaking the *phase* of the two atemporal [quantum-gravitational waves](#), after which it would require zero force to fly in 3-D space. In both cases, a [polarization of space](#) is implied. (NASA completed their '[propellantness propulsion](#)' project with negative results.)

One of the obvious advantages of 'the universe as a [brain](#)' is its *developmental* cosmology (or biocosmology) -- we have **three** entities to consider, not just one (matter and fields). Namely, we have 'physical reality' (local mode of spacetime) and its [GPI field](#) (global mode), both of which are *increasing* their 'information content' along the Arrow of Space by what may look like *creatio ex nihilo* (hence 'the unknown unknown') unfolding from their common source. The latter is residing [within](#) each and every geometrical point of the [underlying topological manifold](#), being in the state of '[absolute rest](#)' (usually called 'the true monad without windows' or simply [John 1:1]).

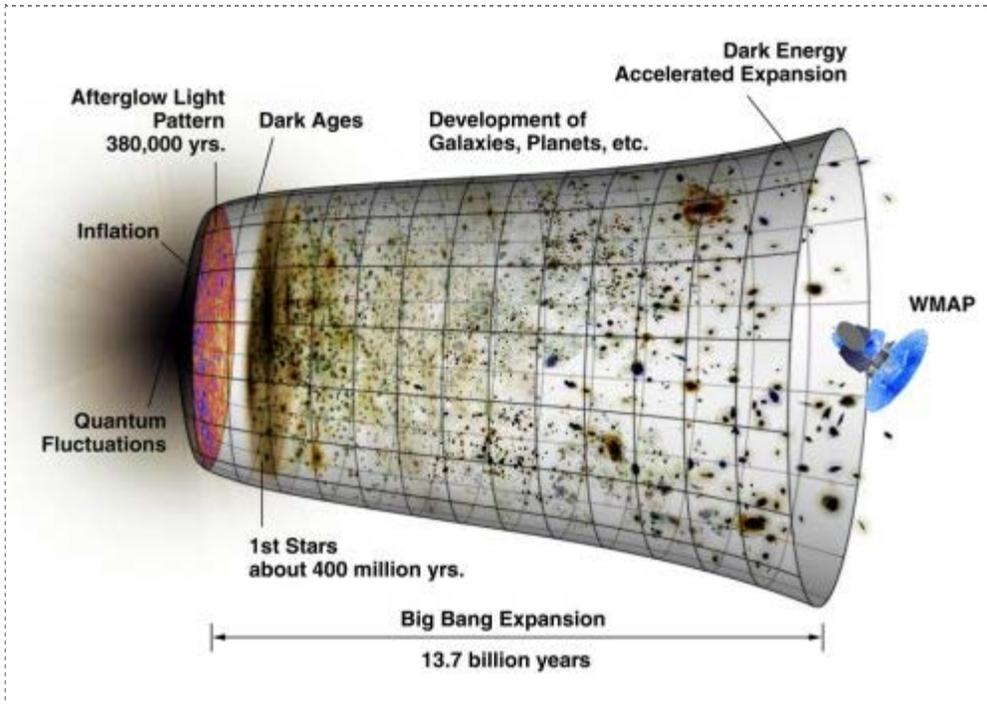
Thus, if we "run" the Arrow of Space toward [The Beginning](#), the universe would undergo non-unitary "losses" resulting in a *very simple* cosmological state: ensuing from the current [GR textbooks](#), retrodiction is indeed futile, just as we cannot possibly trace back the current state of our brains from the one in our prenatal age.



As is well known, one cannot *derive* a human individual from her/his '[first three minutes](#)' after the conception. No way. Ditto to 'the universe as a [brain](#)'. Simple, no?

Let's compare this developmental quantum cosmology to the "inflationary" scenario. Claus Kiefer quoted in [gr-qc/0502016](#) M. Gell-Mann and [J. B. Hartle](#) who have claimed that "quantum mechanics is best and most fundamentally understood in the framework of quantum cosmology". I fully agree, in the sense that nobody understands [quantum mechanics](#) nor [quantum cosmology](#).

As Mario Rabinowitz noted in [arXiv:astro-ph/0412101](https://arxiv.org/abs/astro-ph/0412101), "Inflation theorists simply shrug their shoulders and say that their theory does not violate relativity, since it is not the proto-stars and proto-galaxies that were moving that fast, but rather the very fabric of space itself moving the material objects apart. It's too bad that Einstein was not alive to comment on it himself when inflation was proclaimed and almost universally accepted. One can only wonder how accepting of it he would have been."



The line of reasoning in current inflationary cosmology is like this: you see a big gorgeous hen, and you say -- okay, this hen has surely evolved from a nice big chicken, which in turns has evolved from a tiny little cute chicken, which has obviously come from an egg, but the egg has evolved from a totally unphysical "inflationary" oven, and no egg can possibly be traced back to that terribly hot oven. On the top of everything, the "oven" has had an incredibly low entropy, that is, an **extremely low gravitational entropy**: how do you know that the very *metric* of spacetime could survive? Recall that you implant '[time-orientability](#)' by hand, so how can you prove that the "inflation" started with **pre-configured** spacetime metric within  $10^{-30}$  seconds ?

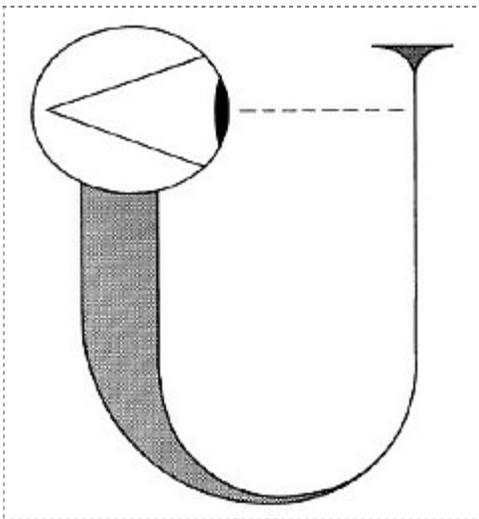
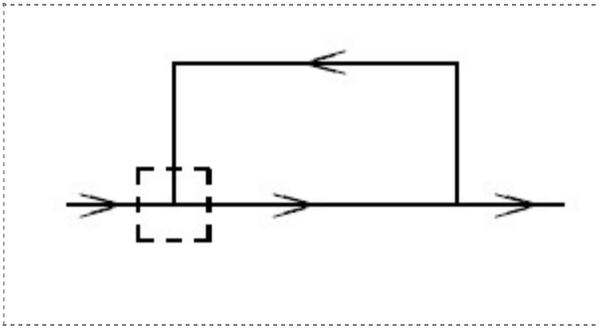
**The total duration of inflation in this model is about  $10^{-30}$  seconds.**

It seems unlikely that Joshua Schiffrin and Robert Wald will try to calculate the chance for such **pre-configured** metric within  $10^{-30}$  seconds, in their updated [arXiv:1202.1818 v2](https://arxiv.org/abs/1202.1818). There is absolutely nothing resembling 'law and order' in the "[spacetime foam](#)" to help you [raise](#) a crystal clear [Lorentzian metric](#) within  $10^{-30}$  seconds.

As Sergio Doplicher explained (The Principle of Locality, [arXiv:0911.5136v1 \[math-ph\]](https://arxiv.org/abs/0911.5136v1)), "points become *fuzzy* and *locality loses any precise meaning*. We believe it should be replaced at the Planck scale by an equally sharp and compelling principle, yet unknown, which reduces to locality at larger distances. (...) On this point in our opinion a deeper understanding is needed." I would suggest to study the "closed system, which does not exchange energy with the external world" [[Ref. 2](#)] at the Planck scale.

Moreover, you need to fix an incredibly fine adjustments of the initial and boundary conditions for the evolution of the **hen** and its fundamental evolving "constants", suitable for life: "Large objects such as ourselves are the product of principles of organization and of collective behaviour that cannot in any meaningful sense be reduced to the behaviour of our elementary constituents" ([Philip](#)

Anderson). Obviously, [elementary particles](#) alone cannot conduct research on themselves.



To avoid the "[multiverse](#)" and its "[anthropic](#)" parapsychology, the one-and-only 'universe as a [brain](#)' should have anticipated from [The Beginning](#) the possibilities for asymptotically flat spacetime and emergence of life (the dotted horizontal line in Wheeler's drawing must be raised a bit higher). Thus, the "duration" of the global time  $[\tau]$  pertinent to 'the universe as a brain' is [unlimited](#); in the case of the human brain, it can be estimated from Neisser's [cognitive cycle](#) mentioned above.

On top of that, the "[expanding](#)" **hen** is up to 96% "dark". Then you just shrug your shoulders and admit that perhaps something very essential is missing, and seek rescue in some "[multiverse](#)".

I will try to explain the Arrow of Space in [June this year](#), if only I am [allowed to talk](#). Such potential event is still in the potential future of the Arrow of Space, so let me try to be optimistic: you never know with the future, do you ?

Whether you believe you can do a thing or believe you can't, you are right, said Henry Ford. Analyze that with math, please !

D. Chakalov  
February 9, 2012  
Last updated: February 25, 2012

[Ref. 1] According to E. Schücking and E.J. Surowitz, [arXiv:gr-qc/0703149](#), "the apparent enigmatic equality of inertial and passive gravitational mass was also still a prize question at the beginning of the twentieth century. The Academy of Sciences in Göttingen, Germany, had offered the Beneke

Prize in 1906 for proving this equality by experiment and theory. The Baron Roland Eötvös won three-fourths of this prize (3,400 of 4,500 Marks); only three-fourths, because he had only done the experiments and had not attempted a theoretical explanation (C. Runge, Göttinger Nachrichten No .1, p. 37–41 (1909)."

I think we need quantum gravity to explain the puzzle. In the framework of [John's jackets](#), one cannot observe any numerical difference between the inertial and gravitational mass 'at a point': John will be indistinguishable from its 'gravitational mass' jacket. Simple, no?

See also: W.G. Unruh, Time Gravity and Quantum Mechanics, [arXiv:gr-qc/9312027v2](#)

pp. 4-5: "Gravity **is** the unequable flow of time from place to place. It is not that there are two separate phenomena, namely gravity and time and that the one, gravity, affects the other. Rather the theory states that the phenomena we usually ascribe to gravity are actually caused by time's flowing unequably from place to place. (...) Time flows unequably from place to place, without calling into play any 'force of gravity' at all."

**Comment:** Was Bill Unruh talking moonshine? Not at all. The ubiquitous Arrow of Space is not a vector, because it points to all directions in 3-D space; its physical manifestations are (i) 'time as change of space' ([nondynamical](#), "explicit (but unmeasurable) time", [Bill Unruh](#)) and (ii) *alteration* of the so-called [templates for space](#). For example, if the [template for space](#) is being "shrunk", don't expect to find some [non-baryonic CDM](#) or "[supermassive black hole](#)" there. Another "dark" effect is the fundamental *topological* property of spacetime, called 'spin'. Can you find some "dark axis" of rotation of an electron? Ditto to the galaxy rotation and '[the axis of evil](#)'. It's all [geometry](#).

[Ref. 2] Ruy H. A. Farias and Erasmo Recami, Introduction of a Quantum of Time ("chronon"), and its Consequences for the Electron in Quantum and Classical Physics, *Advances in Imaging and Electron Physics*, 163, 33-115 (2010); [RRuyAIEP2010Ch2.pdf](#)

p. 51: "As for the electron case, there are three different ways to perform the discretization, and three "Schrödinger equations" can be obtained, (...) which are, respectively, the retarded, symmetric, and advanced Schrödinger equations, all of them transforming into the (same) continuous equation when the fundamental interval of time (which can now be called just [tau]) goes to [zero](#).

.....

pp. 94-95: "The introduction of a fundamental interval of time in the description of the measurement problem makes possible a simple but effective formalization of the state-reduction process. Such behavior is observed only for the retarded case. (...) This means that the symmetric equation is [not suitable](#) to describe a measurement process, and this is an important distinction between the two formulations: actually, only the **retarded** one describes dissipative systems.

.....

"Regarding the nature of such an energy, it can be related to the very evolution of the system. It can be argued that a macroscopic time evolution is possible only if there is some energy flux between the system and the environment. The states described by the symmetric equation are basically equilibrium states, without net dissipation or absorption of energy by the system as a whole. We can also conceive of the symmetric equation as describing a [closed system](#), which does not exchange energy with the external world."

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Regarding [OPERA](#), see Erasmo Recami, [Extended Relativity](#), and

Alan Chodos, Avi Hauser, Alan Kostelecky, The Neutrino as a Tachyon, *Phys. Lett. B* 150, 431 (1985); [84chodoshauserkostelecky.pdf](#)

Erasmo Recami *et al.*, Are muon neutrinos faster-than-light particles? *Physics Letters B*, 178, 115-120 (1986); [AreNeutrinosFasterThanLight.pdf](#)

Alan Chodos, Alan Kostelecky, Nuclear Null Tests for Spacelike Neutrinos, [arXiv:hep-ph/9409404v1](#), p. 2, Footnote 1:

"We disregard here the possibility of **negative-energy** neutrinos, which leads to a variety of

disagreements with observation."

**Comment:** The negative-energy neutrinos are [Macavity-like objects](#), and are essential component of the "total field of as yet unknown structure" ([Albert Einstein](#)). I mentioned [above](#) that the neutrinos are *quasi-local* particles, they don't travel *exclusively* in the [local mode of spacetime](#).

The issue is indeed [very important](#): recall the monograph by Yakov Terletsii [above](#) and Murphy's Law No. 15: [Complex problems](#) have simple, [easy-to-understand](#) wrong answers.

D. Chakalov  
February 18, 2012

=====

Subject: Re: Operetta  
Date: Fri, 17 Feb 2012 22:33:32 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Erasmo Recami <Erasmo.Recami@mi.infn.it>  
Cc: Sergio Doplicher <dopliche@mat.uniroma1.it>,  
Alan Kostelecky <kostelec@indiana.edu>,  
Alan Chodos <chodos@aps.org>,  
Jennifer <jenluc@gmail.com>,  
Richard J Hughes <hughes@lanl.gov>,  
antonio.ereditato@cern.ch,  
alvaro.derujula@cern.ch,  
henri.pessard@lapp.in2p3.fr,  
salesi@unibg.it

Dear Erasmo,

Thank you, once more, for sending me your articles. I keep a signed preprint from your 'Extended Relativity' in [Rivista Nuovo Cim.](#), which you were very kind to send me in 1987 by snail mail. Time runs so fast, doesn't it. It's just not fair! :-)

Anyway, I provided links to your articles relevant to OPERA, as well as two articles by Alan Kostelecky and Alan Chodos, at

<http://www.god-does-not-play-dice.net/#operetta>

As I mentioned earlier, neutrinos are quasi-local particles; they don't travel exclusively in the local mode of spacetime,

<http://www.god-does-not-play-dice.net/#Eckhardt>

Should you and/or your colleagues have questions, please don't hesitate to write me back.

With all good wishes,

As ever yours,

Dimi

On Wed, Feb 15, 2012 at 8:40 PM, Erasmo Recami <Erasmo.Recami@mi.infn.it> wrote:  
[snip]

=====

Subject: Re: How and where does such a thinking happen?  
Date: Sat, 18 Feb 2012 16:57:34 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: [Elemér Rosinger](mailto:eerosinger@hotmail.com) <eerosinger@hotmail.com>  
Cc: [George](mailto:george.ellis@uct.ac.za) <george.ellis@uct.ac.za>

Dear Elemér,

Regarding my email from Tue, 20 Dec 2005 14:17:54 +0200, please check out

<http://www.god-does-not-play-dice.net/#Eckhardt>

A penny for your thoughts!

All the best,

Dimi

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It is extremely difficult to induce penguins to drink warm water.  
Albert John Coleman (1918 – 2010)

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Subject: The Universe as a brain  
Date: Mon, 20 Feb 2012 04:00:41 +0200  
Message-ID:  
<CAM7EkxmQYTjKTJ9Pvr15ApS2KpR=2sQONBOUUF9bqSkNj=dvUg@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Daniela Pérez <danielaperez@iar-conicet.gov.ar>, [romero@iar-conicet.gov.ar](mailto:romero@iar-conicet.gov.ar),  
Cc: [pas@pas.va](mailto:pas@pas.va),  
[hq@ccsem.infn.it](mailto:hq@ccsem.infn.it),  
[horst.wenninger@cern.ch](mailto:horst.wenninger@cern.ch),  
[jhs@theory.caltech.edu](mailto:jhs@theory.caltech.edu),  
[stoecker@uni-frankfurt.de](mailto:stoecker@uni-frankfurt.de),  
[r.d.lepoidevin@leeds.ac.uk](mailto:r.d.lepoidevin@leeds.ac.uk)

Dear Daniela,

You and Gustavo wrote ([arXiv:1202.3635v1 \[physics.hist-ph\]](https://arxiv.org/abs/1202.3635v1)): "Whether a cause can be defined outside space-time seems highly dubious [17] [18] [19] [20]. (...) It is very difficult, if not impossible, to make sense of the concept of causation outside space-time."

Your colleague knows my web site for 9 (nine) years, since Wed, 22 Jan 2003 22:49:31 +0200 (I emailed him regarding his [arXiv:gr-qc/0301070v1](https://arxiv.org/abs/gr-qc/0301070v1) posted on Mon, 20 Jan 2003).

In a nutshell, the Universe contains the First Cause of its own existence; the spacetime has non-trivial topology (no "timelike closed curves" though), and is an \*emergent\* phenomenon produced by an Arrow of Space:

<http://www.god-does-not-play-dice.net/#Eckhardt>

<http://www.god-does-not-play-dice.net/#Beig>

Please feel free to ask questions.

Thank you for reading these lines. Now you know my web site, and it is your free will choice to ignore it (like Gustavo).

All the best,

Dimi

=====

Subject: What means " $\sqrt{0}$ " ?  
Date: Mon, 20 Feb 2012 23:03:33 +0200  
Message-ID:  
<CAM7EkxkDTviASHS4PNwWufjdpDduEFbn0K58MeJPHDQgSVL9zw@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: perelmanc@hotmail.com,  
helfera@missouri.edu,  
jjiri.bicak@mff.cuni.cz,  
unruh@physics.ubc.ca,  
isenberg@uoregon.edu,  
lbszab@rmki.kfki.hu,  
laan@aei.mpg.de,  
tod@maths.ox.ac.uk,  
eric.schechter@vanderbilt.edu,  
kirkmcd@princeton.edu,  
rouse@maths.ox.ac.uk,  
witten@ias.edu

Dear colleagues,

Sorry for this unsolicited email.

May I ask for any information you may have about a proper interpretation of the dubious expression " $\sqrt{0}$ " in Special Relativity,

<http://www.god-does-not-play-dice.net/#templates>

Physically, we know that no particle with rest mass (tardyon) can achieve that "zero", so I am tempted to interpret the latter as an "infinitesimal", yet this isn't of any help (cf. the text at the link above).

I wonder if you know of any theory in which the square root of "zero" can be presented with some meaningful mathematical expression.

Say, something like  $(+/- X)^2 = 0$  ? It's too naïve, I'm afraid.

Please excuse my violent curiosity. As Erwin Schrödinger wrote (Space-Time Structure, Cambridge University Press, 1950, [p. 9](#)): "The most important number in mathematics is the zero."

Best regards,

Dimi Chakalov

-----

**Note:** As the reader might have guessed, the expression  $(+/- X)^2$  resembles the squaring the module of the probability amplitude in QM; here, it must be "zero", because the w-axis of the global mode of spacetime must be totally eliminated in the local mode. Simple, no?

D.C.

February 21, 2012, 16:30 GMT

=====

Subject: Re: [arXiv:0908.3322v3 \[gr-qc\]](https://arxiv.org/abs/0908.3322v3), "in the limit of the infinitesimal"

Date: Sat, 25 Feb 2012 15:57:57 +0200

From: Dimi Chakalov <dchakalov@gmail.com>

To: David B Malament <dmalamen@uci.edu>

Dear David,

I noticed that you've helped Erik "get straight" on [the nature of gravity](#), as he acknowledged in footnote 23 on [p. 17](#) from his arXiv:0908.3322v3 [gr-qc].

Would you be interested in my opinion on how gravity (not gravitational stress-energy [tensor](#)) might end up as 'energy of matter' ?

<http://www.god-does-not-play-dice.net/#Alvaro>

I hope you can help me, too. I acknowledged at my web site that I managed to "understand" GR only once, in my freshman year in June 1972, and it [didn't last long](#).

All the best,

Dimi

On Fri, Feb 24, 2012 at 1:40 PM, Dimi Chakalov <dchakalov@gmail.com> wrote:

>

> Dear Dr. Curiel,

>

> I feel the need to thank you for your beautiful paper. Will study it  
> over the weekend.

>

> I have some thoughts on the 'deep murky waters' (p. 17) of how gravity  
> (not gravitational stress-energy tensor) might end up as 'energy of  
> matter', and have two immodest requests. If possible, please send me  
> copies from your forthcoming "On the Existence of Spacetime Structure"  
> and "General Relativity Needs No Interpretation", Philosophy of  
> Science 76:44-72 (2009).

>

> You mentioned an issue I was never able to understand: "... the affine  
> connection at least in so far as it depends on the curvature." Please  
> help me understand (i) exactly how the affine connection would depend  
> on the curvature "in the limit of the infinitesimal", and (ii) the  
> difference between 'affine connection' and 'pure affine connection'  
> (Erwin Schrödinger, Space-Time Structure, Cambridge University Press,  
> 1950, [p. 211](#)).

>

> Thank you very much in advance.

>

> Best regards,  
>  
> Dimi Chakalov

=====

Subject: Re: [arXiv:0908.3322v3 \[gr-qc\]](https://arxiv.org/abs/0908.3322v3), "in the limit of the infinitesimal"  
Date: Tue, 28 Feb 2012 18:45:56 +0200  
Message-ID:  
<CAM7EkxmEryT=av5mXTLfdi8TDLOKBYuFOz81D251CsaHqoB5Ag@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Erik Curiel <erik@strangebeautiful.com>  
Cc: Graham Nerlich <Graham.Nerlich@adelaide.edu.au>

Dear Dr. Curiel,

Thank you very much for your comprehensive reply. I will be very happy to study your forthcoming paper "On the Existence of Spacetime Structure".

My understanding of the 'tangent plane over a point' and the 'free fall' **embedded** in the spacetime structure is posted at

<http://www.god-does-not-play-dice.net/#Brendan>

Kind regards,

Dimi Chakalov

On Tue, 28 Feb 2012 11:08:46 -0500, Erik Curiel <erik@strangebeautiful.com> wrote:

>  
> Dear Mr. Chakalov,  
>  
> Thank you for your kind note. To address your questions:  
>  
> 1. For our purposes, "in the limit of the infinitesimal" can simply mean "in  
> the tangent plane over a point". At every point, the affine structure is  
> intimately related to the curvature by the relation  
>  $[D, D] x = \text{Riem}(x)$   
> where  $'[D, D] x'$  is the anti-symmetrized product of two derivative operators  
> acting on the tangent vector  $x$  and  $'\text{Riem}(x)'$  is the contraction of the  
> tensor with  $x$ . (Since you like Schrodinger's book---which is beautiful---I  
> suggest you look there for the derivation of this relation.)  
>  
> 2. If I recall correctly, Schrodinger uses "pure affine connection" to refer  
> to an affine connection with no relation to a fixed metric. Not all affine  
> connections arise from metrics.

[snip]

On 12-02-24 6:40 AM, Dimi Chakalov wrote:

[snip]

You mentioned an issue I was never able to understand: "... the affine connection at least in so far as it depends on the curvature." Please help me understand (i) exactly how the affine connection would depend on the curvature "in the limit of the infinitesimal", and (ii) the difference between 'affine connection' and 'pure affine connection' (Erwin Schrödinger, Space-Time Structure, Cambridge University Press,

1950, [p. 211](#)).

Thank you very much in advance.  
[snip]

=====

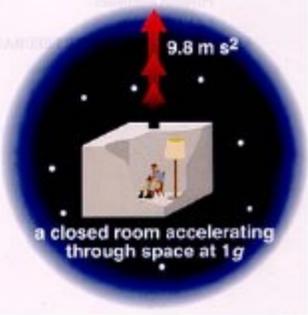
Where do the observed positive mass come from, at the instant 'now' at which the "freely falling" universe is **halted** and shows its positive inertial mass ("a closed room on the Earth," see the drawing below) and asymptotic boundaries? Is the red arrow pointing to the Äther ([global mode](#) of spacetime) and simultaneously to **all** possible directions, determined with the metric of the local (physical) mode spacetime, hence displayed as "time"?

## Equivalence Principle

Einstein's "happiest thought" came from the realization he could take the equivalence principle further.  
Simply put, Einstein reasoned that;



a closed room on the Earth



a closed room accelerating through space at 1g

There is no experiment that can distinguish between uniform acceleration and a uniform gravitational field.

Lecture Notes 1 <http://www.physics.usyd.edu.au/~gfl/Lecture>

The asymmetry of time can come *only* from some asymmetry related to 3-D space, such as the [Arrow of Space](#). Hence the "reversed" image from the Arrow of Space, known as 'free fall', should be introduced with '[time orientability](#)' from the outset. The two phenomena are 'global features of spacetime' equipped with [non-trivial topology](#).

The "closed room" is 'the whole universe' defined with [Finite Infinity](#), which is being "[accelerated](#)" in the global mode of spacetime by the [Arrow of Space](#). Simple, no?

Surely 'there is no spacetime without matter', but can we **derive** all features of spacetime (e.g., [time](#)

[orientability](#)) from matter alone? Is the phenomenon called '[spin](#)' a [fundamental property](#) of spacetime that cannot be derived from matter alone? With the global mode of spacetime, the antisymmetric part of the [affine connection](#) (the torsion) need not "vanish".



Most importantly, how would you **embed** the 'free fall' in the [spacetime manifold](#) and recover Einstein's "total field of as yet [unknown structure](#)" ?

D. Chakalov  
February 29, 2012  
-----

Subject: Re: [arXiv:1202.5708v1 \[gr-qc\]](#)  
Date: Tue, 28 Feb 2012 17:01:08 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Brendan McMonigal <monigal@physics.usyd.edu.au>  
Cc: gfl@physics.usyd.edu.au, poby3060@uni.sydney.edu.au,  
Miguel Alcubierre <malcubi@nucleares.unam.mx>

Dear Brendan,

Thank you very much for your reply.

I think Miguel should have tried to explain the initial '[free fall](#)' in the first place, because such global ubiquitous feature of spacetime is just as mysterious as is the so-called "dark" energy,

<http://www.god-does-not-play-dice.net/#Heraclitus>

Not surprisingly, his efforts to suggest a modified "free fall" by some exotic form of matter rendered the whole idea unfeasible.

My efforts are toward 'reversible elimination of inertial mass' (REIM),

<http://www.god-does-not-play-dice.net/#Eckhardt>

The crux of the matter is a hypothetical Arrow of Space, which casts its reversed image in terms of 'free fall', so if we can eliminate (reversibly) this initial free fall locally, around the ship, then its inertial mass will be nullified (reversibly) and it should fly just like an UFO, or rather like we "move" our thoughts, without any inertial effects.

Have you seen real "levitation" ? [Daniel Dunglas Home](#) has demonstrated it on 16 December 1868;

now you can watch other people on [YouTube](#).

All the best,

Dimi

On Tue, 28 Feb 2012 15:44:19 +1100, Brendan McMonigal <monigal@physics.usyd.edu.au> wrote:

>  
> Hi Dimi,  
>  
> Thank you for your interest, I will do my best to clarify these points.  
>  
> 1) What the warp drive does, is alters the geometry of the spacetime  
> immediately around the ship such that the direction of freefall is the  
> direction the ship wants to 'fly'. A simple analogy would be to think of it  
> like dangling a carrot in front of a donkey you are riding; in this analogy,  
> the ship is the man on the donkey, the altered geometry is the carrot, and  
> the donkey wanting to move to the carrot is the 'freefall'. The alteration  
> to the geometry is only ever local, but that is all that is required to  
> create the 'motion'.  
>  
> 2) Strictly speaking, the ship is stationary in space, rather it is the  
> space that is distorted around the ship. This is why it is different to,  
> say, a plane flying through space. Due to the way that light is affected by  
> warp drive, it is not easy to say quite what it would look like, but it is  
> clear that the space in front of the ship would bunch up as it approached  
> the ship, as there is a region leading the ship where spacetime is  
> contracted.  
>  
> I hope my comments have helped.  
>  
> Cheers  
> Brendan

> On Tue, Feb 28, 2012 at 2:29 PM, Dimi Chakalov <dchakalov@gmail.com> wrote:

>>  
>> Dear Dr. McMonigal,  
>>  
>> May I ask you to help with the Alcubierre Warp Drive.  
>>  
>> I've read some very confusing (to me) statements in general-audience  
>> articles, such as:  
>>  
>> 1. The Alcubierre Warp Drive is following 'free fall' in the direction  
>> of its "flight", and  
>>  
>> 2. The space in front of the Alcubierre Warp Drive will be seen by an  
>> observer inside the ship as "running" toward her/him, instead of the  
>> usual perception from flying with commercial plane, such as 'space is  
>> at rest; the plane is moving \*in\* space'.  
>>  
>> Thank you for your time, patience, and consideration.  
>>  
>> Kind regards,  
>>  
>> Dimi Chakalov  
>

=====  
Subject: A note on the post-Newtonian limit of quasi-local energy expressions, [arXiv:1102.1867v3](https://arxiv.org/abs/1102.1867v3) [gr-qc]

Date: Wed, 29 Feb 2012 17:52:50 +0200

Message-ID:

<CAM7Ekx=24MouUJ9oKnJ1PGeWZvKugkgsJ=OY28Qm-ZT=yPE9kA@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Laszlo Szabados <lbszab@rmki.kfki.hu> ,

Jörg Frauendiener <joergf@maths.otago.ac.nz>

Cc: Adam Helfer <helfera@missouri.edu> ,

William G Unruh <unruh@physics.ubc.ca> ,

Luca Bombelli <bombelli@olemiss.edu> ,

Domenico Giulini <domenico.giulini@itp.uni-hannover.de> ,

Kirill Krasnov <kirill.krasnov@nottingham.ac.uk> ,

Stefano Finazzi <finazzi@science.unitn.it> ,

Willie Wai-Yeung Wong <wongwwy@member.ams.org> ,

Thibault Damour <damour@ihes.fr> ,

Lars Andersson <laan@aei.mpg.de> ,

Jiří Bičák <Jiri.Bicak@mff.cuni.cz> ,

Richard M Schoen <schoen@math.stanford.edu>

Dear László and Jörg,

You argued that, "in static space-times", "any physically acceptable quasi-local energy expression should behave qualitatively like this 'effective' energy expression in this limit."

I'm afraid any quasi-local energy expression "in static space-times" is a spherical cow approximation. Will be happy to [elaborate](#).

Besides, the "universal coupling between matter and gravity" (Thibault Damour, arXiv:1202.6311v1 [gr-qc]) cannot be postulated until you resolve "the way that a gravitational stress-energy tensor (if there were such a thing) might enter into the righthand side of the Einstein field-equation", as stressed by Erik Curiel in arXiv:0908.3322v3 [gr-qc],

<http://www.god-does-not-play-dice.net/#Alvaro>

To begin with, the standard prerequisites that "all manifolds are assumed to be Hausdorff, second countable and  $C^\infty$ " ([Lars Andersson](#), arXiv:gr-qc/9911032v4, Footnote 1, p. 3), on which you install differentialbe structure, tangent vectors, smooth Lorentz metric (and eventually some "future pointing timelike unit vector field"), lack an essential component: the "free fall" feature of spacetime,

<http://www.god-does-not-play-dice.net/#Brendan>

It must be embedded in the spacetime manifold ab initio. We cannot derive the 'free fall' from any physical thing, just as we cannot derive "time-orientability",

<http://www.god-does-not-play-dice.net/#Waldyr>

One way to solve this task is with an Arrow of Space, which I am sure you know very well, but persistently ignore.

Do you have any other solution? Please let me know about it, and I will immediately close my web site and study your professional paper(s), if any.

I extend this request to all your colleagues: please let me know how you would embed the 'free fall' in the spacetime manifold.

Hope to see you in [Prague](#),

<http://tinyurl.com/Einstein-Prague>

All the best,

Dimi

-----

**Note:** There is also another *purely geometrical* puzzle: the torsion. "If one desires to set up a gravitational theory in the elementary particle domain" ([Friedrich W. Hehl](#), On the Kinematics of the Torsion of Space-Time, *Found. Phys.* 15(4), 451-471 (1985), [p. 453](#)), the torsion dynamics becomes non-trivial, given (i) the "dark" energy of "expanding" space and (ii) the nonlocalizability of both "particles" and the gravitational energy density. Which requires a new "quantisation" of the spacetime manifold [from the outset](#).

D.C.

March 2, 2012

=====

Subject: Re: Request for references  
Date: Thu, 7 Jun 2012 04:38:40 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Laszlo Szabados <lbszab@rmki.kfki.hu>  
Cc: Adam Helfer <helfera@missouri.edu>,  
[IGUS Jim](#) <hartle@physics.ucsb.edu>

Dear László,

Regarding your [Review](#), you argued seven years ago that the gravitational energy-momentum and angular momentum "should be associated to \*extended\* domains rather than to points".

I fully agree, but it seems to me that [your approach](#) at implementing 'the quasi-local case' is wrong, for reasons explained at

[http://www.god-does-not-play-dice.net/#EH\\_if\\_any](http://www.god-does-not-play-dice.net/#EH_if_any)

I will be happy to elaborate. As you suggested on Sat, 28 Mar 2009 02:49:13 +0100 (CET), "Let's do our job, science ..."

I included two colleagues of yours in the Cc: list, because have quoted from their papers at the link above.

All the best,

Dimi

On Wed, 23 Feb 2005 17:37:02 +0100 (CET), László B. Szabados <lbszab@rmki.kfki.hu> wrote:  
[snip]

- >
- > Thus, to summarize: even if we start with genuine tensorial variables,
- > then certain important physical quantities turn out to be non-tensorial.
- >
- > In subsection 3.3.1 I argued that this phenomenon is not accidental,
- > a consequence of an unfortunate choice for the field variables, but
- > this is a consequence of a much deeper fact, namely that the metric
- > has a double role: it is a field variable and defines the geometry
- > **at the same time.**
- >
- > Or, in other words, GR is a completely diffeomorphism
- > invariant theory, which diffeomorphisms form an incredibly huge set.
- > Thus all the observables are associated with the whole spacetime, which
- > can be introduced if the spacetime is asymptotically flat, or you should
- > have some extended, physical object that breaks this invariance.
- > This is the quasi-local case. These quasi-local quantities can be
- > introduced even if the spacetime is not asymptotically flat.

[snip]

- > What I say in my review is *\*not\** that GR is a non-local theory,
- > I say only that the gravitational energy-momentum and angular
- > momentum, i.e. the gravitational analogs of the classical conserved
- > quantities and observables are non-local. Non-local in the sense that
- > they should be associated to *\*extended\** domains rather than to
- > points.

-----

**Note:** Laszlo Szabados replied on Thu, 7 Jun 2012 23:11:08 +0200 (CEST) just by saying that he sees "nothing wrong in the above argumentation". I do.

The task for associating the gravitational energy-momentum and angular momentum to **extended** domains rather than to "points" is the essence of 'quasi-local GR'. He tackles the [canonical GR](#), while my approach is from [quantum gravity](#), so at least one of these two approaches must be wrong.

Let's find something that we both agree upon, which will be considered 'the common ground' for our incompatible approaches. As John Bell argued, "reality has been identified only at a **single time**" [[Ref. 1](#)]. It is a point-like *event*, and is 'local'.

How can we make this point-like *event* 'quasi-local' ? In my approach, the point-like event is both "local" (it is an infinitesimal point) and "non-local", because it is the **nexus** of the [bi-directional negotiations](#) between such "point" and 'the rest of the universe' along the Arrow of Space. Thus, the [geometry itself](#) becomes 'quasi-local' at such "[point](#)". The latter is **extremely** "non-local", in the sense that the *atemporal* feedback (global mode of spacetime) from 'the whole universe as ONE' (cf. [UGMC](#)) is being projected "inside" an infinitesimal "point" that is **extremely** "local" from the outset. Every such *quasi-local* point is being **re**-created in the instant 'now' (think about a transcendental tachyon, not Cauchy surface) from the Arrow of Space. This is *the only possible* spacetime for a dynamical self-determined bootstrapped Universe. Otherwise it will fall apart.

Forget about [canonical GR](#). Check out the insoluble problems of [C. Kiefer](#) and [A. Perez](#).

Laszlo Szabados starts from "quasi-local configuration space" and "quasi-local *phase space*" and his aim is to suggest specific boundary terms and boundary conditions for [canonical GR](#) (arXiv:0902.3199v2 [gr-qc], [pp. 4-5](#)). If he is on the right track, he should be able to suggest at least *one* conceptual solution to *one* of the problems listed at the link in my [email](#) or to the problems of [canonical GR](#). Just one very simple task: boundary conditions for the gravitational "field" [[Ref. 2](#)]. This will be 'the proof of the pudding'.

He can't do it, however. He doesn't work in quantum gravity and still believes that GR is a 'classical theory'. But it [isn't](#).

As I stated previously ([29 Feb 2012](#)), if Laszlo Szabados can offer *any other solution*, I will immediately close my web site and study his professional paper(s), if any.

D. Chakalov

June 8, 2012, [12:54:57 GMT](#)

[Ref. 1] J. S. Bell, Quantum mechanics for cosmologists, in: *Speakable and unspeakable in quantum mechanics*, 2nd ed., Cambridge University Press, 2004

Ch. 15, [p. 136](#): "(W)e have no access to the past. We have only our 'memories' and 'records'. But these memories and records are in fact *present* phenomena. (...) The theory should account for the *present* correlations between these *present* phenomena.

....

"The question of making a Lorentz invariant theory on these lines raises intriguing questions. For reality has been identified only at a **single time**."

[Ref. 2] Adam Helfer, Angular momentum of isolated systems in general relativity, [arXiv:0903.3016v1 \[gr-qc\]](#).

"How can we make precise the idea of an isolated system? In some sense, we must say what it means to travel far from the system, and say that in that limit the system becomes "self-contained." Roughly speaking, this should mean passing to an appropriate *asymptotic regime* such that all gravitational effects are localized **inside** of it."

=====

Subject: Re: What is "torsion" ?

Date: Sat, 3 Mar 2012 01:58:32 +0200

From: Dimi Chakalov <dchakalov@gmail.com>

To: Friedrich\_Wilhelm Hehl <hehl@thp.uni-koeln.de>

> But I have to tell you that I don't and will not follow your blog.

I love your German humor !

> Is there any reason for me to believe that you have the  
> necessary education to discuss seriously any question of physics?

Easy: please send me your professional solution to the two tasks (cf. my email printed below), and I will send you my evaluation of your efforts.

Then you'll find out whether I have "the necessary education to discuss seriously any question of physics."

**NB:** Please don't hesitate to use as much math as you possibly can -- you can't scare a dog with a sausage.

If, for some strange unanticipated reason, you are unable to resolve the two tasks (cf. below), all I

can offer you is the quantum gravity theory at my web site: Besser eine Laus im Kraut als gar kein Fleisch.

All the best,

Dimi

-----

Subject: Re: What is "torsion" ?  
Date: Fri, 2 Mar 2012 22:14:29 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Friedrich\_Wilhelm Hehl <hehl@thp.uni-koeln.de>

Dear Fred,

> This is my answer of 1985.

Thank you; I know your seminal paper very well. "If one desires to set up a gravitational theory in the elementary particle domain" (p. 453), the torsion issue becomes non-trivial, given (i) the "dark" energy of "[expanding](#)" space and (ii) the nonlocalizability of both "[particles](#)" and the gravitational energy [density](#). Which is the scope of my approach toward [quantum gravity](#).

> Don't you read the existing literature?

Of course I do. Didn't you follow [the link](#) in my email?

If you can suggest a joint solution to tasks (i) and (ii), please let me know where I can read it.

All the best,

Dimi

=====

**Note:** I can safely predict that [Friedrich W. Hehl](#) will never reply professionally by offering his solution to the two tasks above, simply because he can't. For example, look at his proposal for "nonlocal gravity", co-authored by [Bahram Mashhoon](#), at the DPG Conference in Bonn, 15 March 2010, [Slide 3](#):

"Postulate of locality: An accelerated observer (measuring device) along its *worldline* is at **each instant** physically equivalent to a [hypothetical inertial observer](#) (measuring device) that is otherwise identical and instantaneously *comoving* with the accelerated observer (measuring device)."

Then [Slide 6](#): "How can we then generalize general relativity which is a strictly local theory? Idea: We know electrodynamics is a gauge theory; we can make it nonlocal, as shown on the last slide." But the idea is wrong, and [Friedrich W. Hehl](#) will have to admit it, after failing to solve the two tasks above, by focusing on what *actually* happens "[at each instant](#)". He will never try this *very* difficult exercise, and will instead prefer to keep quiet, pretending that he doesn't read my "[blog](#)" about the 'total field of as yet unknown structure' ([A. Einstein](#)).

Here's the crux of GR (Paolo Pani *et al.*, [arXiv:1201.2814v2 \[gr-qc\]](#)):

The beauty and the beast of Einstein's General Relativity (GR) are encoded in the non-linearity of its field equations. Already in vacuum, GR describes the dynamics of non-linear objects, like black holes [1]. In order to study the formation of black holes in dynamical situations, e.g. during a stellar collapse, one needs to couple the vacuum theory to matter. How to include this coupling in a proper way was one of Einstein's main concerns. The requirement of stress-energy tensor conservation,  $\nabla_{\mu} T^{\mu\nu} = 0$ , which in turn implies geodesics motion, together with Bianchi's identities,  $\nabla_{\mu} G^{\mu\nu} = 0$ , naturally suggests a linear coupling between the Einstein tensor and the stress-energy tensor,  $G_{\mu\nu} \propto T_{\mu\nu}$ . Indeed, under quite generic assumptions (see e.g. [2]) Einstein's equations are the most general field equations which involve the stress-energy tensor linearly. Nonetheless, it comes as a surprise that a highly non-linear theory as GR is just linearly coupled to matter.

Which is why people use [PDEs](#) and tell their students that GR were a "[classical theory](#)". Surely the current [GR textbooks](#) present GR as a 'classical theory', but it is "merely a makeshift in order to give the general principle of relativity a **preliminary** closed-form expression" ([A. Einstein](#)). It can be safely used to correct the [GPS system](#), but **cannot** be used for any task which requires **non-linear** bi-directional interactions "[at each instant](#)", facilitated by the 'total field of as yet unknown structure' ([A. Einstein](#)).

Notice that the "preliminary closed-form expression" ([A. Einstein](#)) of present-day GR is based on only **one** single instant at which the non-linear bi-directional negotiations -- "space acts on matter, telling it how to move; in turn, matter reacts back on space, telling it how to curve", John Wheeler -- are **settled** as solutions to the Einstein field equation, pertaining to this **one** single instant, after which you obtain a dead frozen "spacetime" (and use [PDEs](#), if you insist). But if you wish to study and detect the genuine gravitational waves (GWs), you need to take into account the non-linear bi-directional negotiations at **each and every** instant of the propagation of these "waves" -- **one** single instant will freeze these **fundamentally** non-linear "waves" and they will **not** carry energy to their counterpart in the r.h.s. of the field equations: energy transport by GWs is a **fundamentally** non-linear phenomenon ([Hermann Bondi](#)).

Yes, [LIGO is for the birds](#). We need [the genuine dynamics of GR](#). Forget about [PDEs](#).

That's what this "[blog](#)" is all about. As I acknowledged [previously](#), I had the feeling that have finally managed to "understand" GR only once, in June 1972, and it [didn't last long](#).

But perhaps [Friedrich W. Hehl](#) believes that he "understands" the non-linear dynamics of GR. After all, he has published many peer-reviewed scientific papers, which implies that he does indeed have "the necessary education to discuss seriously any question of physics".

Then why is he keeping quiet?

D. Chakalov  
March 4, 2012  
Last update: March 29, 2012

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Subject: [arXiv:1203.2154v1 \[gr-qc\]](#), The initial-boundary value problem (IBVP),  
Sec. XIV, Q1  
Date: Mon, 12 Mar 2012 05:52:05 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Jeffrey Winicour <winicour@pitt.edu>  
Cc: [Alan Rendall](#) <rendall@aei.mpg.de>

Dear Dr. Winicour,

I think we can introduce natural boundaries for the gravitational field, provided we can embed the 'free fall' in the spacetime manifold,

[http://www.god-does-not-play-dice.net/#free\\_fall](http://www.god-does-not-play-dice.net/#free_fall)

<http://www.god-does-not-play-dice.net/#Beig>

The second link elaborates on the statement by Alan Turing, quoted in your paper: "Science is a differential equation. Religion is a boundary condition."

My answer to your Q1 in Sec. XIV is in the negative. Will be happy to elaborate.

All the best,

Dimi Chakalov

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**Note:** In Sec. XIV, Jeffrey Winicour posed Question 1: "Is there a strongly well-posed IBVP based upon a 3 + 1 formulation?" No, there can't be anything "well-posed" with the "3+1 formulation", except errors.

There is no "evolution" *whatsoever* with the unfortunate "3+1 formulation" or with some "edgeless spacelike hypersurface that serves as a Cauchy surface" ([Matt Choptuik](#)). The latter can offer just **one linearized** instant from some "future directed, time-like unit vector field T tangential to the boundary" [[Ref. 1](#)] used to "evolve" the Cauchy data with PDEs (cf. [above](#)). The genuine dynamics of GR is fundamentally **non-linear**, in the sense explained [above](#). PDEs aren't even a [spherical cow approximation](#).

All this mess comes from the notorious "splitting" of spacetime, after Dirac and [ADM](#). [Forget it](#).

Moreover, Jeffrey Winicour ([p. 7](#)) and [Helmut Friedrich](#) assume **smooth** fields [[Ref. 1](#)], ignoring the fundamental problem stressed by [Paul Tod](#). Piotr Chrusciel, for example, used "smooth" and "smoothness" 66 times in his report [above](#), for [well-known reasons](#).

I will be happy to [elaborate](#) in details, iff I am allowed to talk in [Prague](#). As Alan Rendall acknowledged ([arXiv:gr-qc/0503112v1](#), p. 4), "It follows from the above discussion that spacetime singularities should be associated with reaching the limits of the physical validity of general relativity."

[Quantum effects](#) can be expected to come in. If this is so then to go further the theory should be replaced by some kind of theory of quantum gravity. Up to now we have no definitive theory of this kind and so it is **not** clear how to proceed."

My proposal for a new kind of quantum gravity is sketched [above](#). One can contemplate about 'local points' only in classical physics, say, about the "point" of the mass center of a Frisbee, and subsequently about the trajectory of that "point" in some fictitious rigid background spacetime. But in present-day GR such "points" aren't justified, because there is no "background" in the local mode of spacetime, and the *physical stuff* which **defines** 'spacetime' cannot be localized at **any** such 'local point' -- the spacetime *itself* becomes **quasi-local**, as demonstrated with the [nonlocalizability](#) of the gravitational energy [density](#). It is manifestly wrong in GR to suggest some classical, 'local points' at which one could attach "[a tangent vector](#)" ([Erik Curiel](#)) or draw some "spacetime version of the Pythagorean theorem" ([Matt Choptuik](#)). The only possible way to define "points" in GR is to make them **quasi-local** with Machian quantum gravity: *perfect yet quasi-local* points can be defined only with Machian relational ontology, 'with respect to *everything else* in the universe', like a [school of fish](#): "non-localizable energy" is inadmissible in the theory of relativity ([Hermann Bondi](#)).

This is the correct physical meaning of 'quasi-local': no *physical stuff* in the r.h.s. of Einstein field equation could become "[non-local](#)". Instead, the spacetime points themselves become quasi-local (compare it with Laszlo Szabados, arXiv:0902.3199v2 [gr-qc], [Sec. 2](#)). Otherwise it won't be possible to explain the non-linear coupling of the gravitational field to matter: just look at the dreadful linearized approximations [above](#). If you disagree, try "[energy conservation](#)" (example from Hans Ohanian [here](#)) and "[gravitomagnetism](#)".

It is 'the whole universe as ONE' which defines -- dynamically, with the [Arrow of Space](#) -- a *perfect quasi-local* point 'here-and-now', to replace the "edgeless Cauchy slice". Hence we need [Finite Infinity](#) to fix the "boundaries" of spacetime *dynamically*, along the [Arrow of Space](#) which is defined with respect to the ([totally hidden](#)) [reference fluid of GR](#): see the *background time* code of the animation from John Walker [above](#).

Notice that we shouldn't be able to solve the [Hamiltonian constraint problem](#) in canonical quantum gravity, because if we could, the Hamiltonian "dynamics" would **expose** some preferred global "time" which is "[nondynamical](#) and explicit" ([Bill Unruh](#)) yet [totally hidden](#): it *must* stay **totally hidden** (or "[dark](#)", as some [otherwise smart](#) people called it).

All this has been said many times here at this web site. I only wanted to commemorate Einstein's 133th birthday by elaborating on his '[total field of as yet unknown structure](#)'.



March 12, 2012  
Last update: March 14, 2012

[Ref. 1] [Helmut Friedrich](#), Initial boundary value problems for Einstein's field equations and geometric uniqueness, [IML-0809f-37.pdf](#), *Gen. Rel. Grav.* 41, 1947 (2009).

p. 2: "To simplify the discussion we assume all fields to be smooth.

.....

pp. 16-17: "...require the choice of a [future directed, time-like unit vector field](#) T tangential to the boundary. The vector field T, for which no natural choice exists in general, is characterized indirectly and becomes explicitly available only **after** solving the equations. Problems arise if one wants to compare solutions pertaining to boundary conditions based on different choices of T and on different boundary data.

"This situation leads to awkward practical problems if gauge transformations need to be considered in the course of an **evolution**. It is an open question whether this is an intrinsic problem of the initial boundary value problem for Einstein's field equations or whether there can be formulated, under general assumptions, initial boundary value problems for Einstein's field equations which avoid these difficulties."

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Subject: arXiv:1203.2641v1 [gr-qc], [p. 3](#)  
Date: Wed, 14 Mar 2012 04:31:04 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Olaf Dreyer <olaf.dreyer@gmail.com>

Hi Olaf,

May I ask two questions.

You wrote: "Locally all physics is as it is in Minkowski space. Gravity is in the way these local Minkowski spaces are connected. (...) Through this connection the metric  $g_{ab}$  becomes the glue that connects the local Minkowski spaces."

1. If gravity were indeed eliminated by Mother Nature "locally", at each and every point from a [geodesic](#), the latter will be converted to a trajectory in "local Minkowski spaces", correct ?

2. Who taught you [GR](#) ?

Dimi

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It is like a lot of worms trying to get out of a bottle by crawling all over each other. It is not that the subject is hard; it is that the good men are occupied elsewhere. Remind me not to come to any more gravity conferences!

Richard Feynman, *What Do You Care What Other People Think?* W. W. Norton & Co., New York, 1988, [p. 92](#)

Why is that "the good men are occupied elsewhere"? Consider this. People agree with [Hermann Minkowski](#) that "space by itself, and time by itself, are doomed to fade away into mere shadows, and only a kind of **union** of the two will preserve an independent reality."

Yet the '[GR bartenders](#)' treat 'time' and 'space' as totally different entities, "thereby doing **grave**

**injustice** to space-time covariance that underlies general relativity" ([A. Ashtekar](#)).

They endow 'space' with some [Akasha-like "memory"](#) to distinguish between 'before' and 'after', despite the fact that 'time' can "evolve" just as much as 'space'. Of course there is no "evolution" *whatsoever* in present-day GR, as I argued [above](#). On top of that, the same people claim that GR were some "classical theory". But if gravity were indeed eliminated by Mother Nature "locally", at each and every point from a [geodesic](#), the latter will be flattened to a trajectory in Minkowski spacetime.

Obviously, Hermann Minkowski wouldn't come to any "[gravity conferences](#)" either. And if Einstein were here alive, he would ask, how do you make such "evolution" [non-linear](#)? With [PDEs](#)?

I very much hope to be allowed to talk in [Prague](#). We shouldn't abuse GR anymore.

D. Chakalov  
March 16, 2012

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Subject: [arXiv:1203.5709v2 \[gr-qc\]](#), Sec. 2.2, "... corresponds loosely to the \*rate\* of change of [the contact vector](#)."

Date: Wed, 28 Mar 2012 04:52:33 +0300

From: Dimi Chakalov <dchakalov@gmail.com>

To: hwestman@physics.usyd.edu.au, tzlosnik@perimeterinstitute.ca

Cc: Graham.Nerlich@adelaide.edu.au

Dear colleagues,

Seems to me that in the capture of Fig. 2 you used "other" twice.

Your paper is truly fundamental -- "the ideal waywiser at a given point is 'invisible' to all other other points" -- but I can't agree with your efforts to seek some "encoding" of the Affine Connection in the field of "contact vectors":

"In particular, we see that the metric directly corresponds to the change of contact point when the waywiser is rolled. However, the metric tensor cannot tell us how to parallel transport tangent vectors,  $u^a$  say, along the surface, something which is encoded in the affine connection [xxx]. Nevertheless, also this mathematical object can easily be constructed from the waywiser variables and corresponds loosely to the \*rate\* of change of the contact vector."

I think the Affine Connection is the fundamental binding phenomenon of "points", and its nature cannot be uncovered by any ideal waywiser that can test only the end result ("a succession of infinitesimal SO(3) transformations") from such binding phenomenon: any time you probe the "succession of infinitesimal transformations", the Affine Connection is gone. It isn't there. You can't see it, simply because you cannot "see" anything that stands [between](#) these infinitesimal points.

Besides, you tacitly imply some **long-term memory** of the ideal waywiser, such that it can say 'look, I'm now rolling on a curve, as compared to my previous infinitesimal state!' Do you agree?

All the best,

Dimi Chakalov

=====

Subject: Re: [arXiv:1203.5709v2 \[gr-qc\]](#), Sec. 2.2, "... corresponds loosely to the \*rate\* of change of

[the contact vector.](#)"

Date: Wed, 28 Mar 2012 12:07:11 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Hans Westman <hwestmanxx@gmail.com>  
Cc: tzlosnik@perimeterinstitute.ca,  
Graham.Nerlich@adelaide.edu.au,  
hehl@thp.uni-koeln.de,  
Andrzej Mariusz Trautman <amt@fuw.edu.pl>

Dear Hans,

Thank you for your prompt reply.

> Presumably one can have different interpretations. But on the mathematical  
> level it is true that the affine connection can be extract from the waywiser  
> pair  $\{V^A(x), A^{\{AB\}}(x)\}$ .

I believe one can have different interpretations on the Affine Connection in the first place. Yours is concerned with its end result only, while I am interested in its inherent dynamics and treat it as 'the binding process' of 'the whole universe as ONE',

<http://www.god-does-not-play-dice.net/#Winicour>

Tullio Levi-Civita demonstrated in 1919 that 'parallelism' and 'curvature' are affine-type features,

<http://www.god-does-not-play-dice.net/#Eckhardt>

and I am interested in the phenomenon which creates the underlying topological manifold "equipped" with differentiable structure, such that, at the end of the day, you can imagine "a succession of infinitesimal SO(3) transformations".

Basically, the difference in the interpretations of the Affine Connection boils down to the interpretation of 'dynamics' and 'time': yours is based on a dead frozen manifold, while mine deals with an emergent manifold: time doesn't emerge from 'change within space' (e.g., co-ordinate time), but from 'change \*of\* space' along an Arrow of Space.

> Of course, we are not doing without a connection altogether; we still make use  
> of the rolling connection  $A^{\{AB\}}$ .

What is **pushing** the ideal waywiser in such a way that "at a given point" it is invisible to all "other" points, as you put it ?

> I'm not sure what you mean by long term memory.

An Akasha-like global memory,

[http://www.god-does-not-play-dice.net/#GR\\_bartenders](http://www.god-does-not-play-dice.net/#GR_bartenders)

Best regards,

Dimi

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**Note:** Time doesn't emerge from 'change *within* space', and gravitational observables do not evolve "dynamically" -- read [Karel Kuchar](#). It was noted by [Charles Torre](#) that GR observables have to include "an infinite number of derivatives and are therefore very nonlocal" ([Johannes Tambornino, arXiv:1109.0740v2 \[gr-qc\]](#)). What we observe is a genuine dynamical evolution of GR observables (not "[Dirac observables](#)") with respect to the matter content of 'the whole universe as ONE' defined

with [Finite Infinity](#): a genuine 'change **of** space' along the Arrow of Space. You don't have any other choice. That's it. Ignore it at your peril.

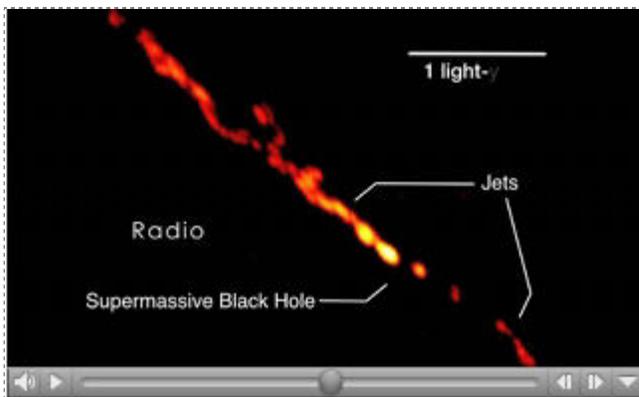
Just two examples: [Sabine Hossenfelder](#) failed to mention the [direct evidence](#) against some "discrete nature" of spacetime (see [above](#)), and [Johannes Tambornino](#) is still keeping his faith in [LOG](#). Two young physicists ready to retire. They just don't want to acknowledge that it is **impossible** to derive Lorentzian metric from "spacetime foam". Do you believe in miracles? If you do, you too are ready to retire. Sorry for being frank.



The current paradoxical situation is similar to the ultraviolet catastrophe of late 19th century. You need a new Quantum Theory compatible with Einstein's "total field of as yet [unknown structure](#)". You don't have any other choice. That's it. [Ignore it at your peril](#).

I *very* much hope to deliver my talk on the [Arrow of Space](#) at the Einstein Conference in [Prague](#) (pending approval by the [Scientific Organizing Committee](#)). We'll have a jolly good time, notwithstanding the PR crusade for [GW "astronomy"](#).

For example, what if the phenomenon of "spin" is a topological property of space endowed with **torsion**? Surely we see some axis of rotation (unlike the axis of electron's spin), but with the Arrow of Space the origin of the "spin" may be [purely geometrical](#), hence if you try to explain it as caused by matter, the latter will have to be "[dark](#)".

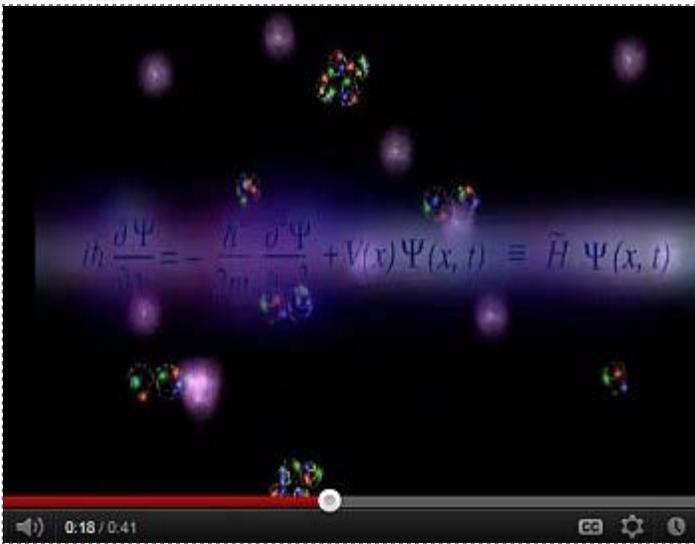
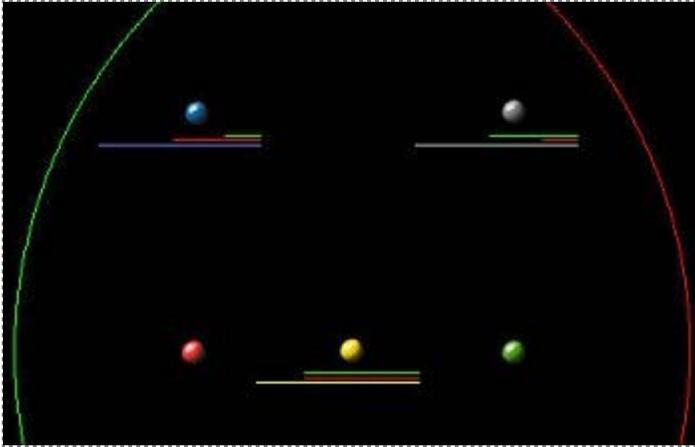


According to NASA, the stuff you *cannot* see between the jets could only be some invisible [55-million-solar-mass](#) defect of the spacetime continuum (yes, the Brooklyn Bridge is on sale).

No **real** ([positive energy density](#)) physical stuff could be embodied as 'the carrier' of this fundamental and *purely geometrical* feature of the spacetime itself. The same tallies to the '[free fall](#)'. I will slice and dice this succinctly in my talk, entitled '[Arrow of Space](#)'.

For a start, look at the discussion of the [Bondi-Metzner-Sachs](#) group in Robert Wald's textbook ([pp. 283-287](#)): "In a general, [curved spacetime](#) one would not expect **any** exact isometries to be

present." What can replace "the unphysical spacetime" (*ibid.*), other than the so-called [global mode of spacetime in Finite Infinity](#) ? In the two animations below, from John Walker and the Cassiopeia Project, the genuine dynamics of both gravitational (cf. the [reference fluid](#)) and quantum observables requires the 'global mode of spacetime': one can *physically* observe only their "colored" (after the [KS Theorem](#)) "[jackets](#)" in the local (physical) mode of spacetime, one-at-a-time, along the Arrow of Space.



*Der Geist bewegt die Materie... [oder was](#) ?*

D.C.  
 March 31, 2012, [20:50:48 GMT](#)

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Subject: Re: arXiv:1203.5709v2 [gr-qc], Sec. 2.2, "... corresponds loosely to the \*rate\* of change of the contact vector."

Date: Mon, 16 Apr 2012 16:49:25 +0300  
 From: Dimi Chakalov <dchakalov@gmail.com>  
 To: Hans Westman <hwestmanxx@gmail.com>



energy cannot be "conserved in time", to define the corresponding notion of 'time'. The genuine dynamics of GR is encoded in the reversible, bi-directional "transfer between the *intangible* energy of the gravitational field (as it will be called here), which is **not** described by the energy-momentum tensor, and the tangible forms which are so described" (Hermann Bondi).

This bi-directional, *intangible* <--> *tangible* energy conversion is the crux of the non-linear coupling between matter and gravity. The **dynamics** of the energy non-conservation in GR cannot be modeled with any linear theory. It doesn't even remotely resemble the "dynamics" of ADM and its tantalizing task for sorting out "which components are dynamic, which are constrained, and which are gauge" (Gregory B. Cook).

These are the 'things we *know* that we don't know' about Einstein's 'total field of as yet unknown structure.' If you disagree, try "the single Master Constraint", Eq. 1.7, in the Master Constraint Programme by Bianca Dittrich and Tom Thiemann. Then ask Karel Kuchar for help.

D.C.  
April 2, 2012

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Subject: Re: The existence of Dirac observables for gravity  
Date: Tue, 29 May 2012 15:36:04 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Bianca Dittrich <dittrich@aei.mpg.de>  
Cc: doriti@aei.mpg.de, hermann.nicolai@aei.mpg.de, frank.eckert@aei.mpg.de, thomas.thiemann@gravity.fau.de, kiefer@thp.uni-koeln.de, hehl@thp.uni-koeln.de, lsmolin@perimeterinstitute.ca, perez@cpt.univ-mrs.fr, rovelli.carlo@gmail.com, lewand@fuw.edu.pl, Helmut Friedrich <hef@aei.mpg.de>

Bianca dear,

You suggested "perfect discretizations" in [arXiv:1205.6127v1 \[gr-qc\]](http://arxiv.org/abs/1205.6127v1), and speculated that "the amplitudes for such building blocks can be constructed through a coarse graining process."

[How far in 3-D space would you be able to see](#) with such "coarse graining process" ? Remember that min. 7.3 billion light years from Earth the spacetime is **perfectly smooth** (references at my web site).

In case you and your colleagues fail with that "coarse graining process", check out

<http://www.god-does-not-play-dice.net/#ESI>

More from [Helmut Friedrich](#), 'The large scale Einstein evolution problem', <http://ae100prg.mff.cuni.cz/img/abstracts/9f42de26a136d803d39c4bdd43b31f8c.pdf>

Have a nice summer.

Dimi

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Subject: "3+1 Formalism in General Relativity", [p. 74](#)

Date: Tue, 3 Apr 2012 01:22:25 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Ericourgoulhon <eric.gourgoulhon@obspm.fr>  
Cc: Stanley Deser <deser@brandeis.edu>,  
Jonathan Thornburg <jthorn@astro.indiana.edu>

Hi Éric,

May I ask three questions. The opinion of your colleagues will be greatly appreciated, too.

You stated ([p. 74](#)) that you can incorporate without problems the cosmological "constant" in EFE.

1. How would you accommodate the brand new (to ADM) case of "expanding" space driven by some "dark" energy ?

2. How would you define "expanding" space: with respect to \*what\* ?

<http://www.god-does-not-play-dice.net/#Heraclitus>  
[http://www.god-does-not-play-dice.net/#affine\\_connection](http://www.god-does-not-play-dice.net/#affine_connection)

3. How would you rigorously define "[event horizon](#)", without any poetry ?

I assume that you are professional physicist, and don't play with GR as a hobby. If I'm wrong, please don't bother to reply to this email nor to my initial email from Tue, 17 Oct 2006 22:56:37 +0300.

Regards,

Dimi

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Subject: arXiv:1204.0054v1 [gr-qc], [p. 6](#)  
Date: Tue, 3 Apr 2012 12:28:55 +0100  
Message-ID:  
<CAM7Ekx=Cht2zXWmgQJg52+MUjEaLYj5oQdMmkiOnADQkP2XrVA@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Yuri Bonder <yuri.bonder@nucleares.unam.mx>  
Cc: slandau@df.uba.ar,  
gabriel.leon@nucleares.unam.mx,  
sudarsky@nucleares.unam.mx,  
malcubi@nucleares.unam.mx,  
monigal@physics.usyd.edu.au,  
hwestman74@gmail.com,  
hermann.nicolai@aei.mpg.de,  
Simen.Brack@hioa.no,  
Oyvind.Gron@hioa.no,  
landsberg@hep.brown.edu,  
jpereira@ift.unesp.br

Dear Dr. Bonder,

It is a rare pleasure to read your latest paper. Thank you.

I believe one can accommodate "\*all\* possible trajectories of the center of mass" ([p. 6](#)) and recover a genuine trajectory of [single quantum particle](#) with a new Quantum Theory,

<http://www.god-does-not-play-dice.net/#Tod>

[http://www.god-does-not-play-dice.net/#affine\\_connection](http://www.god-does-not-play-dice.net/#affine_connection)

Notice the latest paper by Simen Braeck and Øyvind Grøn, [arXiv:1204.0419v1 \[gr-qc\]](https://arxiv.org/abs/1204.0419v1), in which they argue that "the relative 'motion' of the galaxies must be attributed to an expansion of the three-space between them". The medium ([the reference fluid of GR](#)) w.r.t. which the 3-D space is "expanding" is addressed at

<http://www.god-does-not-play-dice.net/#Heraclitus>

If we let the reference fluid of GR to keep "**\*all\* possible trajectories** of the center of mass", perhaps we could reconcile Quantum Theory with GR from the outset.

Will be happy to provide details, should you or your colleagues are interested.

Kind regards,

Dimi Chakalov

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Subject: Re: [The wine cellars of LIGO](#)

Date: Fri, 6 Apr 2012 01:33:23 +0300

Message-ID:

<CAM7EkxmnAsEBhBKjB4oYCzH1s8dtWpNNskneUNJv9qgkYkk18g@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Joan Centrella <Joan.Centrella@nasa.gov> ,

Alan J Weinstein <ajw@caltech.edu> ,

James Ira Thorpe <James.I.Thorpe@nasa.gov> ,

john.g.baker@nasa.gov ,

stmwill@princeton.edu ,

markodh@googlemail.com ,

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Karen.m.Smale@nasa.gov ,

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Drew Keppel <drew.keppel@ligo.org>,  
Hans-Jürgen Schmidt <hjschmi@rz.uni-potsdam.de>,  
Thomas A Prince <prince@srl.caltech.edu>,  
Vivian Drew <vdrew@stanford.edu>,  
hamish.johnston@iop.org

Dear Colleagues,

Regarding my email from Mon, 30 Jan 2012 14:44:12 +0200,  
Message-ID:  
<CAM7EkxmbWB\_2nTzZWDuSWdpVT2TU+62ZNtsAWc\_DoEoK3jQL8g@mail.gmail.com> ,  
please notice an update at

[http://www.god-does-not-play-dice.net/#LIGO\\_Prague](http://www.god-does-not-play-dice.net/#LIGO_Prague)

Your professional feedback will be highly appreciated, and duly recorded -- the forthcoming scandal with wasting taxpayers' money by LIGO "scientific" collaboration will be \*enormous\*.

Please feel free to pass [this email](#) to all officials from NSF and NASA, involved with LIGO funding.

I will be more than happy to provide specific details.

Yours sincerely,

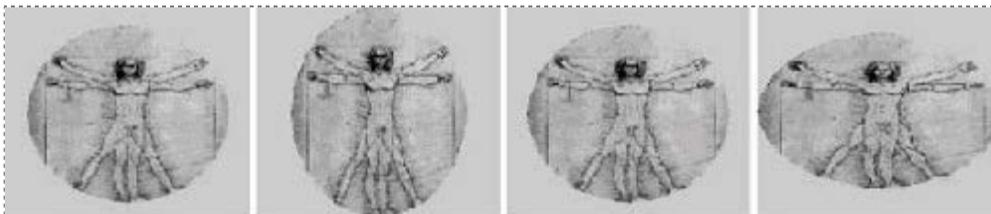
Dimi Chakalov

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**Note:** According to [Wiki](#) (emphasis added), "Waves familiar from other areas of physics such as water waves, sound waves, and electromagnetic waves are able to carry energy, momentum, and angular momentum. By carrying these away from a source, waves are able to rob that source of its energy, linear or angular momentum. Gravitational waves perform **the same** function. Thus, for example, a binary system loses angular momentum as the two orbiting objects spiral towards each other—the [angular momentum](#) is radiated away by gravitational waves."

Gravitational waves (GWs) "perform **the same** function", but, unlike electromagnetic waves, the energy transport by GWs is fundamentally [non-linear phenomenon](#), so the first off question is this: how do you explain the transition between "[the intangible energy](#) of the gravitational field (as it will be called here), which is **not** described by the energy-momentum tensor, and the tangible forms which are so described" ([Hermann Bondi](#)) ?

To execute the "deformations" dictated by the passing GW, the [tangible](#) forms of energy, associated with the "deformations" of the "GW detector" (cf. below), will need an **input** from the *intangible* GW energy, originating **way back** from their source (see [below](#)), and this energy input is *precisely* the **converted** *intangible* GW energy into some [tangible](#) forms of energy.



The conversion of *intangible* GW energy into tangible forms of energy.  
Source: B. C. Barish, [LIGO-G030020-00-M](#), April 10, 2003, Slide #15

If LIGO Scientific Collaboration (800+ scholars) are **not** doing [parapsychology](#), they will have to explain [the input of tangible forms of energy](#), originating from the *intangible* GW energy. No, don't jump to [interferometers](#). You have some [tangible forms of energy](#) of the source of **very strong GWs**, which have been *somehow* (how?) converted into *intangible* GW energy, and here on Earth you expect to detect the [reversed conversion](#) of the *intangible* GW energy into some [tangible forms of energy](#) (along with some characteristic "pattern" revealing information about the source of the initial **very strong GWs**).

Start with a simple object, say, a Coca Cola bottle: (i) what are the [tangible](#) forms of energy which "[can do work](#)", and (ii) how is the *intangible* GW energy being converted into these tangible forms? Regarding the latter, is the Coca Cola bottle going to get "hotter" or "colder" upon its "stretching 'n squeezing" ?

Notice that (i) involves quantum effects in the Coca Cola bottle, at the length scale of  $2.3 \times 10^{-26}$  m. But first you have to resolve the riddles of [energy non-conservation](#) in GR and the quasi-localization of the *intangible* gravitational energy (MTW, [p. 467](#)).

If LIGO "scientific" collaboration cannot answer these two *very* simple questions, they will have to admit that the taxpayers' money they need -- "**at least 3-4 billion dollars**", as stated by Prof. Dr. Bernard F. Schutz [above](#) -- is actually for their 'GW parapsychology': some kind of 'effective stress-energy tensor' which would allow to safely separate "the background" from the "perturbation" (A. Buonanno, [p. 17](#)):

#### 4. Effective stress-energy tensor of gravitational waves

Until now we have defined the GWs as fluctuations of a flat spacetime. Here, we want to be more general and consider GWs as perturbations of a generic background  $\bar{g}_{\mu\nu}$ , that is

$$g_{\mu\nu} = \bar{g}_{\mu\nu} + h_{\mu\nu}, \quad |h_{\mu\nu}| \ll 1. \quad (4.1)$$

We need a criterion to define what is the background and what is the perturbation.

Details from Michele Maggiore, [Gravitational Waves: Theory and Experiments](#), Oxford University Press, 2007, [pp. 34-35](#):

So, we can rewrite eq. (1.122) as

$$\bar{R}_{\mu\nu} = \frac{8\pi G}{c^4} \left( t_{\mu\nu} - \frac{1}{2} \bar{g}_{\mu\nu} t \right) + \frac{8\pi G}{c^4} \left( \bar{T}_{\mu\nu} - \frac{1}{2} \bar{g}_{\mu\nu} \bar{T} \right), \quad (1.129)$$

or, in an equivalent way,

$$\bar{R}_{\mu\nu} - \frac{1}{2} \bar{g}_{\mu\nu} \bar{R} = \frac{8\pi G}{c^4} (\bar{T}_{\mu\nu} + t_{\mu\nu}). \quad (1.130)$$

The most interesting aspect of eq. (1.130), however, is that it shows that the effect of GWs on the background curvature is formally identical to that of matter with energy-momentum tensor  $t^{\mu\nu}$ . We are therefore able to assign an energy-momentum tensor to GWs.

Then "something that is dimensionless" (exact quote from [Kip Thorne](#)), calculated in the case of PSR J1603-7202 as " $2.3 \times 10^{-26}$ ", would miraculously<sup>1</sup> travel [5345ly](#) to Earth, carrying its *intangible* GW energy, just to end up at LIGO's arms, at which point it will be converted into some tangible form of energy.

Is the Brooklyn Bridge for sale, again ?

D. Chakalov

Easter 2012

Last updated: April 24, 2012

<sup>1</sup> [MTW](#), p. 968:

All nonlinear interactions of the wave with itself are neglected in this first-order propagation equation. Absent is the mechanism for waves to scatter off each other and off the background curvature that they themselves produce. Also absent are any hints of a change in shape of pulse due to self-interaction as a pulse of waves propagates. There are no signs of the gravitational collapse that one knows must occur when a mass-energy  $m$  of gravitational waves gets compressed into a region of size  $\lesssim m$ . To see all these effects, one must turn to corrections of second order in  $\mathcal{L}$  and higher [e.g., equations (35.59c) and (35.60)].

Michele Maggiore, [Gravitational Waves: Theory and Experiments](#), Oxford University Press, 2007, [p. 32](#):

At this point we can understand why the linearized approximation of Section 1.1 cannot be extended beyond linear order. If we force the background metric to be  $\eta_{\mu\nu}$ , we are actually forcing  $1/L_B$  to be strictly equal to zero, and therefore any arbitrarily small, but finite, value of  $h$  necessarily violates the condition  $h \lesssim \lambda/L_B$ , and the expansion in powers of  $h$  has no domain of validity. This means that the linearized expansion of the classical theory cannot be promoted to a systematic expansion, and if we want to compute higher-order corrections we cannot insist on a flat background metric.

We can also understand from eqs. (1.120) and (1.121) that the notion of GW is well defined only for small amplitudes,  $h \ll 1$ . If  $h$  becomes of order one, eqs. (1.120) and (1.121) tell us that  $\lambda/L_B$  also becomes at least of order one. Since the separation between  $\lambda$  and  $L_B$  is at the basis of the definition of GWs, when  $h$  becomes of order one the distinction between GWs and background vanishes. In a general context, there is nothing like “a GW of arbitrary amplitude”.<sup>19</sup>

<sup>19</sup>In special cases one can find *exact* wave-like solutions of the full non-linear Einstein equations, see, e.g. Misner, Thorne and Wheeler (1973), Section 35.9, and then there is no need to perform a separation between the background and the waves. However, it would be hopeless to look for exact solutions for the gravitational waves emitted by realistic astrophysical sources.

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Subject: [Relativity and Gravitation, June 25 - 29, 2012, Prague](#)

Date: Sun, 8 Apr 2012 00:59:11 +0300

Message-ID:

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Dear Colleagues,

I believe you are members of the [Scientific Organizing Committee](#) of the Einstein Conference in Prague, and also staunch supporters of GW astronomy.

In my oral contribution submitted last December, which is still pending your approval, I will address two *\*very\** simple questions posted at

<http://www.god-does-not-play-dice.net/#Bondi>

Please let me know if you'd like me to elaborate in my talk on [other problems](#) of GW astronomy.

Wishing you a very happy Easter, and looking forward to meeting you in Prague,

Yours sincerely,

Dimi Chakalov

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**Note:** To prove the original assumption in physics that "mass is that which is conserved" ([Hermann Bondi](#)), one needs to demonstrate rigorously that '[negative mass](#)' is indeed non-existent in GR, or somehow **cancelled out**: "within the general theory, it is not possible to have the **active** and passive masses different" ([P. Bergmann](#)). The latter argument presupposes "conservation of momentum, which means integrals over **extended** regions of space" ([Hermann Bondi](#)), that is, "passing to an appropriate asymptotic regime such that **all** gravitational effects are localized inside of it" ([A. Helfer](#)), the inertial reaction "forces" included. The latter are considered non-existent (much like [Macavity](#)) in some '[free falling elevator](#)', yet they *emerge* **instantaneously** (cf. Mike Zucker below).

Why? How? And with respect to *what* ([Ernst Mach](#))? The mainstream opinion, spelled out by [Ciufolini and Wheeler](#) (p. 270), does not answer these questions. As explained by [J.F. Woodward](#), "when you push on something, it pushes back on you **immediately**. If they're caused chiefly by the most distant matter in the universe, how can that be?" Well, "it would be nice if the inertial mass of an accelerating particle were simply a [back-reaction](#) to its own gravitational field, but that is **not** the case. (...) Newtonian active gravitational mass (the creator of the field) goes over into GR as the creator of curvature. Newtonian passive gravitational mass (that which is pulled by the field) goes into banishment along with the [ether](#), etc." ([Wolfgang Rindler](#)).

Going back to GWs, the seemingly obvious conjecture that gravitational radiation is being "emitted" in 3-D space ([R. Feynman](#)) also presupposes global [conservation laws in GR](#): "If energy is [not conserved](#) quite generally, there is no need to make up a story about where it has gone when a system loses it" ([C. Hofer](#)); details from [Erik Curiel](#).

Surely there isn't any 'physically observable' gravitational radiation in the **dipole** and **monopole** mode, but this does *not* mean that such "ripples" cannot exist in Nature. Here people say that the [conservation](#) (if any) of energy-momentum would *imply* the absence of monopole and dipole gravitational radiation, so GWs should be sought exclusively with the quadrupole approximation. As explained by [B. Schutz](#) (reference [here](#)), by resorting to the [post-Newtonian approximation](#) and ignoring **higher order** effects:

"But this (Eq. 10 - D.C.) is the total momentum in the system, and (to **lowest** order) this is **constant**. Therefore, there is no energy radiated due to dipole effects in general relativity." See also [Chris L. Fryer et al.](#): "At **lowest** order, GWs come from the time changing quadrupolar distribution of mass and energy; monopole GWs would violate [mass-energy conservation](#), and dipole waves violate momentum conservation."

But how can we prove "mass-energy conservation" and "momentum conservation" in our universe dominated by the [so-called "dark" energy](#), to eliminate monopole and dipole GWs? They **cannot** be "emitted" in 3-D space ([R. Feynman](#)) built with only one [charge](#)", and cannot of course be detected

by any "advanced" LIGO or Virgo either.

[Mike Zucker](#) provided the best hint for the [atemporal nature](#) of the monopole and dipole gravitational radiation: "For example, if two stars collide or a star explodes somehow, the change in the mass distribution, the presence or absence of a star where there was one before, has to somehow be communicated throughout the whole universe. And in Newton's picture, there's a problem with that because there isn't any way for that information to take some finite amount of time. Somehow the whole universe must know about everything **instantaneously**."

That's how we get the inertial reaction "forces" -- instantaneously, like in a [school of fish](#) bootstrapped by its "ripples". Such "ripples" must **not** carry energy that "[can do work](#)", which is why in the [non-linear](#) GR they can show up *only* as 'unphysical gauge' ([Angelo Loinger](#)). As Arthur S. Eddington pointed out in 1922 ([p. 269](#)), "They are not objective, and (like absolute velocity) are not detectable by any conceivable experiment. They are merely sinuosities in the co-ordinate system, and the only speed of propagation relevant to them is "the speed of thought"."

**NB:** These are the "thoughts" of 'the universe as a [brain](#)'. No physical stuff "pulsates" in the quantum realm to produce [quantum waves](#) (with dimensionless amplitude), and no physical stuff **alone** could produce the gravitational "ripples" either. These are holistic effects of the Arrow of Space: the rule 'think globally, act locally' will *induce* wave-like behavior in '[the whole school of fish](#)', a bit like the waves in the holomovement of centipede's legs. You have the same phenomenon of *purely geometrical* nature right above your neck: you think *about* your brain, *by* your brain, hence your brain is '[self-acting](#)'. Physically, we cannot observe the "ripples" of 'the universe as a brain'.

All we can *physically* observe is a **self-acting** universe in which the **conversion** of the "[negative mass](#)" and "the *intangible* energy of the gravitational field" ([Hermann Bondi](#)) into 'tangible forms' is facilitated by perpetual [energy non-conservation](#), and smuggled into the right-hand side of the Einstein field equations "post factum", due to [the speed of light](#).

Perhaps a **wave-like** correlation of the energy content of the *very* early universe, at the instant it contained an **equal** amount of [matter and antimatter](#), way before the so-called "spontaneous" [symmetry breaking](#), can shed light on the [cosmic microwave background](#) (the drawing below is for illustrative purpose only, for the [geometry of the universe](#) could be [quite different](#)).



The unsolved puzzle here is the **origin** of the cosmic microwave background ([CMB](#)): "Where did the photons actually come from?" ([Douglas Scott](#)). The [matter/antimatter asymmetry](#) (about one matter particle per billion managed to "survive") was settled by the unphysical gravitational "ripples" over [the whole universe en bloc](#). The **background** of the "survived" matter doesn't contain any trace from

some **real** [relic GWs](#).

The *instantaneous* synchronization of the initial perturbations and of the radiation arriving from opposite ends of the universe (Scott Dodelson *et al.*, arXiv:0902.3796v1, [p. 2](#)) is due to the **unphysical** gravitational "ripples" -- the "thoughts" of the universe, which synchronize and [bootstrap](#) the whole universe as 'ONE'. Such kind of "[John's thoughts](#)" cannot be physical: *Mens agitat molem* (Der Geist bewegt die Materie), as Virgil argued in [The Aeneid](#). Were the gravitational "ripples" **physical**, they would have to be produced by another physical agent, which would in turn have to be produced by yet another physical agent, etc., *ad infinitum*. Aristotle suggested the cut-off on this infinite regression with the [First Cause](#) which isn't physical: Der Geist bewegt die Materie. To eliminate the *physical* presence of 'Der Geist', the [dual age cosmology](#) has been introduced. Simple, no?

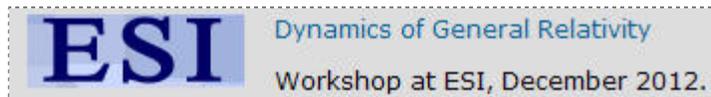
To prove/disprove these conjectures, we first need a rigorous formulation of 'isolated system in GR': "In some sense, we must say what it means to travel far from the system, and say that in that **limit** the system becomes "self-contained." Roughly speaking, this should mean passing to an appropriate asymptotic regime such that all gravitational effects are localized inside of it" ([A. Helfer](#)).

To define 'isolated system in GR' by reaching "that **limit**" ([Finite Infinity](#)), we need to recover Einstein's 'total field of as yet [unknown structure](#)'. I will argue for the introduction of the '[free fall](#)' in conjunction with '[time-orientability](#)', as two fundamental and irreducible features of 'spacetime in GR', introduces as mathematical axioms 'by hand', from the outset. In my opinion, the seemingly innocent "relaxation" of the Einstein field equations "which, *a priori*, do **not** form a partial differential system of well-defined type" (T. Damour, The problem of motion in Newtonian and Einsteinian gravity, in: *Three Hundred Years of Gravitation*, ed. by Stephen W. Hawking and Werner Israel, Cambridge University Press, 1989, Sec. 6.8, [pp. 147-149](#)) is wrong. As I argued [previously](#), there isn't any "evolution" whatsoever with the unfortunate "[3+1 formulation](#)": each and every "point" from the *quasi-local* geodesic is the nexus of '[already completed](#)' negotiations between the positive-energy content localized at such "point" and 'everything else in the universe', in line with the ideas of [Ernst Mach](#) and the bootstrapping principle of [Geoffrey Chew](#).

My oral contribution, submitted on [December 16th](#) last year, is still pending the approval of the [Scientific Organizing Committee](#) of the Einstein Conference in Prague. Stay tuned.

D. Chakalov  
April 9, 2012  
Last updated: April 17, 2012

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Subject: Dynamics of General Relativity: Black Holes and Asymptotics,  
[ESI, December 2012](#)  
From: Dimi Chakalov <dchakalov@gmail.com>  
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Dear Dr. Beig,

Please let me know when I can register for the Workshop in December. I would like to argue for the introduction of the '[free fall](#)' in conjunction with '[time-orientability](#)', as two fundamental and interlinked features of 'spacetime in GR', and will address some issues of "conserved" quantities in asymptotically flat spacetimes endowed with "dark" energy [from the outset](#).

Some relevant material has been briefly mentioned at

<http://www.god-does-not-play-dice.net/#Bondi>

Wishing you and your colleagues all the best for Easter,

Yours sincerely,

Dimi Chakalov

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**Note:** When it comes to the dynamics of General Relativity, the most difficult issues are those which refer to global features of spacetime: what is the origin of the '[free fall](#)'? Could this ubiquitous phenomenon be a blueprint or maybe a "reversed image" from some global dynamics of spacetime produced by the arrow of events known since [Heraclitus](#)? Do we need to introduce the free fall phenomenon by hand at the level of 'differentiable manifold', as we do with [time-orientability](#)? In other words, what could possibly introduce a **temporal** structure to the "points" from a [Borel set](#), to make it a genuine 'spacetime' equipped with the metaphysical principle of [causality](#)? We cannot start from thermodynamics and use some "top-down" approach.

What could be the phenomenon that [connects](#) the "points" in the first place? I will argue that such *causal connection cannot be made only and exclusively only* by matter. Matter is the *necessary* condition for the "connection", but the *sufficient* condition is **purely geometrical**, and can *only* come from 'the whole universe as ONE'. Namely, there exists a fundamental *component* of this "connection", which (i) originates from 'the whole universe as ONE' driven by an Arrow of Space, (ii) and makes these causally-connected "points" **quasi-local**, to accommodate the holistic input from 'the whole universe as ONE'. Let's go back to the 'free fall'.

The metaphor "[closed room accelerating through space](#)" (see [above](#)) is made of five words, each of which refers to a total mystery. I will argue that "[space](#)" could refer to Einstein's '[total field of as yet unknown structure](#)', and "[through space](#)" could *only* mean 'along null hypersurface', namely, in a putative 'global mode of spacetime' which all physical clocks will read as some [atemporal world](#), due to the "[speed of light](#)". Obviously, the views of Robert Beig on the dynamics of General Relativity (GR) are incompatible with the new dynamics of spacetime: all things in GR happen 'in time' due to the Heraclitean [transience](#) (which is banned in GR) along the null-hypersurface of the Arrow of Space, which makes 'space' an *emergent* phenomenon ([Isham and Butterfield](#)). We shall also have a *very* "stimulating" (for the lack of a better word) discussion about the "[conserved](#)" quantities in the asymptotically flat spacetime of the "[closed room](#)", after my talk about [John's jackets](#): we need to have the reference fluid of GR fixed at '[absolute rest](#)', with respect to which we can define the dynamics of spacetime *en bloc*, as driven by the "dark" energy of Einstein's '[total field of as yet unknown structure](#)'. We simply have no choice, or do we?

At the end of the day, I suppose Robert Beig and his distinguished colleagues would struggle with the temptation to strangle me with their bare hands... but because they *all* are polite people, they will probably pretend that haven't heard anything important, and will continue to speculate about "black holes" and "asymptotics" in the framework of [ADM](#), although neither of these concepts makes sense -- they cannot be *rigorously* defined, without juvenile mathematical poetry and/or wishful thinking introduced 'by hand' to the unfortunate '3+1 numerical relativity'. Sad but true. Why?

Very briefly: the idea about some "[event horizon](#)" cannot be rigorously defined (I can elaborate extensively [here](#)), so the speculation about "black holes" involves too much poetry and wishful thinking. As to the second issue, if you start from some feature of the physical spacetime, you cannot extend it [exactly at infinity](#) in order to produce some "boundary" placed at **all** directions (time-like, space-like, and null), such that there will be **absolutely no** leaking of mass and energy from "the unphysical spacetime" (Robert Wald, [pp. 283-287](#)) with respect to which the "physical" one

has been defined -- you have to use Quantum Theory, hence cannot *completely* seal off the "boundary". Roger Penrose skipped this QM exercise in his 1964 conformal treatment of infinity, and almost half a century later [Jeffrey Winicour](#) still happily assumes that "matter fields do not spoil things", and poses the question whether the necessary boundary data can be "represented by gauge invariant, local geometric objects", again without bothering about quantum effects at the "spacelike cap on the future evolution domain." Instead of seeking some new, and still unknown, natural boundaries for the gravitational "field", he is trying to suggest that we *might* not need them, just like the old story about the [Fox and the grapes](#).

Let's start from scratch.

I was never able to understand the Equivalence Principle (cf. [B. Schutz](#)), because of the apparent freedom to eliminate gravity locally, '[at a point](#)'. It reminds me of an old joke: what do you see below?

|-----|

Obviously, this is a [wegtransformierbar](#) elephant walking on (flat) tightrope! It always drops down due to the Equivalence Principle, poor thing.

Let me try something *very* simple: the **finite size** of the "neighborhood **U**" (cf. Yuri Bonder [above](#) and the unsolved task for a quantum version of the [strong equivalence principle](#)) in the excerpt below, from *An Introduction to GENERAL RELATIVITY*, by [R. Aldrovandi and J. G. Pereira](#), March-April/2004, [pp. 70-71](#):

§ 3.11 As we have said, curves are of fundamental importance. They not only allow testing many properties of a given space. In spacetime, every (ideal) observer is ultimately a time-like curve.

The nub of the equivalence principle is the concept of observer:

An observer is a timelike curve on spacetime, a world-line.

Such a curve represents a point-like object in 3-space, evolving in the time-like 4-th “direction”. An object extended in 3-space would be necessarily represented by a bunch of world-lines, one for each one of its points. This mesh of curves will be necessary if, for example, the observer wishes to do some experiment. For the time being, let us take the simplifying assumption above, and consider only one world-line. This is an ideal, point-like observer. If free from external forces, this line will be a geodesic.

And here comes the crucial point. Given a geodesic  $\gamma$  going through a point  $P$  ( $\gamma(0) = P$ ), there is always a very special system of coordinates (Riemannian normal coordinates) in a neighborhood  $U$  of  $P$  in which the components of the Levi-Civita connection vanish at  $P$ . The geodesic is, in this system, a straight line:  $y^a = c^a s$ . This means that, as long as  $\gamma$  traverses  $U$ , the observer will not feel gravitation: the geodesic equation reduces to the forceless equation  $\frac{du^a}{ds} = \frac{d^2 y^a}{ds^2} = 0$ . This is an inertial observer in the absence of external forces. If  $\Gamma = 0$ , covariant derivatives reduce to usual derivatives. If external forces are present, they will have the same expressions they have in Special Relativity. Thus, the inertial observer will see the force equation  $\frac{du^a}{ds} = F^a$  of Special Relativity (see Section 3.7).

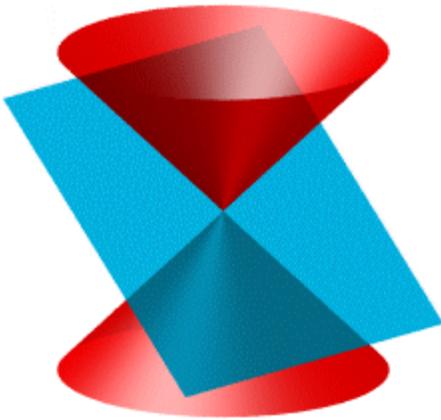
§ 3.12 There is actually more. Given any curve  $\gamma$ , it is possible to find a local frame in which the components of the Levi-Civita connection vanish along  $\gamma$ . That observer would not feel the presence of gravitation.

§ 3.13 How point-like is a real observer ? We are used to say that an observer can always know whether he/she is accelerated or not, by making experiments with accelerometers and gyroscopes. The point is that all such apparatuses are extended objects. We shall see later that a gravitational field is actually represented by curvature and that two geodesics are enough to denounce its presence (§ 3.46).

§ 3.14 As repeatedly said, the principle of equivalence is a heuristic guiding precept. It states that, as long as the dimensions involved in the definition of an observer are negligible, an observer can choose his/hers coordinates so that everything (s)he experiences is described by the laws of Special Relativity.

Suppose, for the sake of the argument, that GR were some "classical" theory, as usually stated in today's textbooks. Then it doesn't matter if we choose, or not-choose, to get rid of "the components of the Levi-Civita connection" -- Mother Nature has always made them **vanished** 'out there'. It's like our decision to look, or not-look, at the Moon at noon -- it just won't be there. This is the essence of 'objective reality *out there*' in any 'classical theory'. Thus, if GR were a *bona fide* "classical" theory, we would be *always* confined in the "neighborhood **U**" and will be always *perfectly* shielded from gravitation.

I think the [wegtransformierbar gravitational energy](#) is a **quantum** phenomenon: see the story about John's jackets [here](#). Just like the UNdecidable **uncolorizable** pre-quantum [Kochen-Specker state](#), the gravitational energy (John) **must** disappear *totally* at a "point" (remember the falling elephant?), leaving there only its fleeting *positive-energy* "[jacket](#)", one-at-a-time along the Arrow of Space. Ditto to the [reality of gravitational waves](#) -- they can **enter** the local (physical) mode of spacetime "[post factum](#)" only, through a [null-surface](#).



Notice again the brand new option for developing quantum gravity with '[John's jackets](#)': the ultimate source of quantum-gravitational reality is neither totally present nor totally absent, but only casting its fleeting "projection", along the null-surface of the Arrow of Space, at the local (and "time"-invariant, from [CPT symmetry](#)) mode of spacetime, like shadows on Plato's cave. Physically, we can only observe a "shadow" or "jacket" at particular "point", explicated from "John" [post-factum](#), that is, one-at-a-time along the Arrow of Space.

To explain the *emergence* of a **quasi-local** "geodesic **y** going through a point **P**" above, consider again the Gedankenexperiment with four dice [above](#), which are **correlated** "in the air" (in the [global atemporal](#) mode of spacetime), in such a way that the sum of their readings on the table (local mode of spacetime) must be confined in the interval [10, 20], at the instant ("point **P**") they are fixed/dropped on the table. We can *physically* observe only the dice on the table, where they exist as 'facts' explicated on a [perfect continuum](#) (local mode).

Suppose we observe consecutive sets of readings like  $n_1: (3, 5, 1, 6)$ ,  $n_2: (4, 4, 3, 5)$ ,  $n_3: (5, 6, 2, 5)$ ,  $n_4: (1, 3, 5, 1)$ , *etc.*, all of which are correlated '[post factum](#)' by the requirement [10, 20].

Physically, we're constrained by the 'speed of light', so we will only observe an **emergent quasi-local** "geodesic **y**" of such already-correlated **n**-states explicated on a [perfect continuum](#) (local mode of spacetime). Every **n**-state matches the "point **P**" at which the components of the Levi-Civita connection have **already** vanished: all we can *physically* observe, due to the '[speed of light](#)', is a *pre-correlated* quantum-gravitational "[jacket](#)" cast there from "John".

Here comes an explanation of the motto (since July 1998) of this website: Dead matter makes quantum jumps; the living-and-quantum matter is [smarter](#). Notice that if we place these **n**-states in the [phase space](#) of classical mechanics, they will be separated by infinitely many point-like states, and all dice will be always confined 'on the table'. Hence it will take a **finite** time interval for **all** dice to roll from one set of "correlated" **n**-states to the **next** set (not to mention the [Buridan-donkey](#) computational task which will 'halt' your super-computer). In the quantum-gravitational realm, there

are no "intermediate" states, because the **one single atemporal** EPR-like correlation is executed '**post factum**' -- as it *would have been* recorded by a physical clock 'on the table'. A macroscopic ("dead") device cannot possibly log on the *pre*-correlated dice, and will inevitably "read" their dynamics by a "quantum jump".

But the "jump" isn't quantum. It is macroscopic. It is simply an **artifact** of the measuring device, facilitated by the representation of "probabilities" ([Chris Isham](#)). In the quantum-gravitational realm 'out there', we have only **emergent quasi-local** trajectories/geodesics on the **perfect** continuum (local mode of spacetime) of the **n**-states ([VGP formulation of GR](#)), each of which corresponds to a static frozen **linearized** and **post-correlated** universe, down to the **Planck scale**. There are no "jumps" along the Arrow of Space either, but a perfect continuum of **re-created** Phoenix Universes (Georges Lemaître, [1933](#)). If the correlating effects of 'the universe as ONE' in the global mode of spacetime are *negligible*, one can imagine a [fixed flat Minkowski spacetime](#).

Here comes the problem with the current "[dynamics of GR](#)": people try to make the spacetime "dynamical" after splitting it into two "separable" entities, and then use **the same** dead frozen "time" that can "evolve" just as much as space can ([Robert Geroch](#)). But there is no dynamics whatsoever, in *any* shape or form, in the **re-created** and **post-correlated n**-states from the *local mode* of spacetime. It's just a "flattened" and **linearized** Arrow of Space, with which you can adjust the [GPS system](#). You can't rely on such linearized GR and its 'comma to semicolon rule' (S. Weinberg, [p. 106](#)) for tasks involving objects larger than the solar system (cf. the tug-of-war manifestation of gravity [above](#)).

I recall a *very* tricky statement by Chris Isham that "general relativity does seem to work well as a theory, and yet I can certainly read the time on my wrist watch!" Well, his wristwatch reads a **continual** chain of **post-linearized n**-states or "jackets" along the Arrow of Space, which resolves the *paradox* (not "problem") of time in quantum gravity. The latter is inevitable due to "the invariance of classical GR under the group  $\text{Dim}(S)$  of diffeomorphisms of the spacetime manifold  $S$ ", as explained by Chris Isham [here](#), and by Karel Kuchar [here](#). With the Arrow of Space, at every **n**-state we have a **perfect conservation of energy** pertaining to the linearized frozen Phoenix Universes, hence can imagine **it** as one *quasi-local* "point" from its *quasi-local* geodesic evolving along the "vertical" (like [Photoshop layers](#)) direction of the Arrow of Space. Surely Chris Isham can read such **post-linearized** time with his "wrist watch!", but he needs quantum gravity to explain the global "**nondynamical** and explicit" time ([Bill Unruh](#)) which cannot *in principle* become '[GR observable](#)'.

This is the outline of the motto of this website (see above), in the context of the Machian quantum gravity. No "dark" stuff with [positive energy density](#) and no "quantum jumps" exist in Nature. As Erwin Schrödinger stated, "Wenn es doch bei dieser verdammten Quantenspringerei bleiben soll, dann bedauere ich, mich mit der Quantentheorie überhaupt beschäftigt zu haben" (If we have to go on with these damned quantum jumps, then I'm sorry that I ever got involved).

**NB:** I will be more than happy to defend Schrödinger at the [Erwin Schrödinger Institute](#), if only Bobby Beig allows me to talk. Observe that in both GR and QM we have lost the mundane concept of 'objective reality *out there*' from classical physics:

1. "The requirement of general covariance takes away from space and time the last remnant of physical objectivity," A. Einstein, 1916 (*Annalen der Physik* 49, 769-822)
2. "In general, a variable *has* no definite value before I measure it; then measuring it does *not* mean ascertaining the value that it **has**." E. Schrödinger, [1935](#)

We can recover the notion of 'reality in QM', only it isn't physical but '[potential reality](#)'; see the case studied by Nevill Mott [here](#). To reveal the corresponding, in the context of GR, presentation of the UNdecidable **uncolorizable** pre-quantum [Kochen-Specker state](#) (never in plural), check out the original paper by Ernst Specker [above](#), and Isham and Butterfield (arXiv:gr-qc/9910005v1, [p. 3](#); emphasis added):

In quantum theory, on the other hand, the relation between values and results, and in particular assumptions (i) and (ii), are notoriously problematic. The state-space is a Hilbert space  $\mathcal{H}$ ; a quantity  $A$  is represented by a self-adjoint operator  $\hat{A}$  (which, with no significant loss of generality, we can assume throughout to be bounded), and a statement about values " $A \in \Delta$ " corresponds naturally to a linear subspace of  $\mathcal{H}$  (or, equivalently, to a spectral projector,  $E[A \in \Delta]$ , of  $\hat{A}$ ).

Assumption (i) above (the existence of possessed values for all quantities) now fails by virtue of the famous Kochen-Specker theorem [4]; which says, roughly speaking, that provided  $\dim(\mathcal{H}) > 2$ , one cannot assign real numbers as values to all quantum-theory operators in such a way that for any operator  $\hat{A}$  and any function of it  $f(\hat{A})$  ( $f$  a function from  $\mathbb{R}$  to  $\mathbb{R}$ ), the value of  $f(\hat{A})$  is the corresponding function of the value of  $\hat{A}$ . (On the other hand, in classical physics, this constraint, called *FUNC*, is trivially satisfied by the valuations  $V^s$ .) In particular, it is no longer possible to assign an unequivocal true-false value to each proposition of the form " $A \in \Delta$ ".

In a nutshell (C. Isham, [arXiv:1004.3564v1](https://arxiv.org/abs/1004.3564v1), Sec. 5.1, 'The Kochen-Specker theorem and contextuality', p. 20):

"... the implication of the discussion above is that the value ascribed to B (resp. the result of measuring B) depends on whether it is considered together with A1, or together with A2. In other words the value of the physical quantity B is *contextual*. This is often considered one of the most important implications of the Kochen-Specker theorem."

What, if any, remains **invariant** in 'the quantity B' upon observing it 'together with A1' and 'together with A2'? What keeps its "sameness"? According to GR textbooks -- nothing, because the quantity B isn't 'observable' but gauge-dependant. Just like the so-called '[absolute structures](#)', it isn't "physical". It doesn't obey the 'generalized principle of action and reaction' either (James L. Anderson, [Principles of Relativity Physics](#), Academic Press, New York, 1967, p. 73 and p. 339).

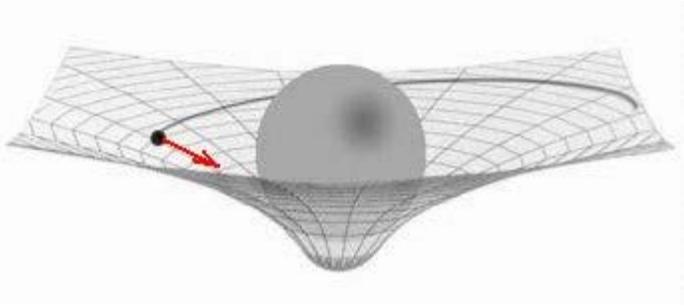
What remains **invariant** is the unphysical '[John](#)' -- not its gauge-dependant 'jackets' that can be *introduced* 'by hand' (and work amazingly well, e.g., energy pseudo-tensors), and also *eliminated* 'by hand', as in the case of GWs (cf. A. Loinger, [arXiv:physics/0312149v3](https://arxiv.org/abs/physics/0312149v3)). **It** shows up in GR as Karel Kuchar's Perennials and the Aristotelian First Cause which governs the dynamics "from outside as an [unmoved mover](#)". Notice that John's "all time  $\tau$  is eternally present" (*idem*), as it should be. Not surprisingly, the "waves" of [John](#) aren't "physical" either. Yes, they are **real**, but cannot be detected with [LIGO, Virgo and the like](#).

Ditto to the "[god particle](#)"; details from [Holger Lyre](#).

Observe that every **n**-state occupies the instant 'now' from the Arrow of Space, at which the two modes of spacetime **coincide** -- we have a **re**-created Phoenix Universe in which the "neighborhood **U**" is stretched to the dimensions of the whole universe, all negotiations between the two sides of the Einstein field equation are settled, and the negative gravitational energy *almost*-exactly (here we enter the cosmological "constant" puzzle) cancels "the energy you think is being gained in the matter fields" ([Sean Carroll](#)). There is *absolutely nothing* "dark" in such **frozen** instant 'now' from the Arrow of Space. But if we compare the **n**-states 'now' along the "[vertical](#)" direction the Arrow of Space (like [Photoshop layers](#)), the *holistic* effects from '[the school of fish](#)' ([Machian QG](#)) will be indeed deeply confusing, since people are conditioned, since 1930s, to seek explanation of such "dark" energy from some stuff with [positive-energy density](#).

Notice again that all correlations "in the air" occur in the global [luxonic time](#), which an (inanimate) wristwatch will read as "frozen". The obvious puzzle is that "nothing can "happen" along the wave direction, time stands still in the wave direction" ([B. Schutz](#)), which is why we need two *modes* of spacetime, global ([atemporal](#)) and local (physical). I believe the correct (not [Hamiltonian](#)) formulation of GR can only be recovered with the **geometry** of null hypersurfaces (cf. [Kevin Brown](#)) which, "unlike that of space-like hypersurfaces, is **not** metric" ([D.C. Robinson](#)). There isn't any other feasible option to cure the initial error with the "splitting of spacetime": there is **no problem of space** in GR and in canonical quantum gravity. People are still treating 'spacetime' as a composite made of two separable entities (cf. [Hermann Minkowski](#)), and are "instructing" matter to "[evolve](#)" on a dead frozen "space" which can only "bent" (cf. below), but cannot evolve *en bloc*, as being driven

**uniformly** by the holistic (not "dark") energy of Einstein's '[total field of as yet unknown structure](#)'.



To recover the genuine dynamics of GR, we need to make the very spacetime dynamical, to "fly" along the **null hypersurface** of the [Arrow of Space](#). The best way to explain the task is to examine the crux of today's GR: the distinction between the *active* (gravitating) and the *passive* (gravitated) mass.

As Homer G. Ellis explained ([arXiv:1205.5552v1](#)), "in newtonian gravity, application of the law of action and reaction to the forces exerted on each other by two gravitating bodies A and B allows the inference that the ratio of active mass to passive mass is the same for B as it is for A, thus by extension is the same for all such material bodies", and "this application of the action-reaction law to bodies **not** in contact (Sic! - D.C.) requires the assumption that gravity acts instantaneously over the intervening distance, an assumption at odds with the **finiteness** of the propagation velocity of gravitational effects implicit in Einstein's theory."

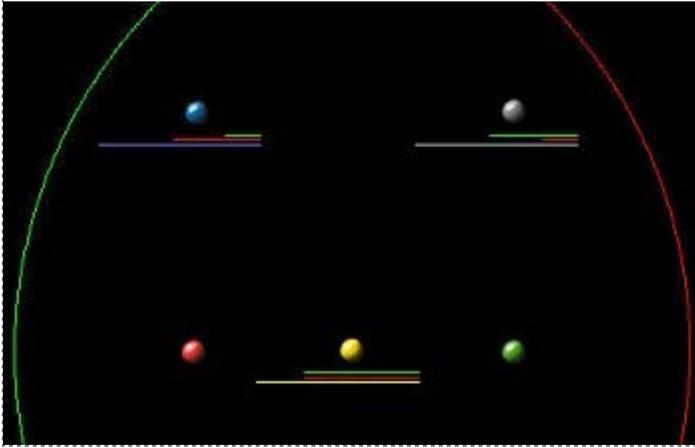
And Wolfgang Rindler (see [above](#)): "One can further distinguish between active and passive gravitational mass, namely between that which causes and that which yields to a gravitational field, respectively. Because of the symmetry of eqn (1.8) (due to Newton's third law), no essential difference between active and passive gravitational mass exists in Newton's theory. In GR, on the other hand, the concept of passive mass does **not** arise, only that of active mass—the source of the field."

However, "the source of the field" is still unknown, as acknowledged by [Einstein](#). The indisputable **finiteness** of the propagation velocity of gravitational effects is valid only for the local mode of spacetime, while in the global mode we **also** have an "instantaneous" -- as it *would have been* read by a physical clock -- EPR-like correlation resulting in "aligned trees" due to the quantum-gravitational "wave", depicted in the drawing [below](#).

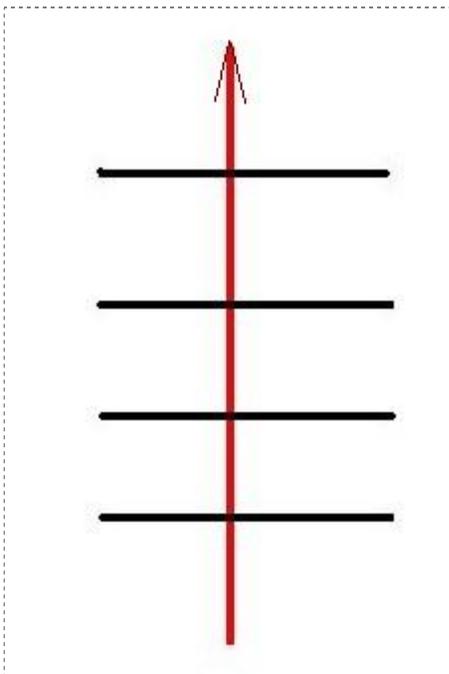
Stated differently, the proper GR makes no distinction between the *active* (gravitating) and *passive* (gravitated) mass, since the latter facilitates the [atemporal feedback](#) from 'the whole universe as ONE'. The "eter" ([Wolfgang Rindler](#)) is [perfectly hidden \]between\[](#) the "points" from the underlying topological manifold.

I will refer to this Ansatz as 'Unified Gravitational Mass Conjecture' (UGMC), and hope to elaborate on the origin and mechanism of inertial "reaction" forces and [REIM](#) at the [ESI Workshop](#) in Vienna this year.

Also, the proper GW detector must be endowed with the faculty of *self-acting* (see [above](#)), and must access the *global mode* of time: check out the **time code** of the animation from John Walker [below](#) depicting the 'relativity of of simultaneity' (no invariant meaning to "the same time but at different places"). You observe **all** events from the whole Cauchy slice *en bloc* from the global mode of spacetime. You are "outside" the 4-D spacetime, [\]between\[](#) the emission-and-absorption of a "free photon" ([Kevin Brown](#)), in the *potential reality* of 'John' (**not** his "[colored jackets](#)"), and of course your poor ("dead") wristwatch will read your [luxonic time](#) as "frozen".



To sum up, here's a sketch of the "dark Zen gaps" (the [global mode of spacetime](#) is pictured with **red**) along the "frozen" (as read by your inanimate wristwatch), null-direction of the [Arrow of Space](#):



Every "horizontal" (black) slice is an instant 'now' from the [Arrow of Space](#): the **re**-created spacetime is [perfectly continual](#) in its local (physical) mode, at **all** length scales down to the [Planck scale](#). This is 'the back bone' of the universe. For inanimate matter at the length scale of tables and chairs (not the [human brain](#)), we may envisage that in certain cases the quantum-gravitational effects (pictured with **red**) would be FAPP insignificant, then safely use an approximation in terms of some fictitious Minkowski spacetime. Also, all "horizontal" (black) slices denote an *instantaneous* (at a [single time](#)), already-negotiated universe (here we enter the [Machian gravity](#)), at which [one can "eliminate" gravity](#) -- but at this *instantaneous single time* only. Again, notice that in both cases, with or without quantum-gravitational effects, we "handle" the Arrow of Space as we do with [Photoshop layers](#), and as we "flatten" and **sum up** (Sic!) all "horizontal" (black) slices in the local (physical) mode of spacetime, we face all sorts of [quantum](#) and "[dark elephant](#)" paradoxes, and cannot explain the [kinematics of space](#) and [the origin of time](#).

What we call 'time' doesn't come from [thermodynamics](#). It is an omnipresent (cf. the '[dark Zen gaps](#)'), hence "hidden" variable, in the sense that it *does not* "point" to any particular direction in 3-

D space. Physically, the universe exists **only** at [single instances](#), "separated" by the '[dark Zen gaps](#)' in the global mode of spacetime, and any physical (inanimate) clock will read such 'global [atemporal luxonic mode of time](#)' (cf. the animation from John Walker) as "frozen" -- the **fundamental increment of time** along the 'ladder' above **cannot** be detected by a physical clock "online", as it evolves along the Arrow of Space. Physically, it can *only* be detected '[post factum](#)'. The human brain and '[the universe as a brain](#)' do not suffer from such limitations.

*Se non è vero è molto ben trovato, eh ? 😊*

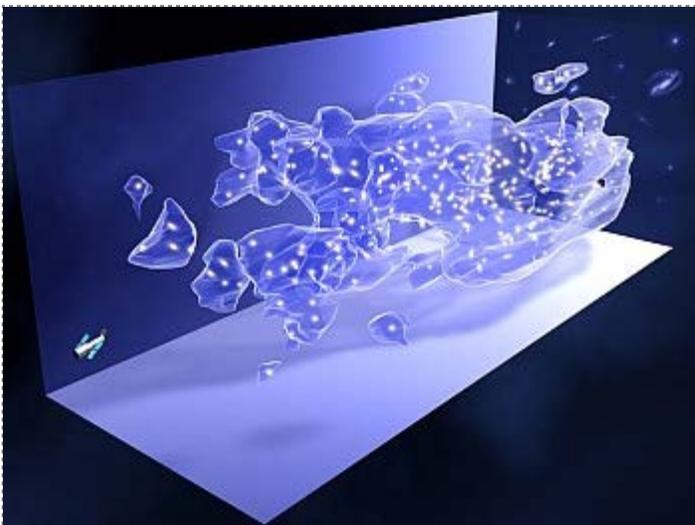
Seriously, the task is indeed simple, because if we keep in mind the broader picture of quantum gravity, we should offer solutions to four tasks: (i) the measurement problem in [Quantum Mechanics](#), (ii) the [macro-objectification](#) problem (smooth reversible transitions between the macroscopic world and the quantum realm), (iii) the gravitational effects of the quantum vacuum ([E. Curtis Michel](#)) and the "cosmological energy catastrophe" (Pavel Kroupa *et al.*, [arXiv:1006.1647v3](#), footnotes 1 and 2), and (iv) the emergence of Lorentzian metric from the so-called "[spacetime foam](#)" (details [here](#)). Once we put all this the table, the spectrum of choices to resolve these four puzzles will narrow sharply. Then we will try our best proposal, and if it resolves another problem effortlessly (e.g., [the origin of CMB](#)<sup>1</sup>), we'll gain further confidence in our approach toward quantum gravity -- it will be 'simple', simply because at this point we would have practically [no freedom to get it wrong](#). Soon or later, all pieces from the jigsaw puzzle will snap to their places, *effortlessly*.

But then comes a gentle reminder from [Friedrich Schiller](#):

*Nur die Fülle führt zur Klarheit,  
Und im Abgrund wohnt die Wahrheit.*

D. Chakalov  
April 15, 2012  
Last updated: July 30, 2012

<sup>1</sup> The interpretation of [CMB](#) as an 'echo' of some "[big bang](#)" presupposes some *cancellation* of matter/anti-matter (called "[annihilation](#)") resulting in the observed matter/anti-matter [asymmetry](#), but the questions of "how many" baryons exist in the universe today, in the form of [matter rather than antimatter](#), and [what happened to the antimatter](#) are still unsolved: there is far too much "[non-baryonic dark stuff](#)" to fit in the universe.



Which is why I use the term *cancellation*, as with the other "dark" element from the [tug-of-war gravity](#), e.g., the cancellation "between different contributions to 1 part in  $10^{60}$ , in order to be consistent with the observed size of the Universe" (N. Afshordi, [pp. 6-7](#)).

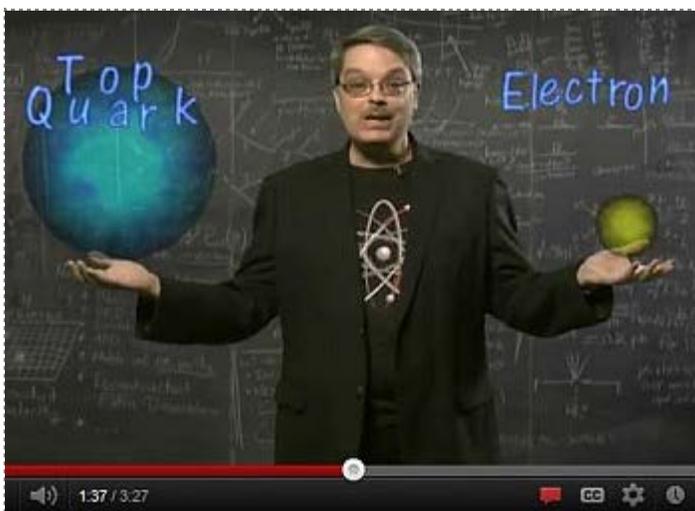
Think about 'baryons in the universe today' (about [one particle per billion](#)) as [John's jackets](#) emerging from the *cancellation* of, say, 1 part in  $10^9$ . No "[big bang](#)" and no violent eruption ever happened -- just a quiet *cancellation* of 'all but **one jacket**', as in the [Potential Reality \(PR\)](#) interpretation of Quantum Mechanics. Namely, the instant 'now' from the Arrow of Space offers only **one empty** template to be filled in with only **one jacket**, with **unit probability**. The rest of "quantum states" (cf. R. Feynman [above](#)) simply do *not* show up as 'physical reality' in the instant 'now', hence there is no violation of the unitary dynamics kept by '[John](#)' (**not** his 'jackets') in the quantum realm 'out there'. The non-unitary "collapse" (cf. [Steve Adler](#)) is also an **artifact** from the macroscopic devices: Dead matter makes quantum jumps; the living-and-quantum matter is [smarter](#).

Recall the story about Wheeler's "cloud" in the game of *20 questions*:

"There had been a plot *not* to agree on an object to be guessed, but that each person, when asked, must give a truthful answer concerning some real object that was in his mind, and which was *consistent with all the answers that had gone before*." With only one question left, John Wheeler guessed: "Is it a cloud?" The answer was "Yes!" (John and Marry Gribbin, *In Search of Schrödinger's Cat*, Black Swan, London, 1998, [p. 209](#)).

The answer 'cloud' did not exist as "baryons" or any [positive-energy](#) stuff before the first question asked by John Wheeler, nor until the 19th answer. It rather *emerged* like [John's jackets](#) from [Margenau's Onta](#) during the ongoing specification on the *context*, in perfect agreement with Kochen-Specker and Conway-Kochen theorems mentioned [below](#). The "ongoing specification" is performed by **one standing quantum-gravitational wave** -- the "thought" of the universe correlating the *instantaneous* emergence (as it would have been recorded with a physical clock) of "[jackets](#)" in the instant 'now' from the [Arrow of Space](#). Simple, no?

Notice again that the "thought" of the universe (the GPI field of [Einstein](#)) is neither physical nor mental phenomenon, but 'potential reality'. It is **not** some uniform homogeneous field -- its has "clumps" of **associations**, like the associative links in the human memory, only in this case we're talking about the "memory" of 'the universe as a [brain](#)' bootstrapped by its [quantum-gravitational wave](#). These "clumps" of **associations** show up as "quarks" which are totally "confined" from the outset, as explained eloquently by [Don Lincoln](#) below.



Compare this with the explanation from [David J. Miller](#)

What physicists at [CERN](#) call 'mass' is the "[verbalized thought](#)", or rather the *physical* "[jacket](#)" from these clumps of **associations** in the GPI field of [Einstein](#) (the "thought" of the universe). If we

parameterize the effects, denoted with **E** (from 'entanglement with the universe as ONE'), of the GPI field with an open interval of natural positive numbers, (0, infinity), we will start from the case of '**E** approaching asymptotically 0', which corresponds to the mundane world of classical mechanics. As **E** grows, it will outline the GPI layer of QM, in which the GPI field absorbs Margenau's [latent observables](#). The next layer is the one at which the GPI field incorporates Margenau's [possessed observables](#), such as the "mass" of elementary particles in [QCD](#). Going further, the next GPI layer will be well [beyond the "standard model"](#), as some yet-to-be discovered inclusion of the electron in the *extended* (with some help from [Fibonacci](#)) family of "quarks". What comes next is anyone's guess, but notice the case of '**E** approaching asymptotically infinity': well, this may be a super "heavy" clump of **associations** of all *potential* particles in the quantum vacuum, which also exist as 'potential reality' (recall that 'John' himself does not gravitate; only his "[jackets](#)"). If you wish to described this last GPI layer with "quarks", check out again [Fibonacci](#). It's all "quarks" down the road, but there **must** be a cut-off at the Planck scale. Simple, no?

Not surprisingly, my offer to elaborate *in details* at CERN's Summer Institute on BSM Physics (18 - 29 June 2012) was [not appreciated](#). Yet the people at CERN's Theory Group can't introduce gravity in their "standard model", *which is why* they [don't have a clue](#) about the leptoquark "mass", nor can explain the "miracle" with the [proton mass](#).

But they have *money*. A *humongous* amount of money. [Billions and billions of Euro](#).

We haven't the money, so we've got to think!  
[Lord Rutherford](#), 1962 Brunel Lecture, 14 February 1962

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Subject: John and Alice  
Date: Sun, 10 Jun 2012 02:26:10 +0300  
Message-ID:  
<CAM7EKxnvXxxPF8b7KGL0LhHbP9xkrxBFq3je\_YG9TDCxpKoc4A@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: [\[snip\]](#)

Dear colleagues,

I've posted three tasks, (i) - (iii), at [http://www.god-does-not-play-dice.net/#EH\\_if\\_any](http://www.god-does-not-play-dice.net/#EH_if_any)

"Just try to (i) explain the schizophrenic behavior of the "watches" called John and Alice [below](#), as seen from a "safe distance", then (ii) define rigorously that "safe distance" ("safe" is sheer poetry), and finally (iii) run the whole story backward in time, to bring *that same* "safe distance" back into the normal, unsuspecting spacetime, before the "event horizon" occurred, namely, before the null geodesics of John ([Friedman](#)) and Alice have reached their ([quasi-local?](#)) endpoints, as explained eloquently by [Bob](#) and [Chuck](#)."

Perhaps you can perform the calculations and publish your results from task (iii).

Wishing you a nice summer,

Dimi Chakalov  
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**Note:** Task (iii) is the time-reversal of the hypothetical *irreversible* formation of black hole, and since [the recipients](#) of my email firmly believe that the current GR is a 'classical theory' (it *isn't*), they will face the poetry of 'event horizon formation' and the problems of its dynamics.

Recall the critical point of 'no return' (S. Carroll, arXiv:gr-qc/9712019v1, [p. 189](#); emphasis mine - D.C.): "not only can you not escape back to region I, you cannot even stop yourself from moving in the direction of decreasing  $r$ , since this is simply the timelike direction. (This could have been seen in our original coordinate system; for  $r < 2GM$ ,  **$t$  becomes spacelike and  $r$  becomes timelike.**) Thus you can no more stop moving toward the singularity than you can stop getting older."

How do you exchange timelike and spacelike directions at **the instant** at which John ([Friedman](#)) would enter the "event horizon", as recorded with his clock? And once you perform this mathematical miracle, how would you connect the two "mirrored" spacetimes by a "safe distance", in such way that Alice would **never actually** witness John entering his mirrored spacetime at the "event horizon", in line with the [weak censorship conjecture](#)? And if John cannot notice that his clock is running "slower" (as he approaches the "event horizon"), would he see Alice's clock running "faster" with respect to his normally running clock? Namely, is John ([Friedman](#)) going to see the remaining lifespan of Alice (or our [solar system](#)?) unfolding with increasingly fast rate, say, within 5 min, as recorded by his clock *just before* entering his mirrored spacetime at the "event horizon"? And what would Alice see if John would instead enter a timelike naked singularity (P. Joshi and D. Malafarina, [arXiv:1201.3660v1 \[gr-qc\]](#))? In the worst "white hole" scenario, John will have to live with some [advanced Russian civilizations forever](#), but with some luck from the Hawking radiation, "the hole could evaporate into [nothingness](#)", before John meets his ([advanced](#)) Russian colleagues. Anyway.

According to Adam Helfer ([arXiv:1105.1980v1 \[gr-qc\]](#)), "a practical notion of black holes should be linked to systems which are complete enough to be considered **isolated**, in both time and space", where the crucial notion of '[isolated](#)' can be defined "up to a well-understood ambiguity," provided "the generators are infinitely long in both directions", although he "might consider relaxing the requirement that they be infinitely long to the past." Then he added: "Precisely because trapped surfaces lie behind event horizons, we hope and expect never to find them observationally!" (*ibid.*, [p. 5](#)). I cannot understand such parapsychology.

Notice the condition [above](#): "before the "event horizon" occurred, namely, before the null geodesics of John ([Friedman](#)) and Alice have reached their ([quasi-local](#)?) endpoints."

Ivan Silva argued [below](#) that such condition is nonsense: it is "as ludicrous as claiming that the boundary of a disc does not exist because no one can reach it."

Well, [it's not that simple](#). Remember the [Pink Panther](#)? He sucked the entire spacetime (up to its asymptotic boundaries) in his vacuum cleaner, and then himself, and finally the vacuum cleaner **sucked itself** and disappeared into "nothingness", or perhaps "[singularity](#)":



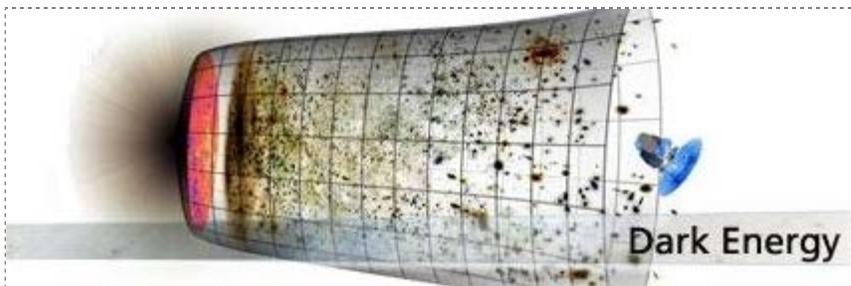
If you start *from within* spacetime, you must totally disappear at the "[end points](#)", or else you will contain 'matter' which will define additional, [UNcountably infinite](#) 'spacetime points' to be sucked by your vacuum cleaner. (The time-reversible process of *creatio ex nihilo* is the crux of the [dual age cosmology](#).)

Likewise, since you start *from within* spacetime, you cannot, not even in principle, instruct some spacetime parameter to 'halt' at some '[end points](#)' at **both** null **and** spacelike infinity. [It's a bundle](#), ladies and gentlemen.

Nobody has defined rigorously the "boundary" conditions for the gravitational field ("disc"), at which the vacuum cleaner sucked itself and disappeared into "[nothingness](#)". (The latter may be "the unphysical spacetime" mentioned in Robert Wald's textbook, [pp. 283-287](#)).

The daunting problem for explaining an 'isolated system in GR' is still unsolved -- check out a modest estimate from Bernie Schutz [here](#), and Helmut Friedrich [here](#). Those who believe the current GR is a classical theory (it [isn't](#)) will first have to recover the 'dimensionality of space': check out Martin Bojowald [above](#).

Notice also the misleading metaphor of [Ivan Silva](#): we can indeed look at "the boundary of a disc" **iff** it is an 'isolated system' in Minkowski spacetime. And if this "disk" is a Frisbee, we can also explain its trajectory in its "phase space", and time-reversible dynamics, without resorting to any "dark energy". In our case, however, we need to take the stand of some [meta observer](#) (global mode of spacetime), who can "see" the whole spacetime *en bloc*, as depicted in the (highly deceptive) drawing below, in order to verify its [free fall](#) and [asymptotic flatness](#) at "future null infinity", as explained eloquently by [Bob](#) and [Chuck](#).



No *physical* observer can perform this miracle, for the same reasons that there is no "4th spatial dimension" ([Ned Wright](#)). The [dynamics of spacetime itself](#) is not like "curvature". We cannot use the [Gauss-Bonnet theorem](#) and pretend that the "dark energy" will show up "intrinsically", i.e., solely [within the 4-dimensional spacetime](#). The latter captures **only** 'the *necessary* condition for spacetime', while 'the *sufficient* condition' (cf. below) is still not implemented in our [theories of spacetime](#). All GR textbooks (e.g., [Bob Wald](#)) use extensively the notion of 'tangent vector at a point', which is essentially incomplete, because the "point" **itself** is [quasi-local](#), to accommodate the 'the *sufficient* conditions for spacetime' fixed by 'the whole universe as ONE' (global mode of spacetime, denoted with " / " below).

The ultimate puzzle is that we (and [Chris Isham](#)) can indeed record the cosmological time depicted with the drawing above with our wristwatches, although there is no **explicit** time parameter in GR -- only "constraints" ([Karel Kuchar](#)), and the **dynamics** of the coupling matter to gravity (matter becomes 'self-acting' and bootstrapped *via* gravity) [isn't linear](#): the "linearized" gravity pertains only to **one single** "surface" (see Kozameh and Newman below) for which the bi-directional negotiations between the two sides of the Einstein field equations (EFE) are finally settled, **after** which we can claim that "there's energy in the gravitational field, but it's negative, so it exactly cancels the energy you think is being gained in the matter fields" ([S. Carroll](#)). We could use such 'one single surface' to

infer time-reversible dynamics of matter iff we had a [fixed linearized spacetime](#). The genuine dynamics of GR is still missing, as we cannot extend the solutions of EFE arbitrarily far away ([H. Friedrich](#)) to recover the **dimensionality** of spacetime -- see M. Bojowald [above](#).

To cut the long story short, "even if we start with genuine tensorial variables, then certain important physical quantities turn out to be non-tensorial" ([László B. Szabados](#)); check out the status of those "Dirac observables" [here](#).

As [Luca Lusanna](#) stressed, "in Friedmann-Robertson-Walker solutions one has canonical clocks (e.g. the temperature of the cosmic background radiation) that not only break Lorentz invariance defining a cosmic (global) time but break the Galilei invariance defining observers which are **at rest** with respect to [the cosmic background radiation](#)."

So, if you wish to introduce rigorously some "asymptotic flatness at future null infinity" and complete task (iii) [above](#), you may need to extend the current GR to [quantum gravity](#). It is the only option for the 'absolute structures' ([Domenico Giulini](#)) to be introduced into Einstein's Allgemeine Relativitätstheorie. The current **free fall** simply [doesn't make sense](#) in the absence of a rigorous, poetry-free formulation of '[isolated system in GR](#)'.

Albert Einstein was fully aware of the pitfalls from the principle of general covariance even before he formulated his unfinished GR -- "merely a makeshift in order to give the general principle of relativity a preliminary closed-form expression. For it was essentially no more than a theory of the gravitational field, which was isolated somewhat artificially from a total field of as [yet unknown structure](#)."

Can we recover this 'total field of as [yet unknown structure](#)'? The most promising approach seems to explain the spacetime in terms of **null surfaces** along which the [Arrow of Space](#) is defined as "[change of space](#)" (compare it with the "surface theory" of General Relativity, suggested first in 1983 by Carlos Kozameh and Ted Newman, cf. [arXiv:gr-qc/9502026v1](#)).

In the Newtonian doctrine of absolute space and time, space is a special object, and the motion of bodies is determined with respect to such **absolute motionless** object, which is "truly distinct from bodies":

**So it is necessary that the definition of places, and hence of local motion, be referred to some [motionless thing](#) such as extension alone or space in so far as it is seen to be truly distinct from bodies.**

Newton, I. (1962). De Gravitatione et Aequipondio Fluidorum. In A. R. Hall, & M. B. Hall (Eds), *Unpublished papers of Isaac Newton*. Cambridge: Cambridge University Press.

Once we face [the 'motion of space' itself](#), as driven by some "[dark energy](#)", we need to recover the [reference fluid of GR](#), because such 'motion of space' can only be defined with respect to an **absolute motionless** object -- the [reference fluid of GR](#) -- which has no dynamics, because it acts as *the Unmoved Mover* ([Karel Kuchar](#)).

In the global mode of spacetime, the *motionless* [reference fluid of GR](#) is **between** the points from the topological manifold, hence it is totally **non-existent** in the local (physical) mode of spacetime produced by the [Arrow of Space](#). In the current GR, it can only show up as an *unobservable* ([Thomas Thiemann](#)) 'absolute structure' ([Domenico Giulini](#)) pertaining to [the whole spacetime en bloc](#), as depicted in the drawing above.

Any time you look at your wristwatch, you see two things **superimposed** over a dimensionless "point": a [local \(physical\) time](#), and the global (absolute) time along the Arrow of Space. It's a bundle consisting of two inseparable yet ontologically distinct entities: (i) the fleeting physical content provided by physical fields, and (ii) the properties of the [quasi-local](#) geometrical "point", fixed by 'the whole universe as ONE' in the global, [non-Archimedean mode of spacetime](#). The first constitute 'the necessary conditions for spacetime', but we cannot **derive** the properties of 'spacetime' exclusively

from (i): the sufficient conditions for spacetime (ii) *complement* the necessary conditions for spacetime (i).

There exists an additional *complementary* input from 'space', which is "truly distinct from bodies" (Newton) passing *through* 'space', because all the properties of 'space' cannot be derived exclusively from (i). For example, the *binding* faculty of space, exhibited in the Affine Connection, cannot be derived exclusively from (i) above. Stated differently, the geometry of 'the whole universe as ONE' provides an additional, *complementary* faculty to (i), which is being manifested **only** by altering the physical properties of matter and fields, (i). We cannot detect (ii) in any other way but in the r.h.s. of the Einstein field equations, (i), where 'matter' has become **self-acting** due to its bootstrapping by gravity.

**NB:** We have the same phenomenon of purely geometrical nature right above our neck: we think *about* our brain, **by** our brain, hence the brain is 'self-acting'. Physically, we cannot observe the "mind" in the brain -- just a *self-acting* brain. Just replace "mind" with 'the *sufficient conditions* for spacetime'.

Another example is the properties of the 'geometrical template' (cf. below), which **cannot** be derived exclusively from the fleeting quasi-local physical content provided by physical fields: the latter are the *necessary condition* for 'spacetime', while the 'geometrical template' fixed by 'the whole universe as ONE' is the *sufficient condition* -- 'Der Geist bewegt die Materie'.

To explain the need for 'geometrical template', which fixes the distance function of **all finite** distances in 3-D space, look at the two drawing below; the red " / " denotes the relation of intermediacy, [A (**zero**) B], interpreted as "**zero** is between A and B". We will ignore the temporal order of "points" and their subsequent individuation with capital letters (A, B, ...), and will replace them with the generic symbol from the *local mode*, **x** .

Suppose the first line below is 'one meter', while the second one is obviously larger:

x/x/x/x/x/x/x/x/x/x/x

x/x/x/x/x/x/x/x/x/x/x/x/x/x/x

How many 'geometrical points' **x** are present in the first and in the second **x**-lines? The "number" is the same: UNcountably infinite. Thus, we need a 'geometrical template' to fix **distinguishable finite** distances in 3-D space and hence the so-called 'scale parameter'. Such 'geometrical template' originates from 'the *sufficient conditions* for spacetime' -- the global, non-Archimedean mode of spacetime of 'the whole universe as ONE'. It is indeed "truly distinct from bodies" (Newton), and it must **not** be 'Dirac observable', or else the "ether" will be exposed.

In order to have '3-D space', the second **x**-line above *must* be larger, to obtain 'large vs small' and 'inside vs outside'. And here comes the 'geometrical template' from 'the *sufficient conditions* for spacetime': it fixes **finite** distances in 3-D space, up to its asymptotic "boundaries". Yet in the new reference frame of an "expanding observer" (according to Relative Scale Principle), the second **x**-line will **always** stay 'one meter'. Hence the so-called "expansion of space" is a just a frame-dependent effect, relative to two observers. It will certainly look "accelerated" to an observer fixed at the length scale of tables and chairs, unlike the opposite frame-dependent effect toward The Small, which doesn't at all look "accelerated" due to the cutoff at the Planck scale. Thus we have a *fundamental asymmetry* embedded in the Arrow of Space, which makes it an 'arrow'.

In one sentence: the *alteration* of the geometrical template is what we call 'gravitation'. If it "shrinks" w.r.t. some fictitious geometrical template in Minkowski spacetime, the effect is *attraction*; if it "expands", the effect is "expansion of space". In the example with the two **x**-lines above, if the second geometrical template was a fictitious template in Minkowski spacetime, which "shrinks" to the first one, the Earth and the Moon will be attracted. (There is a lot more to be said here! Check out 'The Two Rules of Success' below.)

With the Relative Scale Principle and the Dynamic Equilibrium Conjecture, there is no need for "curvature", "non-baryonic dark dancing elephants", nor "perfect dark fluid with positive energy density but negative pressure". These "dark" gravitational effects are **not** being produced by 'matter' (i), but by 'the *sufficient conditions* for spacetime' (ii).

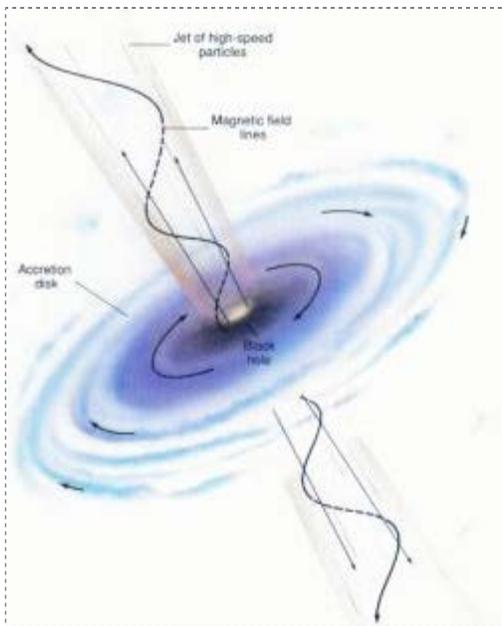
Those who disagree with 'the *sufficient conditions* for spacetime' will have to ground their quantum gravity hypotheses on a [Biblical miracle](#), and also accept the parapsychological doctrine that the human mind can [act directly on brain's tissue](#), plus the whole "anthropic" parapsychology introduced to "explain" the cosmological "constant" problems. [Forget it](#).

D. Chakalov  
June 10, 2012  
Last updated: August 24, 2012

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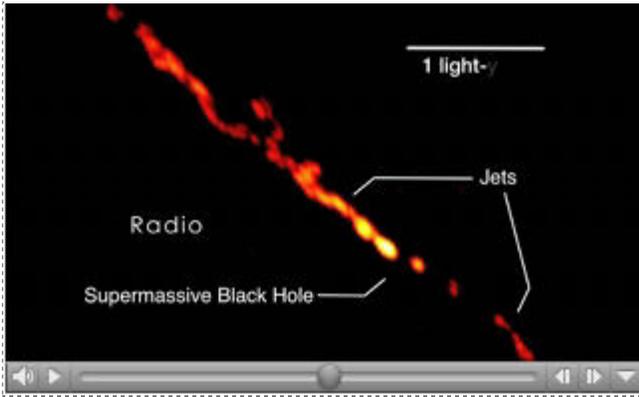
How do we know that Father Christmas has a beard? We know it, because snow falls when he shakes his beard.

Old Tanzanian saying



There's no sense in being precise when you don't even know what you're talking about.

[John von Neumann](#)



According to NASA, the stuff you *cannot* see between the jets could only be some invisible [55-million-solar-mass](#) defect of the spacetime continuum (yes, the Brooklyn Bridge is on sale).

-----

Subject: Fwd: Request for reference about 'event horizon'

Date: Fri, 5 Jul 2013 14:40:49 +0300

From: Dimi Chakalov <dchakalov@gmail.com>

To: Stephen Crothers <thenarmis@gmail.com>

Cc: Helvi Witek <h.witek@damtp.cam.ac.uk> ,

Gary W Gibbons <G.W.Gibbons@damtp.cam.ac.uk> ,

John Friedman <friedman@uwm.edu> ,

Paul K Townsend <p.k.townsend@damtp.cam.ac.uk> ,

Miguel Sanchez Caja <sanchezm@ugr.es> ,

Laszlo Szabados <lbszab@rmki.kfki.hu> ,

Jorg Frauendiener <joergf@maths.otago.ac.nz> ,

Jonathan Thornburg <jthorn@astro.indiana.edu> ,

Jeffrey Winicour <winicour@pitt.edu> ,

Greg Galloway <galloway@math.miami.edu> ,

Paul Tod <tod@maths.ox.ac.uk> ,

Harvey S Reall <H.S.Reall@damtp.cam.ac.uk> ,

Richard Woodard <woodard@phys.ufl.edu> ,

Bernard J Carr <b.j.carr@qmul.ac.uk> ,

Pankaj S Joshi <psj@tifr.res.in> ,

Ettore Minguzzi <ettore.minguzzi@unifi.it> ,

Ravindra Saraykar <ravindra.saraykar@gmail.com>

Dear Steve,

In your spare time, please explain to Dr. Helvi Witek why the hypothetical case in which "apparent horizon" would match "event horizon" (cf. attached) is unrealistic (I'm trying to be *very* polite here). [Gary Gibbons](#) was unable to understand the issue (cf. his arXiv:1201.2340v1 [gr-qc], "By "horizon" I shall mean "apparent horizon" ..."), but perhaps your younger colleague can, given his recent Ph.D. Thesis at

<http://arxiv.org/abs/1307.1145>

Has anyone found a rigorous proof of event horizon ? Or pink unicorn ?

Best regards,

Dimi

----- Forwarded message -----

From: Dimi Chakalov <dchakalov@gmail.com>  
Date: Fri, Jul 5, 2013 at 12:05 PM  
Subject: Request for reference about 'event horizon'  
To: Helvi Witek <h.witek@damtp.cam.ac.uk>  
Cc: Gary W Gibbons <G.W.Gibbons@damtp.cam.ac.uk>

Dear Dr. Witek,

I wonder if you have found, or maybe heard of some proof for event (not "apparent") horizon. The distinction is crucial (some people like G. Gibbons still struggle to understand it), and I hope you have found the proof for BHs.

Kind regards,

Dimi Chakalov  
[chakalov.net](http://chakalov.net)

[Attached images]



-----  
Subject: Re: Event horizon, if any: request for reference  
Date: Fri, 4 May 2012 20:08:05 +0300

From: Dimi Chakalov <dchakalov@gmail.com>  
To: Samir <mathur.16@osu.edu>  
Cc: Richard Woodard <woodard@phys.ufl.edu>,  
Avi Loeb <aloeb@cfa.harvard.edu>,  
Neven Bilic <bilic@thphys.irb.hr>,  
Alan Coley <aac@mathstat.dal.ca>,  
Bernard J Carr <b.j.carr@qmul.ac.uk>,  
Tomohiro Harada <harada@yukawa.kyoto-u.ac.jp>,  
George Svetlichny <svetlich@mat.puc-rio.br>,  
Paul K Townsend <p.k.townsend@damtp.cam.ac.uk>,  
Miguel Sanchez Caja <sanchezm@ugr.es>,  
Laszlo Szabados <lbszab@rmki.kfki.hu>,  
Jörg Frauendiener <joergf@maths.otago.ac.nz>,  
Jonathan Thornburg <jthorn@astro.indiana.edu>,  
Karel V Kuchar <kuchar@physics.utah.edu>,  
Abhay Ashtekar <ashtekar@gravity.psu.edu>,  
Robert Beig <robert.beig@univie.ac.at>,  
James Fry <fry@phys.ufl.edu>,  
Gary W Gibbons <G.W.Gibbons@damtp.cam.ac.uk>

Dear Samir,

Thank you for your prompt reply.

> i dont know a good reference, but [ashtekar](#) has developed a theory of many  
> different kinds of horizons (apparent, event, etc.) so he must have made these all exact

He should have made the 'event horizon' exact but hasn't, I'm afraid.

Here's the standard explanation from Paul Townsend, well before the discovery of the "dark" energy ([arXiv:gr-qc/9707012v1](#), pp. 52-53): "The location of the event horizon  $H^+$  generally requires knowledge of the \*complete\* spacetime. Its location cannot be determined by observations over a finite time interval. However if we wait until the black hole settles down to a stationary spacetime... "

Seems to me that the last sentence contains too much poetry, which hasn't been eliminated in the review article by [Jonathan Thornburg](#), Irr-2007-3: "The event horizon is a global property of an entire spacetime and is defined nonlocally in time: The event horizon in a slice is defined in terms of (and cannot be computed without knowing) the full future development of that slice."

How do you define 'stationary spacetime' with (asymptotically timelike) Killing vector obtained from the "dark" energy of [[whatever](#)] ? And how long you may need to wait until the "black hole" settles down to a stationary spacetime, \*after\* which it will obtain an "event horizon" and eventually become a "black hole" ?

I have an alternative to the Killing vector field and the "dark" energy at <http://www.god-does-not-play-dice.net/#ESI>

but people like [Gary Gibbons](#) don't like it, so I guess you or some of your colleagues can come up with a better idea spelled with math.

All the best,

Dimi

On Fri, May 4, 2012 at 1:45 PM, Dimi Chakalov <dchakalov@gmail.com> wrote:

>

> Dear colleagues,  
>  
> Sorry for this bulk email.  
>  
> I wonder if you are aware of some rigorous proof of the existence of  
> 'event horizon' in GR. I've been searching for many years, with no  
> success.  
>  
> Kind regards,  
>  
> Dimi Chakalov  
-----

**Note:** In order to excogitate on some **defect** of the spacetime continuum, such as "black hole", first you need to prove that **Type I matter fields** will obey the **null energy condition** (NEC) even under the presence of "dark energy" (**SEC** will be manifestly **violated**).

Then you need to reach "infinity" from the "event horizon", many times indeed, as explained eloquently by [Abby Ashtekar](#) and [Badri Krishnan](#) (Irr-2004-10, [p. 9](#)):

"Because one has to **go back and forth between the horizon and infinity**, the physical meaning of the first law [of black hole mechanics] is not transparent."

Only Chuck Norris managed so far to reach infinity (**twice**).

Finally, you need to resolve the "teleological" problem ([ibid.](#)):

"Global nature of event horizons

"The future event horizon is defined as the future boundary of the causal past of future null infinity. While this definition neatly encodes the idea that an outside observer can not 'look into' a black hole, it is too global for many applications. First, since it refers to null infinity, it can not be used in spatially compact space-times. Surely, one should be able to analyze black hole dynamics also in these space-times. More importantly, the notion is teleological; it lets us speak of a black hole **only after we have constructed the entire space-time** (check out a modest estimate from B. Schutz [here](#) - D.C.).

"When astrophysicists say that they have discovered a black hole in the center of our galaxy, they are referring to something much more concrete and **quasi-local** than an event horizon. Is there a satisfactory notion that captures what they are referring to?"

Sure. It's a **joke**, spiced with lots of advanced math. As is well known, astrophysicists *love* jokes, from "[super-massive black holes](#)" to "[expansion of space](#)", but don't particularly appreciate "naked singularities" ([P. Joshi and D. Malafarina](#)) and "[white holes](#)", because, according to *Stanford Encyclopedia of Philosophy*, "absolutely nothing in the causal past of such a white hole would determine what would pop out of it (just as items that fall into a black hole leave no trace on the future). Because the field equations of general relativity do not pick out a preferred direction of time, if the formation of a black hole is allowed by the laws of spacetime and gravity, then white holes will also be permitted by these laws." Which is good news for John ([Friedman](#)) and other explorers of the "event horizon", because instead of being torn apart by the "black hole", they will end up in a beautiful "white hole" packed with *advanced* Russian civilizations, as demonstrated with impeccable math by [Slava Dokuchaev](#).

Then you also have "big bangs, bounces, crunches, rips, and sudden singularities", and since you don't have an Arrow of Space to determine [the global luxonic time](#), a **past** sudden singularity is equally possible, although it "would be a most unusual and disturbing beginning to the history of the universe" ([C. Cattoen and M. Visser](#)), compared to the usual beginning to the history of the universe which is quite common and pleasant, since it is rooted on geodesic past incompleteness (a.k.a. "big bang"). All these stories are jokes, of course.

Just try to (i) explain the *schizophrenic* behavior of the "watches" called John and Alice [below](#), as seen from a "safe distance", then (ii) define rigorously that "safe distance" ("safe" is sheer poetry),

and finally (iii) run the whole story backward in time, to bring *that same* "safe distance" back into the normal, unsuspecting spacetime, **before** the "event horizon" occurred, namely, **before** the null geodesics of John ([Friedman](#)) and Alice have reached their (quasi-local?) **endpoints**, as explained eloquently by [Bob](#) and [Chuck](#).

In my not-so-humble opinion, the "weak cosmic censorship conjecture" is not even a 'conjecture', because the so-called "teleological" problem (see above) is ridiculous. If you disagree, try to calculate the 'time of arrival' of the "event horizon", and tell some astrophysicist how long she would have to wait to have her "black hole" delivered, and then explain what happens "[meanwhile](#)".

Besides, the very idea that Mother Nature would allow such pathological defect in the spacetime continuum is nonsense: what is the purpose of some totally hidden defect that nobody can observe? Does it help something, or facilitate something?

Most importantly, the underlying hypothesis about some "asymptotic flatness at future null infinity" ([Bob Wald](#)) is **wrong** -- Roger Penrose was thinking like a [bartender](#), and made a wrong assumption that by rescaling the metric one can reach some "**endpoints** for the null geodesics which propagate to asymptotically large distances" ([Idem](#)). To be precise:

"The fuzzy idea of where and what is infinity was clarified and made more specific by the work of Penrose [[62](#), [63](#)] with the introduction of the conformal compactification (via the rescaling of the metric) of spacetime, whereby infinity was added as a boundary and brought into a finite spacetime region" ([Ted Newman et al.](#), 2012).

If you start from *within* spacetime, you cannot, not even in principle, reach any "boundary" or "endpoint", because you will **always** have an [UNcountably infinite](#) "number" of spacetime points in front of your nose. The same tallies to the asymptotic spacelike regime (see [below](#)). If Ted Newman and his colleagues believe that Penrose has indeed added infinity "as a boundary and brought into a **finite** spacetime region," they should deliver some recipe for the [asymptotic spacelike regime](#) at  $I^0$  ([Jörg Frauendiener](#) and [Helmut Friedrich](#)) as well.

It's a package. As Adam Helfer pointed out (arXiv:0903.3016v1 [gr-qc], [p. 9](#)), "The asymptotic spacelike regime might seem, based on non-relativistic experience, most natural, but it does not allow for a [direct treatment of radiation](#), a phenomenon of central interest; it is also less well understood mathematically at present." See Jim Hartle below (*Gravity*, 2003, [p. 162](#)).

### Null Surfaces

Surfaces generated by light rays are another important class of three-surfaces called *null surfaces*. At each point in a null surface, there is one tangent direction  $\ell$  that points along a light ray and is null,

$$\ell \cdot \ell = 0, \quad (7.79)$$

and two orthogonal independent spacelike directions. The null direction  $\ell$  is a normal to the null surface because it is orthogonal to the spacelike directions and also to itself by virtue of (7.79). A normal to a null surface is a null vector that lies in it.

I think [mathematical physicists](#) face a severe problem with *their* understanding of 'quasi-local mass': they just cannot accomplish "a well-defined useful **local** notion of [mass or energy](#), with natural properties – e.g., monotonicity – that one has in other physical theories. Such a definition has been elusive despite a great deal of effort by many people and this remains an important open problem" (Piotr Chruściel, Gregory Galloway, and Daniel Pollack, *Mathematical general relativity: a sampler*, arXiv:1004.1016v2 [gr-qc], [p. 38](#)). The importance of this **insoluble** task ([Erik Curiel](#)) is particularly acute in "the notion of future null infinity, which is an idealized boundary attached to space-time that

represents, loosely speaking, the **end points** (*local* or *quasi-local*? - D.C.) of null geodesics escaping to infinity" and the so-called "weak cosmic censorship conjecture" (*ibid.*, [p. 48](#)). As Demetrios Christodoulou acknowledged in his voluminous essay on "black holes" (arXiv:0805.3880v1 [gr-qc], [p. 590](#)), "in the general case the requirement for the formation of a trapped sphere is not on the total incoming energy but rather on the incoming energy in each direction. (...) And of course the nature of the future "boundary" of the maximal development, when [future null geodesic] incompleteness holds, remains an open question."

And it will remain an "open question" **forever**, because they still treat GR as a "[classical theory](#)" and haven't discovered Einstein's 'total field of [as yet unknown structure](#)', which makes mass and energy *quasi-local*. As Matt Visser explained ([arXiv:gr-qc/0204022v2](#), p. 3, emphasis added):

"Unfortunately, in general relativity one cannot simply assert that chronology is preserved, and causality respected, without doing considerable additional work. The essence of the problem lies in the fact that the Einstein equations of general relativity are local equations, relating some aspects of the spacetime curvature at a point to the presence of stress-energy at that point. What general relativity does **not** do is to provide any natural way of imposing **global** constraints on the spacetime — certainly the Einstein equations provide no such nonlocal constraint."

I think the phrase "at a point" is a big can of worms, because **any** observable of the gravitational field is "*necessarily quasi-local*" ([Laszlo Szabados](#)), as depicted in the drawing [below](#).

I hope to elaborate on my conjecture (UGMC) in [December 2012](#). Meanwhile, check out a logical paradox [below](#), explaining the crux of "singularities". It isn't about "some sort of baby universe, or eventually disconnected spacetime" ([Bill Unruh](#)), nor some convenient *ad hoc* "[reasonable assumptions](#)". It is about the **global** constraints on the spacetime and the [internal structure and topology](#) of what people perceive, at macroscopic length scale, as a dimensionless geometrical "point". The task is strictly mathematical.

To sum up, in present-day differential geometry, an idealized abstract object, called 'spacetime manifold', is constructed as in a purely classical theory, with abstract geometrical "points". But [General Relativity is not a 'purely classical theory'](#), because the geometrical "points" themselves **are quasi-local**. We need new geometrical presentations of an 'infinitesimal point' and '[empty set](#)', complementing those used by "[bartenders](#)". It will be [a whole new ball game](#), and mathematicians will have to give up their [privileged status](#) of people who need not learn Physics.

When will this happen? Check out [Max Planck](#).

D. Chakalov

May 26, 2012

Last updated: June 9, 2012, [00:01:24 GMT](#)

=====

Subject: Event horizon, if any: request for reference  
Date: Wed, 30 May 2012 01:55:24 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Greg Galloway <galloway@math.miami.edu>,  
Robert M Wald <rmwa@midway.uchicago.edu>,  
Matthew Choptuik <choptuik@phas.ubc.ca>,  
Demetrios Christodoulou <demetri@math.ethz.ch>,  
Helmut Friedrich <hef@aei.mpg.de>,  
Adam Helfer <helfera@missouri.edu>,  
Luca Bombelli <bombelli@olemiss.edu>

Dear colleagues,

I wonder if you are aware of some rigorous proof of the existence of 'event horizon' in GR. I've been searching for many years, with no success,

[http://www.god-does-not-play-dice.net/#EH\\_if\\_any](http://www.god-does-not-play-dice.net/#EH_if_any)

In addition to the problems mentioned at the link above, the asymptotic spacelike regime is totally unclear to me. Fifteen years after the article by Bob Wald [Ref. 1], I still cannot find any publication clarifying the contribution of those "endpoints for the null geodesics which propagate to asymptotically large distances" and "precise smoothness requirements most suitable to impose at  $I^+$ " for a rigorous formulation of the \*asymptotic spacelike regime\*.

Also, are "the global properties of solutions to Einstein's equation" sufficiently clarified [Ref. 2] to declare the weak cosmic censorship conjecture rigorously proven ?

Any information and references you may have on these two issues will be greatly appreciated. My counter-conjecture is outlined at

<http://www.god-does-not-play-dice.net/#UGMC>

Kind regards,

Dimi Chakalov

[Ref. 1] Robert M. Wald, Gravitational Collapse and Cosmic Censorship, arXiv:gr-qc/9710068v3, Sec. 2

<http://arxiv.org/abs/gr-qc/9710068v3>

"The standard definition of asymptotic flatness at future null infinity requires that one be able to conformally embed the spacetime in a suitable way into a spacetime with a boundary,  $I^+$ , which, roughly speaking, provides **endpoints** for the null geodesics which propagate to asymptotically large distances.

.....

"The precise smoothness requirements most suitable to impose at  $I^+$  undoubtedly will depend on the precise choice of asymptotic conditions on the initial data (see above), and will not be considered here.

.....

"The above conjecture remains somewhat imprecise on account of the two words written in italics. In order for the matter to be "suitable", it clearly is necessary that the coupled Einstein-matter field equations have a well posed initial value formulation. It undoubtedly also should be required that the matter stress-energy tensor satisfy suitable energy conditions, such as the dominant energy condition.

.....

"Unfortunately, it is far from clear precisely what measure or topology should be imposed on the space of initial data. Undoubtedly, it will be necessary to develop a much deeper insight into the dynamics implied by Einstein's equation before a natural choice of measure or topology will emerge, and I feel that the precise definition of "generic" would best be left open until that point.

"Does the weak cosmic censorship conjecture hold? To answer this question, we would need to know a great deal about the global properties of solutions to Einstein's equation."

[Ref. 2] Helmut Friedrich, [The large scale Einstein evolution problem](#),

<http://ae100prg.mff.cuni.cz/img/abstracts/9f42de26a136d803d39c4bdd43b31f8c.pdf>

=====

Subject: Re: Event horizon, if any: request for reference  
Date: Mon, 28 May 2012 17:18:14 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: ettore.minguzzi@unifi.it  
Cc: ellis@euclid.colorado.edu,  
sanchezm@ugr.es,  
josemm.senovilla@ehu.es,  
schoen@math.stanford.edu,  
yau@math.harvard.edu,  
seri@math.princeton.edu,  
rendall@aei.mpg.de,  
rmwa@midway.uchicago.edu,  
rouse@maths.ox.ac.uk,  
badri.krishnan@aei.mpg.de

Dear Ettore,

Thank you for your prompt reply.

- > the mathematical deduction of the formation of a black hole event horizon in
- > GR when matter is sufficiently concentrated is a well known mathematical
- > problem in GR, known as the "weak cosmic censorship" problem. No surprise
- > you did not find a proof of its existence.
- >
- > For references search "weak cosmic censorship" in google.

I said that I've been searching it for many years, with no success.

The stipulation about formation of some "trapped surfaces", after the Schoen-Yau theorem, is well known, but the "weak cosmic censorship" conjecture presupposes that, "for generic initial data, the maximal Cauchy development possesses a complete future null infinity",

[http://en.wikipedia.org/wiki/Cosmic\\_censorship\\_hypothesis#Weak\\_and\\_strong\\_cosmic\\_censorship\\_hypothesis](http://en.wikipedia.org/wiki/Cosmic_censorship_hypothesis#Weak_and_strong_cosmic_censorship_hypothesis)

How do you get (i) maximal Cauchy development with (ii) complete future null infinity for (iii) generic initial data in the presence of "dark energy" which manifestly violates SEC, and possibly NEC, after which [the "celebrated" singularity theorems](#) must be re-written ?

Even if you ignore the whole mess from "dark energy of [whatever]", look what José wrote a few years ago in [arXiv:physics/0605007v1](http://arxiv.org/abs/physics/0605007v1):

"Singularities in the above sense clearly reach, or come from, the edge of space-time. This is some kind of boundary, or margin, which is not part of the space-time but that, **somehow**, it is accessible **from within it**."

There is too much poetry here; sorry. There is even more poetry in the "teleological" problem, from Ashtekar and Krishnan at

[http://www.god-does-not-play-dice.net/#EH\\_if\\_any](http://www.god-does-not-play-dice.net/#EH_if_any)

Please send me one reference for (i) maximal Cauchy development with (ii) complete future null

infinity, starting from (iii) generic initial data from Einstein field equations.

I extend this request to your colleagues as well.

Best regards,

Dimi

-----

**Note:** I am grateful to [Ettore Minguzzi](#) for bringing up the issue of the so-called weak cosmic censorship. Perhaps it can elucidate the "teleological" problem, which "lets us speak of a black hole only **after** we have constructed the entire space-time" (cf. Ashtekar and Krishnan [above](#)): how long you need to wait for the "maximal Cauchy development" to reach "complete future null infinity" ?

And how long you may have to wait until the "black hole" settles down to a stationary spacetime (to match an "apparent horizon" to "event horizon"), **after** which it will obtain an "event horizon" and eventually become a "black hole" (cf. Paul Townsend [above](#)) ? Because there is a big crowd of astrophysicists out there, shouting 'I want *my* [super-massive](#) black hole, and I want it **now!**'

Well, from the perspective of the so-called [UGMC](#), the global mode of spacetime captures the complete future (and past) null infinity from the outset, only there is no "event horizon" in any shape or form whatsoever. Unlike the "event horizon", [UGMC](#) isn't a joke but a conjecture based on a new [dynamics of spacetime](#).

As to the observed [relativistic jets](#), perhaps they are produced by opening a "window" into the "negative" mass, as suggested many years ago by [Yakov Terletsii](#). There could be a humongous amount of latent energy in the so-called '[polarization of space](#)', and that is what makes this whole issue [utterly important](#).

D. Chakalov  
May 28, 2012

=====

Subject: Re: Event horizon, if any: request for reference  
Date: Tue, 29 May 2012 20:26:08 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: John Friedman <friedman@uwm.edu>  
Cc: Stephen Crothers <thenarmis@gmail.com>

Hi John:

> The Schwarzschild and Kerr solutions are **exact vacuum solutions** that have  
> event horizons.

Do you have Internet? Check out the link I sent you, particularly the proof by [Stephen J. Crothers](#).

Those "vacuum solutions" are the ultimate poetry you can think of.

Do you have a rigorous proof of "event horizon" ?

Dimi

> On 05/29/2012 12:09 PM, Dimi Chakalov wrote:

>>  
>> Dear John,  
>>  
>> I wonder if you are aware of some rigorous proof of the existence of  
>> 'event horizon' in GR. I've been searching for many years, with no  
>> success,  
>>  
>> [http://www.god-does-not-play-dice.net/#EH\\_if\\_any](http://www.god-does-not-play-dice.net/#EH_if_any)  
>>  
>> Hope you can help.  
>>  
>> Kind regards,  
>>  
>> Dimi  
-----

**Note:** There is a big can or worms revealed by [Stephen J. Crothers](#), so John Friedman won't respond, for obvious reasons. Yet the issue of "black holes" is not entirely useless.

Suppose he meets a beautiful blond girl (let's call her [Alice](#)) with long gorgeous legs and everything, and wishes to impress her -- there's hardly anything more effective than a brief explanation of those "black holes" (courtesy from [John Baez](#)):

"In fact, inside the event horizon, **t** is actually a *spatial* direction, and the future corresponds instead to decreasing **r**. It's only outside the black hole that **t** even points in a direction of increasing time. So if you, watching from a [safe distance](#), attempt to witness my fall into the hole, you'll see me fall more and more slowly as the light delay increases. You'll never see me actually *get to* the event horizon. My watch, to you, will tick more and more slowly, but will never reach the time that I see as I fall into the black hole."

Alice will be stunned and fascinated, and John (Friedman) will feel just great. It tried this trick with my Italian girlfriend, many years ago, and the end result was absolutely delicious.

D.C.  
May 30, 2012  
Last updated: June 7, 2012

=====  
Subject: Re: Event horizon, if any: request for reference  
Date: Thu, 17 May 2012 14:54:04 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Luigi Foschini <luigi.foschini@brera.inaf.it>  
Cc: Stephen Crothers <thenarmis@gmail.com>

Dear Luigi,

Thank you for your reply.

> I think that the best definition is that coming from the mathematics. That  
> is, given - for example - the Schwarzschild metric, the event horizon is  
> that coordinate singularity occurring when the distance from the centre is  
> equal to  $2GM/c^2$ .

Check out Stephen J. Crothers,

<http://www.sjcrothers.plasmaresources.com/article-1-1.pdf>

[http://www.ptep-online.com/index\\_files/2005/PP-01-09.PDF](http://www.ptep-online.com/index_files/2005/PP-01-09.PDF)

[http://www.ptep-online.com/index\\_files/2006/PP-05-10.PDF](http://www.ptep-online.com/index_files/2006/PP-05-10.PDF)

- > In this case, the  $dt^2$  term vanishes, while the  $dr^2$  term
- > and the angular one diverge to infinite. It is a singularity different from
- > that for  $r=0$ : the event horizon can be removed with a proper choice of
- > coordinate (e.g. Kruskal), while the singularity at  $r=0$  is an essential
- > singularity and cannot be removed.
- >
- > Hope it is useful.

Well, it is a very good example of how people "read" the math. Details from Angelo Loinger, The black holes do not exist - "Also Sprach Karl Schwarzschild", [arXiv:physics/0402088v1](http://arxiv.org/abs/physics/0402088v1).

All the best,

Dimi

- > On 5/16/12 3:57 PM, Dimi Chakalov wrote:
- >
- > Dear Luigi,
- >
- > Can you suggest a rigorous definition of 'event horizon' ?
- >
- > [http://www.god-does-not-play-dice.net/#EH\\_if\\_any](http://www.god-does-not-play-dice.net/#EH_if_any)
- >
- > All the best,
- >
- > Dimi
- >

**Note:** Another startling example of how people "read" the math is [Gerardus 't Hooft](#):

"Due to the energy that should exist in a gravitational wave, gravity should interact with itself. Einstein's equation should have a term describing gravity's own energy. In fact, it does. (...) One way to see how this works, is to split the metric  $g_{\mu\nu}$  into a background part,  $g^o_{\mu\nu}$ , for which we could take flat space-time, and a dynamical part: substitute in the Einstein-Hilbert action:

$$g_{\mu\nu} = g^o_{\mu\nu} + g^l_{\mu\nu} .$$

"The dynamical part,  $g^l_{\mu\nu}$ , is defined to include all the ripples of whatever gravitational wave one wishes to describe. Just require that the background metric  $g^o_{\mu\nu}$  obeys the gravitational equations itself; one can then remove from the Lagrangian all terms linear in  $g^l_{\mu\nu}$ . This way, one gets an action that starts out with terms quadratic in  $g^l_{\mu\nu}$ , while all its indices are connected through the background field  $g^o_{\mu\nu}$ . This is because both  $g^o_{\mu\nu}$  and  $g^l_{\mu\nu}$

transform as true tensors under a coordinate transformation; all terms in the expansion in powers of  $g^I_{\mu\nu}$  are therefore separately generally invariant.

"The stress-energy-momentum tensor can then be obtained routinely by considering infinitesimal variations of the background part, just like one does for any other type of matter field; the infinitesimal change of the total action (the space-time integral of the Lagrange density) then yields the stress-energy-momentum tensor. Of course, one finds that the dynamical part of the metric indeed carries energy and momentum, just as one expects in a gravitational field. As hydro-electric plants and the daily tides show, there's lots of energy in gravity, and this agrees perfectly with Einstein's original equations. In spite of DC calling it "utter madness", this procedure works just perfectly."

Yes, it is **utter madness** to relate hydro-electric plants and daily tides with any "splitting the metric" into two "parts", background and dynamical.

"L and C shout that this stress-energy-momentum tensor is a "pseudotensor". Indeed, its transformation properties are subtle, and one might wish to claim that splitting  $g_{\mu\nu}$  in a background part and a dynamical part is "**unphysical**". But then, indeed, one should accept the fact that the notion of energy is observer dependent anyway. An observer who is in free fall in a gravitational field may think there's no energy to be gained from gravity.

"Actually, one can define the energy density in different ways, since one has the freedom to add pure gradients to the energy density, without affecting the total integral, which represents the total energy, which is conserved. Allowing this, one might consider the Einstein tensor  $G_{\mu\nu}$  itself to serve as the gravitational part of the stress-energy-momentum tensor, but there would be problems with such a choice. The definition using a background metric (which produces **only** terms that are quadratic in the first derivatives) is much better, and there's nothing wrong with a definition of energy, stress and momentum that's frame dependent, as long as energy and momentum are conserved. In short, if one wants only first derivatives, either frame dependence or background metric dependence are inevitable."

To say that the splitting  $g_{\mu\nu}$  in a background part and a dynamical part is "**unphysical**" would be a compliment to G. 't Hooft, which I'm afraid he does not deserve; cf. A. Perez, arXiv:1205.2019v1 [gr-qc], p. 4.

D. Chakalov  
May 17, 2012

=====

Subject: Re: STRANGE MISCONCEPTIONS OF GENERAL RELATIVITY, by G. 't Hooft  
Date: Thu, 17 May 2012 15:59:31 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Gerardus <g.thooft@uu.nl>

Cc: "Szabados,L." <lbszab@rmki.kfki.hu>,  
"Dupre, Maurice J" <mdupre@tulane.edu>,  
Adam Helfer <helfera@missouri.edu>,  
Norbert Straumann <norbert.straumann@gmail.com>,  
Domenico Giulini <domenico.giulini@itp.uni-hannover.de>,  
Luca Bombelli <luca@phy.olemiss.edu>,  
Stephen Crothers <thenarmis@gmail.com>,  
"C. Y. Lo" <c\_y\_lo@yahoo.com>,  
Merced Montesinos Velásquez <merced@fis.cinvestav.mx>,  
Angelo Loinger <angelo.loinger@mi.infn.it>

Hello Gerardus,

Regarding my email from Tue, 16 Mar 2010 15:50:10 +0200, I quoted from your masterpiece at

[http://www.god-does-not-play-dice.net/#EH\\_if\\_any](http://www.god-does-not-play-dice.net/#EH_if_any)

Please say something. Don't be shy. Make your best shot.

D.

=====

Subject: Event horizon, if any: request for reference  
Date: Thu, 17 May 2012 22:03:46 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Pankaj <psj@tifr.res.in>, Ravindra <ravindra.saraykar@gmail.com>  
Cc: Richard Woodard <woodard@phys.ufl.edu>,  
Avi Loeb <aloeb@cfa.harvard.edu>,  
Alan Coley <aac@mathstat.dal.ca>,  
Bernard J Carr <b.j.carr@qmul.ac.uk>,  
Tomohiro Harada <harada@yukawa.kyoto-u.ac.jp>,  
George Svetlichny <svetlich@mat.puc-rio.br>,  
Paul K Townsend <p.k.townsend@damtp.cam.ac.uk>,  
Miguel Sanchez Caja <sanchezm@ugr.es>,  
Laszlo Szabados <lbszab@rmki.kfki.hu>,  
Jörg Frauendiener <joergf@maths.otago.ac.nz>,  
Jonathan Thornburg <jthorn@astro.indiana.edu>,  
Karel V Kuchar <kuchar@physics.utah.edu>,  
Abhay Ashtekar <ashtekar@gravity.psu.edu>,  
Robert Beig <robert.beig@univie.ac.at>,  
James Fry <fry@phys.ufl.edu>,  
Gary W Gibbons <G.W.Gibbons@damtp.cam.ac.uk>,  
Harvey S Reall <H.S.Reall@damtp.cam.ac.uk>,  
Jiří Bičák <Jiri.Bicak@mff.cuni.cz>

Dear Pankaj and Ravindra,

You acknowledged in [arXiv:1205.3263v2 \[gr-qc\]](https://arxiv.org/abs/1205.3263v2) that GR "does not predict that such a singularity will be necessarily covered in an event horizon, forming a black hole", and it is by no means clear that we can speak about "singularity" in the first place, given the lack of any observational evidence for either "event horizon" or "time-like naked singularity" ([arXiv:gr-qc/0410041v1](https://arxiv.org/abs/gr-qc/0410041v1)).

[Ravindra](#): I wonder if you are aware of some rigorous proof (no mathematical poetry) of the

existence of 'event horizon' in GR. I've been searching for many years, with no success. I asked Pankaj [previously](#), but he couldn't provide such reference. Since you're trained in math, I hope you know the problem in details.

The current status of my search for a rigorous proof of 'event horizon' is posted at

[http://www.god-does-not-play-dice.net/#EH\\_if\\_any](http://www.god-does-not-play-dice.net/#EH_if_any)

I hope to hear from your colleagues as well: just the math of 'event horizon', and no poetry, please!

Best regards,

Dimi

=====

Subject: Re: Event horizon, if any: request for reference

Date: Tue, 29 May 2012 18:47:36 +0300

From: Dimi Chakalov <dchakalov@gmail.com>

To: Ravindra Saraykar <ravindra.saraykar@gmail.com>

Cc: psj@tifr.res.in,

sbsarwe@gmail.com,

sureshghate@gmail.com,

galloway@math.miami.edu,

didier.solis@uady.mx,

damaxwell@alaska.edu,

piotr.chrusciel@univie.ac.at,

ettore.minguzzi@unifi.it,

seri@math.princeton.edu

Dear Professor Saraykar,

Thank you for your email from Tue, 29 May 2012 20:26:45 +0530.

> About existence of event horizon :

>

> If an asymptotically flat spacetime  $M$  (in the sense of admitting a regular  
> null infinity) contains a future trapped surface, then there exists an event  
> horizon.

Before we consider this statement a 'fact', I think we should first check out whether there is an inadmissible degree of poetry in the statements that (i) an asymptotically flat spacetime would admit/acquire a regular null infinity, and (ii) the formation of a future trapped surface.

Regarding (i), please notice that the formation of 'asymptotically flat spacetime' requires full knowledge of its topology, which is currently totally unclear due to the unknown tug-of-war ([DDE vs. CDM](#)) manifestation of gravity at cosmological scales, producing a "balanced", asymptotically flat spacetime.

Regarding (ii), please see the problems with SEC and NEC at

<http://www.god-does-not-play-dice.net/#Ettore>

> The proofs of this fact are given in the books by Hawking and

> Ellis, and Wald. The result is also true if  $M$  contains a weakly trapped

- > surface (null expansions less than or equal to zero, rather than strictly
- > less than zero), but then the proofs in Hawking and Ellis and in Wald are
- > not quite correct. A fully rigorous proof is given at the end of the paper
- > by Galloway, Chrusciel and Solis ( gr-qc/ 0808.3233, Annales Inst. Henri
- > Poincare 10:893-912,2009 ). All of these results require the condition
- > called "i\_0 avoidance".

Let me quote from Galloway, Chrusciel, and Solis, arXiv:0808.3233v2 [gr-qc], [p. 2](#):

"Recall that for asymptotically flat stationary space-times, whatever the space-dimension  $n \geq 3$ , simple connectedness holds for globally hyperbolic domains of outer communications satisfying the null energy condition."

I'm afraid their "appropriate global hypotheses" ([ibid.](#)), NEC included, do not hold for the new dynamics of spacetime due to the so-called dark energy of [you-name-it], producing "a unique future directed null vector field" ([ibid.](#)).

Please check out the discussion at the link above. I will be happy to elaborate.

- > This condition is an assumption that the causal future of a compact set does
- > not contain all of future null infinity ( scri^+ ). This condition is
- > satisfied for example, in all standard black hole spacetimes (e.g.,
- > Schwarzschild, Kerr, Reissner-Nordstrom). More generally, black hole
- > spacetimes with "sufficiently regular" scri satisfy i\_0 avoidance. This is
- > argued, for example, in Hawking and Ellis, Prop 9.2.1, where it is needed in
- > a manner very similar to the Friedman-Schleich-Witt proof of topological
- > censorship. Also, Wald explicitly observes in Prop. 12.2.2 of his book on
- > GR that i\_0 avoidance holds for the the general class of spacetimes
- > considered in this proposition.
- >
- >
- > I hope, this is of some help to you.

Yes, it is. Thank you for your efforts.

Regards,

Dimi Chakalov

- > On Tue, May 22, 2012 at 8:07 PM, Dimi Chakalov <dchakalov@gmail.com> wrote:
- >>
- >> P.S. Note added at
- >> <http://www.god-does-not-play-dice.net/#Recami>
- >>
- >> D.

=====

Subject: Re: Event horizon, if any: request for reference

Date: Thu, 31 May 2012 13:09:10 +0300

Message-ID:

<CAM7Ekxm8FKVqJXeiAn2sHHgDac7g2YGdrsLpjdHrXskDPOR\_YA@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Ravindra Saraykar <ravindra.saraykar@gmail.com>

Cc: psj@tifr.res.in,  
sbsarwe@gmail.com,  
sureshghate@gmail.com,  
galloway@math.miami.edu,  
didier.solis@uady.mx,  
damaxwell@alaska.edu,  
piotr.chrusciel@univie.ac.at,  
ettore.minguzzi@unifi.it,  
seri@math.princeton.edu,  
rmwa@midway.uchicago.edu,  
choptuik@phas.ubc.ca,  
demetri@math.ethz.ch,  
hef@aei.mpg.de,  
helpera@missouri.edu,  
bombelli@olemiss.edu

Dear Ravindra,

> black holes ( singularities in general ) do not exist

Sure. The task is strictly mathematical:

<http://www.god-does-not-play-dice.net/#singularity>

> even more : Einsteins General Relativity itself is a wrong theory.

As [Einstein](#) himself admitted, General Relativity is "...merely a makeshift in order to give the general principle of relativity a preliminary closed-form expression. For it was essentially no more than a theory of the gravitational field, which was isolated somewhat artificially from a total field of as yet unknown structure."

My efforts to reveal this 'total field of as yet unknown structure' are posted at the link below, from May 22nd.

Again, the task is strictly mathematical.

Wishing you and your colleagues a nice summer,

Best regards,

Dimi

>> > On Tue, May 22, 2012 at 8:07 PM, Dimi Chakalov <dchakalov@gmail.com>  
>> > wrote:  
>> >>  
>> >> P.S. Note added at  
>> >> <http://www.god-does-not-play-dice.net/#Recami>  
>> >>

=====



Subject: "Gravitational Wave Astronomy: Needle in a Haystack," by [Neil J. Cornish](#)

Date: Wed, 11 Apr 2012 06:12:25 +0300

Message-ID:

<CAM7Ekx=j2Uob8JX4Zm6OSGtJygkA5wgyis-iuHJZnnk7dBwbAA@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Neil J Cornish <cornish@physics.montana.edu>

Cc: Suzanne Abbott <philtransa@royalsociety.org> ,

Stuart Taylor <stuart.taylor@royalsociety.org> ,

press@royalsociety.org, rld@astro.ox.ac.uk,

lyndsay.fletcher@glasgow.ac.uk,

lahav@star.ucl.ac.uk, s.miller@ucl.ac.uk

Hello Dr. Cornish,

Paper is a valuable commodity, it must not be wasted. I think you should immediately pull out your [arXiv:1204.2000v1 \[gr-qc\]](#) from the Philosophical Transactions of the Royal Society A, and start from scratch:

<http://www.god-does-not-play-dice.net/#Bondi>

I stand ready to explain your errors in [details](#).

Sincerely,

Dimi Chakalov

-----

**Note:** Do you know how to cook [Andean Flamingo](#) with [Jabuticaba](#)? Easy. No problem. Just try two handy approximations, for obvious reasons. Instead of Andean Flamingo, use a large broiler, and if you can't find Jabuticaba in your local grocery, replace it with cabbage, then cook it as 'chicken with cabbage'.

Same story with LIGO "scientific" collaboration and their two approximations, linearized GR (cf. [Hermann Weyl](#)) and [quadrupole approximation](#). I'm not sure if the Editors of *The Philosophical Transactions of the Royal Society* would be desperate for a piece of cold chicken with soggy cabbage though. Highly unlikely.

Actually, the proper epitaph for 'the needle in a haystack' is from Confucius: The hardest thing of all is to find a black cat in a dark room, especially if there is [no cat](#).

"For if we are uncritical we shall always find what we want: we shall look for, and find, confirmations, and we shall look away from, and not see, whatever might be dangerous to our pet theories. In this way it is only too easy to obtain what appears to be overwhelming evidence in favor of a theory which, if approached critically, would have been refuted" (K. Popper, *The Poverty of Historicism*, 2nd ed., Routledge, 2002, [p. 124](#)).

Probably Neil Cornish will just reject my email. That will be really "smart", yes. Typical for LIGO "scientific" collaboration, too.

D. Chakalov  
April 12, 2012  
Last updated: April 18, 2012

=====

Subject: [PSR1913+16](#)  
Date: Sat, 21 Apr 2012 15:55:02 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Guo Jun Qiao <gjn@pku.edu.cn>  
Cc: Ingrid H. Stairs <stairs@astro.ubc.ca>,  
Edward P. J. van den Heuvel <e.p.j.vandenheuvel@uva.nl>,  
J. M. Lattimer <lattimer@mail.astro.sunysb.edu>,  
M. Prakash <prakash@snare.physics.sunysb.edu>,  
Jin Lin Han <hjl@bao.ac.cn>,  
R. T. Gangadhara <ganga@iiap.res.in>,  
K. J. Lee <k.j.lee@water.pku.edu.cn>,  
R. X. Xu <r.x.xu@pku.edu.cn>,  
H. G. Wang <hgwang@gzhu.edu.cn>,  
Yuan Jie Du <duyj@nssc.ac.cn>

Dear Professor Qiao,

May I ask for your opinion about all possible reasons for the loss of kinetic energy of PSR1913+16,

<http://www.god-does-not-play-dice.net/#Ponga>

Perhaps **pulsar wind** [[Ref. 1](#)] or other mundane physical process?

I extend this request to your colleagues as well.

Thank you for your time and consideration.

Your sincerely,

Dimi Chakalov

[Ref. 1] Jin Lin Han, Pulsars as Fantastic Objects and Probes,  
arXiv:0901.1593v1 [astro-ph.SR]  
<http://arxiv.org/abs/0901.1593>

Sec. 2 Pulsar emission

Radio emission from pulsars is generated in pulsar magnetosphere. We define the boundary of this magnetosphere by the light-cylinder, e.g. at the radius where the rotation speed is equal to the light speed. The particles, i.e. positrons and electrons, are accelerated along the magnetic fields above polar cap or the outer gap. These particles radiate [22] so that we can see the emission in radio and

high energy band.

*However, it is not clear what physical processes are involved for the particles to radiate. Pulsar wind or wind nebula [63] can be formed if particles flow out through the open magnetic field lines passing through the light-cylinder. It is the rotation that provides the energy source for pulsar emission and **particle outflowing** (... hence the latter will rob the energy source of the pulsar, but with some luck you may get a [Nobel Prize](#) for the alternative hypothesis -- D.C.).*

=====

Subject: Tony Downes et al., arXiv:1108.5220v2 [gr-qc], [p. 13](#)  
Date: Mon, 3 Dec 2012 19:08:38 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: anthony.downes@me.com, downes@physics.uq.edu.au, g.milburn@uq.edu.au  
Cc: caves@info.phys.unm.edu, jdowling@phys.lsu.edu, pullin@lsu.edu, sandersb@ucalgary.ca

Tony and Gerard,

I quoted from your latest paper at

<http://www.god-does-not-play-dice.net/#Hobson>

Pity you included Carlton Caves in v2, because he is totally biased, much worse than Jehovah's Witnesses and [Jonathan Dowling](#), to name but a few.

Take care,

Dimi

=====



Subject: [arXiv:1204.1350v1 \[gr-qc\]](#)  
Date: Mon, 9 Apr 2012 09:44:42 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Gergely Székely <szekely.gergely@renyi.mta.hu>

Dear Dr. Székely,

I found your article very illuminating. May I share some thoughts about the irrational numbers.

Consider the Golden Ratio  
[http://en.wikipedia.org/wiki/Golden\\_ratio](http://en.wikipedia.org/wiki/Golden_ratio)

and imagine the middle point, C, such that  $AC/CB = AB/AC$ . If we attach rational numbers to A and B, C will be uniquely defined but irrational, although it is by no means ontologically different than the

"points" A and B. If we choose to set, say,  $AC = 1$  m, then A and C will be rational numbers, but not B.

BTW are you aware of the Thompson Lamp paradox?

Kind regards,

Dimi Chakalov

-----

**Note:** Gergely Székely and his co-authors posed a very intriguing question: What do numbers have to do with the geometry of spacetime? The ideas hinted in my email do not support their [arXiv:1204.1350v1 \[gr-qc\]](#) (nor the views of [Alfred Tarski](#)), however. Since both natural and irrational numbers are related to "points", the first claim about the the geometry of spacetime -- the grin of the Cheshire cat without the cat, as observed by [Alice](#) (in the l.h.s. of the [Einstein field equation](#)) -- is that any **finite** chunk of space contains *uncountably infinite* "points". If you treat these "points" as a 'set', "its cardinal number is larger than that of the set of all natural numbers" ([Wiki](#)).

But as the [Thompson Lamp paradox](#) suggests, it may not be a 'set', because a **finite**, and purely geometrical, chunk of 'the grin of the Cheshire cat without the cat' both **involves** a "point" that belongs to the 'set', and at the same time [the same "point"](#) does **not** belong to the 'set'. Hence we have a *beautiful* logical contradiction, showing the *dual* nature of a very special "number" -- [zero](#). Actually, what we call '[spacetime](#)' is comprised *exclusively* from such *dual* objects. Let me try to explain.

On the one hand, if we apply *potential infinity* to the end-state of the Thompson Lamp [hypertask](#), it will *look like* '[the empty set  \$\mathbf{R}\$](#) ' which, as people argue ([Wiki](#)), does **not** belong to the "set" of divergent 'on/off states of the lamp'. But on the other hand, if we apply [actual/completed infinity](#) à la [bartenders](#), the end-state of the lamp **does** belong to the same "set".

-----

**NB:** Compare this with what José Senovilla wrote [above](#): "Singularities in the above sense clearly reach, or come from, the edge of space-time. This is some kind of boundary, or margin, which is not part of the space-time but that, **somehow**, it is accessible **from within it**." This is the crux of "[singularities](#)".

-----

The logical paradox can be resolved only with the *dual nature* of the "number" [zero](#) in the framework of the so-called '[John's jackets](#)': '[the empty set  \$\mathbf{R}\$](#) ' is the UNdecidable pre-quantum [Kochen-Specker state](#) which is non-existent (hence "zero") in the local (physical) mode of spacetime ("John" doesn't belong there), yet if treated with actual/completed infinity the same [empty set  \$\mathbf{R}\$](#)  will display its fleeting **physical** "jacket". The latter can be presented with both natural and irrational numbers. Q.E.D.

To paraphrase Henri Poincaré, the [Mengenlehre](#) and Baldy's Law<sup>1</sup> are a disease from which we have not yet recovered -- see the "open sets" [above](#) and the discussion of the [Equivalence Principle](#) viz. the *quasi*-localization of the gravitational energy with respect to 'everything else in the universe'.

As Steven Weinstein pointed out (General relativity and quantum theory -- ontological investigations, in: *Metadebates on Science: The Blue Book of 'Einstein Meets Magritte'*, [Vol. 6](#), edited by Gustaaf C. Cornelis, Sonja Smets, and Jean Paul van Bendegem, Kluwer Academic, Dordrecht, 1999, [pp. 267-279](#)):

"From a strictly mathematical perspective, the metric is an attribution of properties to points on the manifold, and the manifold does not in itself represent spacetime."

Replace 'the points **on** the manifold' with '[jackets](#)', and 'the manifold **in itself**' with "John", and you're done. Always keep in mind the fundamental difference between the metric "field" from GR textbooks, and the [Affine Connection](#) -- the **pre-geometric** binding agent of the "points" from 'the manifold in itself' **does not exist** in the local (physical) mode of spacetime. It is the omnipresent

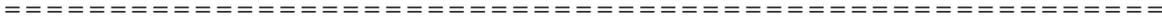
empty set R, denoted with the unique number zero. It exists in the global, atemporal, non-Archimedean mode of spacetime as 'potential reality', thanks to the Arrow of Space.

To those who disagree, I suggest to read here about the quarrel I had in 1986 with a Russian physicist, and then recall the 1929 paper by Nevill Mott: you have continuous, uninterrupted interactions involving **energy exchange** between a **single** quantum particle and its macroscopic detector. You can measure with your wristwatch the duration of the track, so how would you explain the macroscopic "copies" ("jackets") of that **single** quantum particle, produced by its continuous energy exchange with its detector ?

If you can explain the puzzle *without* John's jackets, call CERN's Theory Group and tell them that they *might* eventually detect their "god particle". Then call LIGO "scientific" collaboration and assure them that they too can detect their dimensionless ghost. And finally, call the Scientific Organizing Committee of the Einstein Conference in Prague and tell them that I have nothing new to offer, so they can safely reject my talk.

D. Chakalov  
April 16, 2012  
Last updated: May 30, 2012, 17:12 GMT

<sup>1</sup> Baldy's Law: Some of it plus the rest of it is all of it.



Subject: Re: arXiv:0704.2291v1 [astro-ph]

Date: Wed, 18 Apr 2012 16:25:24 +0300

Message-ID:

<CAM7Ekxm7z1a+wmyOVwjq-WbyTOrc3PrJvBZd3ooEzHBOz7nEQ@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Simon White <swhite@mpa-garching.mpg.de>

Cc: Pavel Kroupa <pavel@astro.uni-bonn.de>,  
Hans Peter Nilles <nilles@th.physik.uni-bonn.de>,  
Mordehai Milgrom <Moti.Milgrom@weizmann.ac.il>,  
Craig J Copi <cjc5@po.cwru.edu>,  
Robert Minchin <rminchin@naic.edu>,  
Adam Helfer <helfera@missouri.edu>

Dear Simon,

Seems to me you've neglected my email sent five years ago, on Fri, 20 Apr 2007 14:24:49 +0300 (cf. below).

At the debate with Dr. Pavel Kroupa on 18 November 2010, 'Anmerkungen zur Dunkle-Materie-Debatte: Kroupa vs. White',

<http://www.scilogs.de/kosmo/blog/himmelslichter/allgemein/2010-12-06/anmerkungen-zur-dunkle-materie-debatte-pawel-kroupa-vs.-simon-white>

you insisted on your definition of "dark" matter as some "invisible" (e.g., non-baryonic) stuff made of [positive-energy density](#) (recall the failure to detect some WIMPS).

On the other hand, your colleague was trying to suggest some interpretation of these anomalous effects with MOND.

I think there is a third possibility based on quantum gravity: please see an outline at

<http://www.god-does-not-play-dice.net/#ESI>

Will be happy to elaborate.

All the best,

Dimi

-----  
Subject: Re: [arXiv:0704.2291v1 \[astro-ph\]](#)

Date: Fri, 20 Apr 2007 14:24:49 +0300

From: Dimi Chakalov <dimi@chakalov.net>

To: Simon White <swhite@MPA-Garching.MPG.DE>

References: <001d01c782ec\$2d980a20\$6501000a@home>  
<20070420082358.GE16275@ncb-11.MPA-Garching.MPG.DE>

Dear Simon,

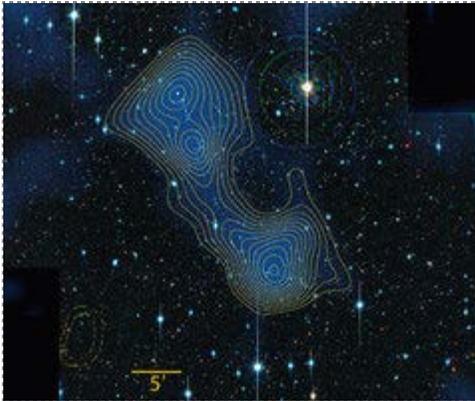
Thanks you for your reply. Just a few thoughts.

[snip]

It is a pleasure to read your review article to Nature, "[The large-scale structure of the Universe](#)". I am deeply puzzled by VIRGOHI 21,

<http://www.god-does-not-play-dice.net/Minchin.html#1>  
[snip]

=====



Subject: <http://dx.doi.org/10.1038/nature11224>  
Date: Sat, 14 Jul 2012 03:10:06 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Jörg P Dietrich <dietrich@usm.lmu.de>  
Cc: Simon White <swhite@mpa-garching.mpg.de>,  
Pavel Kroupa <pavel@astro.uni-bonn.de>,  
Catherine Meusburger <catherine.meusburger@gmail.com>,  
Hans Peter Nilles <nilles@th.physik.uni-bonn.de>,  
Roy Maartens <roy.maartens@port.ac.uk>,  
Slava Mukhanov <mukhanov@theorie.physik.uni-muenchen.de>,  
Paul Frampton <frampton@physics.unc.edu>,  
[Robert Minchin](mailto:rminchin@naic.edu) <rminchin@naic.edu>

Dear Dr. Dietrich,

You used a model (and statistical considerations) to subtract out the masses of the galaxy clusters, and attributed the remaining mass to some non-baryonic "dark" filament, which turned out to be roughly four times more than the visible stuff.

It's a bit like this: you go in a china shop and see all (baryonic) porcelain vases and cups arranged in the air, in a perfectly stable configuration, and wonder what the heck has designed and supported such an amazing configuration of fragile stuff. Then your colleagues tell you that it is all due to an invisible **dark dancing elephant**, which is roughly four times larger than the shop itself. Would you buy such story?

I will be happy to offer you and your colleagues an alternative explanation, which starts from here:

<http://www.god-does-not-play-dice.net/#Munchhausen>

Kind regards,

Dimi Chakalov

-----  
**Note:** An expert in astrophysics and astronomy reacted to my 'dark dancing elephant' metaphor in the following fashion (Mon, 16 Jul 2012 11:36:21 +0200): "I believe that DM exists. I cannot see it, but I know gravity exists. Hence there must be DM."

Notice the *non sequitur*: gravity exists, ergo there **must** be "non-baryonic dark matter".

Such line of reasoning reminds me of a quiz I learned from my teenage daughter:

**Q:** What is green, lives underground, has one eye, and eats stones?

**A:** The One-Eyed Green Underground Stone Eating Monster!

You may add "non-baryonic", it won't improve the "logic". We simply do not know any non-baryonic 'dancing elephant' which can support and organize the visible baryonic 'vases and cups', and will be roughly four times (or more, cf. the "dark galaxy") larger than all vases and cups combined. It's just too much. *Much too much*. Which is why we need to seek a better understanding of gravity: check out the asymptotic nature of spacetime and the 'necessary and sufficient conditions for spacetime'.

D. Chakalov  
July 17, 2012

=====

Subject: Re: The Dark Matter/Dark Energy Crisis: Dynamical Equilibrium ?

Date: Thu, 21 Jun 2012 18:14:01 +0300

Message-ID:

<CAM7EkxkRcDewCmksMsZZfm1JiAXXMZMxGdYpjPRguENsC=vBSQ@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: pavel@astro.uni-bonn.de

Cc: Simon White <swhite@mpa-garching.mpg.de> ,

Hans Peter Nilles <nilles@th.physik.uni-bonn.de> ,

Roy Maartens <roy.maartens@port.ac.uk>

P.S. Regarding quantum gravity from the Arrow of Space: the fundamental asymmetry in the tug-of-war manifestation of gravity is that the so-called DDE points to the future, while the so-called CDM points to the past from the Arrow of Space:

<http://www.god-does-not-play-dice.net/#Roy>

Hence we "observe" inhomogeneous clusters of non-baryonic CDM and perfectly smooth DDE, yet the two tug-of-war effects of gravity are purely geometrical, as explained at the two links below.

Anyway, do you, or your colleagues, have specific arguments against my Dynamic Equilibrium Conjecture below ?

D.

On Thu, Jun 21, 2012 at 5:16 PM, Dimi Chakalov <dchakalov@gmail.com> wrote:

>

> Dear Pavel,  
>  
>> CDM is a good hypothesis but the problem is that CDM (nor WDM) cannot exist  
>> due to the Dual Dwarf Galaxy Theorem.  
>  
> The dual dwarf galaxy conjecture is an intriguing idea, but I think  
> first you need to sort out the proper quantum gravity: recall my email  
> from [Wed, 18 Apr 2012 16:25:24 +0300](mailto:Wed, 18 Apr 2012 16:25:24 +0300). My efforts are posted at  
>  
> <http://www.god-does-not-play-dice.net/#Silva>  
>  
> <http://www.god-does-not-play-dice.net/#ESI>  
>  
> Do you, or your colleagues, have specific arguments against my conjecture below?  
>  
> Best regards,  
>  
> Dimi  
>  
>  
>> On 21/06/12 2:02 PM, Dimi Chakalov wrote:  
>>>  
>>> Dear Dr. Kroupa,  
>>>  
>>> Regarding your latest article,  
>>> <http://www.publish.csiro.au/paper/AS12005.htm>  
>>>  
>>> I wonder what would be your objections against the conjecture that the  
>>> "asymptotic flatness" of spacetime may be the end result from two  
>>> tug-of-war "dark" entities, CDM vs DDE, at cosmologically large  
>>> scales.  
>>>  
>>> The objections from your colleagues will be greatly appreciated, too.  
>>> I am trying to find all possible arguments against my theory of  
>>> quantum gravity, and hope you and your colleagues can help me find my  
>>> errors.  
>>>  
>>> Kind regards,  
>>>  
>>> Dimi Chakalov

=====

Subject: Request for advice  
Date: Thu, 19 Apr 2012 02:10:41 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Jack Lee <lee@math.washington.xxx>  
Cc: Lars Andersson <laan@aei.mpg.de>

Dear Professor Lee,

I have an immodest request. If possible, please help me find the proof (if any) that the manifold

specified in GR [Ref. 1] is indeed (i) second countable and (ii) **orientable**, even if its "points" are \*uncountably\* infinite, as I argued at

<http://www.god-does-not-play-dice.net/#Gergely>

It seems to me that, given Gödel's explanation of Cantor's continuum problem (November 1947), a line in Euclidean space contains uncountably infinite "points", hence we are dealing with a non-Archimedean realm in which adding/subtracting any number of "points" simply doesn't matter, as explained eloquently in the song about aleph-null bottles of beer on the wall,

<http://mathworld.wolfram.com/Aleph-0.html>

This is an open question in GR, since many people believe that 3-D space "expands" due to some non-dilutable "dark" energy of [whatever], by somehow inserting "[more space](#)". However, if the [Archimedes' lemma](#) does not hold for the manifold in GR textbooks, we may have a whole new ball game.

Thank you for your time, and please excuse my violent curiosity.

Yours sincerely,

Dimi Chakalov

[Ref. 1] Lars Andersson, The global existence problem in general relativity, [arXiv:gr-qc/9911032v4](https://arxiv.org/abs/gr-qc/9911032v4), Footnote 1, p. 3: "All manifolds are assumed to be Hausdorff, second countable and  $C^\infty$ , and all fields are assumed to be  $C^\infty$  unless otherwise stated."

-----

**Note:** If you are dealing with **uncountably** infinite "set" of points, you can't make them "second countable" ("[countable base](#)" topology cannot recover all points "counted" with [irrational numbers](#)). Such "set" cannot be made **orientable** either. Surely if you open the window of your room in a cold winter day, you will notice that your room gets colder, but Jack Lee can't insert such "orientability" from [thermodynamics](#) into the [underling manifold](#).

Here's an excerpt from his textbook '[Riemannian Manifolds: An Introduction to Curvature](#)' (source [here](#)): "The most fundamental fact about geodesics, which we prove in Chapter 4, is that given any **point**  $p \in M$  and any vector  $V$  tangent to  $M$  at  $p$ , there is a unique geodesic **starting at**  $p$  with initial tangent vector  $V$ ."

But you can't define any **point**  $p$  in GR, simply because "points" are defined **by** their physical content: "the points occurring in the base sets of differentiable manifolds with which general relativity models spacetime should **not** be reified as **physically real**" (J. Butterfield and C.J. Isham, [arXiv:gr-qc/9903072v1](https://arxiv.org/abs/gr-qc/9903072v1)). The only thing that can make some "point" **physically real** is its fleeting physical "[jacket](#)", but the latter cannot be fixed at a "point" (MTW, [p. 467](#)).

Thus, we have a "set" of uncountably infinite "points", all of which are **quasi-local**: the "localization" is being performed (i) dynamically (cf. "**not yet**" [below](#)) and (ii) **relationally**, with respect to 'everything else in the universe'.

These are the very first statements you should read on p. 1 of every graduate-level text on differential geometry, to understand "[curvature](#)", "metric", and the [Affine Connection](#). But I don't know if it possible to convert these statements into theorems and try to "prove" them: check out the logical paradox [above](#).

In general, it seems mathematicians would prefer to keep their privileged status of people who need not to learn physics. Consider, for example, the following expression:

$$10^{-44} \cdot 10^{44} = 1$$

If this was a "definition" of 'one second' with the [Planck time](#), it will be total nonsense: we cannot add up things at the Planck scale, as we do in the Archimedean definition of 'one second', by some

[Gedankenexperiment](#) that cannot be reproduced with any physical stuff.

So, what is the topological presentation of non-Archimedean geometry?

I talked with two highly respected mathematicians here in Sofia, over a glass of scotch, about the puzzle from [Lucretius](#), and they basically said, 'look, we're dealing with abstract entities, we aren't concerned about physics', and I said, 'fine, but then how would you describe mathematically a [Platonic idea](#), resembling the **non-colorizable**, UNdecidable, pre-quantum [Kochen-Specker state](#)? What is your notion of 'genuine zero' corresponding to 'the ideal monad [without windows](#)'?

Then of course we [changed the subject](#) and finished the bottle. You never get headaches from a bottle of fine scotch, as opposed to the "open sets" in [topology](#).

D. Chakalov  
April 20, 2012

=====

Subject: [arXiv:1206.0045v1 \[gr-qc\]](#), p. 2, the Gannon-Lee theorem, "... at least when quantum effects can be neglected."

Date: Mon, 4 Jun 2012 06:40:28 +0300

Message-ID:

<CAM7Ekxw0juDK\_RQh4Yz\_OS\_O4DqFtQE-eKCrpwFaoyH01FyrQ@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Ivan Silva <ivanpcs@mtm.ufsc.br>

Cc: C.W.Lee@bolton.ac.uk, galloway@math.miami.edu,  
geroch@midway.uchicago.edu, lee@math.washington.edu

Dear Dr. Silva,

You wrote, as a comment to the abstract of your [arXiv:1206.0045v1 \[gr-qc\]](#), "all comments welcome".

I think the so-called "event horizon" and "weak cosmic censorship conjecture" are jokes,

[http://www.god-does-not-play-dice.net/#EH\\_if\\_any](http://www.god-does-not-play-dice.net/#EH_if_any)

Regarding the Gannon-Lee theorem and ref. [21] in your manuscript (C.W. Lee, A restriction on the topology of Cauchy surfaces in general relativity, Commun. Math. Phys. 51 (1976) 157-162), I think the problem of explaining quantum effects under the condition of squeezing large amount of matter into small volume of 3-D space is related to the problem of explaining the total energy of the quantum vacuum. The latter is known as 'the worst calculation in theoretical physics' (the so-called old cosmological problem known since [1930s](#)), and I think the first problem can \*only\* be resolved by the "reversed" process of producing matter from the vacuum, i.e., matter would simply \***dissolve**\* back to the quantum vacuum.

Such quantum-gravitational effect is predicted (actually, required) in my theory of quantum gravity; please see some remarks at

<http://www.god-does-not-play-dice.net/#ESI>

<http://www.god-does-not-play-dice.net/#Tod>

Needless to say, I will be happy to [elaborate](#).

Kind regards,

Dimi Chakalov

-----  
**Note:** Look at Charles W. Lee, A restriction on the topology of Cauchy surfaces in general relativity, *Commun. Math. Phys.* **51**, 157-162 (1976), p. 157:

It would be difficult to prove anything about the topology of space near to singularities, due to the arbitrariness associated with them. As the universe is expected to be globally past incomplete it would also be difficult to say anything about its topology as a whole without some uniformity principle. For these reasons we limit ourselves to a part of space that can be "enclosed by" a well-behaved sphere. There is no restriction on the size of the sphere.

The 'uniformity principle' here is the [dual age cosmology](#), which removes all geodesic pathologies. The 'well-behaved sphere' (complemented by a well-behaved torus) is defined along the **w**-axis [above](#). If we look toward the Small, **it** would be exposed as [uncountably infinite](#) points with size approaching asymptotically "zero", while if we look along the opposite direction of the **w**-axis, toward the Large, *the same it* will be exposed as *the* largest object, tending in size asymptotically toward 'the universe as ONE'. We are dealing with a **dual object**, exposed at the edge of the physical world as both ONE and "many" ([uncountably infinite](#)). [Simple, no?](#)

Ivan Silva didn't comment on my spacetime, but reinstated his belief (email from Mon, 4 Jun 2012 10:23:41 -0700) that the so-called event horizon and weak cosmic censorship were "mathematically well-defined concepts". Well, let's suppose, for the sake of the argument, that he is right, and some "event horizon" is formed **AFTER** the full future development of the **complete** spacetime is accomplished: this would be a *miracle*, because the "location" of the "event horizon" cannot be determined by "observations over a **finite** time interval" ([Paul Townsend](#)). Another reason to consider such event a *miracle* is that Ivan Silva will be able to reach the asymptotic "boundary" of spacetime by starting from *within* spacetime, **after** which he will enter the absolute reference frame of some meta-observer witnessing (present continuous) the 'free fall' of the whole universe *en bloc*, as a "[closed system](#)".

Finally, once Ivan Silva comes back to his initial location *within* spacetime, he will be able to resolve the "teleological" problem explained by Abby Ashtekar and Badri Krishnan [above](#), which will be yet another fantastic miracle.

Miracles cannot be presented as "mathematically well-defined concepts", however. Check out the explanation of "singularity" [here](#). The task is strictly mathematical. Don't play jokes with the asymptotic flatness of spacetime like [Chuck Norris](#).

Start instead from the [open sets in topology](#) and try to uncover the *non-Archimedean geometry* of the putative global mode of spacetime pertaining to the 'free fall' of the whole universe *en bloc*, as a "[closed system](#)". If my spacetime is correct, you will reveal the topological structure of what "[bartenders](#)" consider a geometrical "point" from 'the grin of the [Cheshire cat](#) without the cat', as observed by [Alice](#) (in the l.h.s. of the [Einstein field equations](#)). This "point" is the crux of the matter. Once you find out its topology and kinematics, its dynamics along the Arrow of Space will show up effortlessly. Good luck.

D. Chakalov

June 4, 2012

Last update: June 5, 2012, [13:37:51 GMT](#)

=====

Subject: Re: [arXiv:1206.0045v1 \[gr-qc\]](http://arxiv.org/abs/1206.0045v1), p. 2, the Gannon-Lee theorem, "... at least when quantum effects can be neglected."

Date: Sat, 9 Jun 2012 18:24:28 +0300

Message-ID:

<CAM7EkxkGqaxPdqufrAYTd\_8SR26K1VdR83A8gr0uY-7c13oA1g@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Ivan <ivanpcs@mtm.ufsc.br>

Cc: John <friedman@uwm.edu>

Ivan dorogoi,

>> With all due respect, please explain (i) \*exactly what\* does not make  
>> any sense, and (ii) \*why\*.

>

>

> Very well. Let me try to do that where it is possible. The following  
> representative part is at least understandable. The rest of your ideas sound  
> like a sea of unmitigated nonsense to me, as my ideas and other scientists'  
> also seem to appear to you. Therefore, let me repeat, I am unable to comment  
> on them.

Why? If you are a scientist, you should be able to explain \*why\* my arguments don't make sense to you.

> " Well, let's suppose, for the sake of the argument, that he is right, and  
> some "event horizon" is formed AFTER the full future development of the  
> complete spacetime is accomplished: this would be a miracle, because the  
> "location" of the "event horizon" cannot be determined by "observations over  
> a finite time interval" (Paul Townsend). Another reason to consider such  
> event a miracle is that Ivan Silva will be able to reach the asymptotic  
> "boundary" of spacetime by starting from within spacetime, after which he  
> will enter the absolute reference frame of some meta-observer witnessing  
> (present continuous) the 'free fall' of the whole universe en bloc, as a  
> "closed system"."

>

> Even if one discount all the gibberish in your web site, this remark alone  
> reveals that your notions are hopelessly muddled up.

I'm afraid this is a typical Russian reaction,

<http://www.god-does-not-play-dice.net/russian.html>

> As I said before, one must distinguish between the event horizon as a  
> mathematical definition and the physical world it seeks to portrait. In a  
> purely mathematical definition, no "waiting" is involved. We do not have  
> to "expect it to form" or "go" anywhere, anymore than one has to count  
> the natural numbers in order to have a well-defined set of them, or to wait  
> for the function  $f(x) \Rightarrow x^2$  to spit out its values. One does not have to "wait"  
> for its graph to be traced out to know it is a parabola. There is no "before"  
> and "after" involved in the concepts themselves.

>

> Likewise for the notion of conformal infinity. To claim that conformal infinity  
> (again, as a \*purely mathematical\* notion) is "a joke" or "too much poetry"  
> because "only Chuck Norris can reach it" is as ludicrous as claiming that  
> the boundary of a disc does not exist because no one can reach it. No one  
> is trying to physically chase a mathematical definition, nor is anyone  
> attempting to hug a Hilbert space and kissing a [MOTS](#).

If no object is actually "trying to physically chase" the conformal infinity, then its "mathematical definition" is pure abstraction, the product of your wild Russian imagination.

- > These are mathematical abstractions, and everybody knows it. That many
- > times scientists indeed use realist language towards mathematical concepts
- > is only because it is much easier and more fruitful to think that way, NOT
- > because one expects to trip on a functor while one strolls down the street.
- >
- > The only thing one can meaningfully demand is whether such abstract notions
- > help us in understanding the Universe. Whether they can deliver
- > experimentally testable claims.

Bingo! In order to help you understand the universe, these "abstract notions" should make sense. And since neither you nor any of your colleagues ([John included](#)) have produced the recipe for the "asymptotic spacelike regime" (cf. the initial URL below), you cannot, not even with your wild Russian imagination, claim that you're talking about 'spacetime'.

Sorry, Ivan, just get real and face the facts.

- > In the case of an event horizon, a reasonable question is whether there
- > is some physical object which can be accurately described by this concept.
- > These ARE reasonable questions, and scientists are just trying to figure that
- > out. So help them, instead of pestering everyone with your senseless comments.
- > Join the effort, if you can. If not, get out of the way.

Let me quote from the section I asked you to read at

[http://www.god-does-not-play-dice.net/#EH\\_if\\_any](http://www.god-does-not-play-dice.net/#EH_if_any)

"Just try to (i) explain the schizophrenic behavior of the "watches" called John and Alice [below](#), as seen from a "safe distance", then (ii) define rigorously that "safe distance" ("safe" is sheer poetry), and finally (iii) run the whole story backward in time, to bring *that same* "safe distance" back into the normal, unsuspecting spacetime, before the "event horizon" occurred, namely, before the null geodesics of John ([Friedman](#)) and Alice have reached their (quasi-local?) endpoints, as explained eloquently by [Bob](#) and [Chuck](#)."

Please do the exercise and publish your calculation. We all will hear about you on CNN Breaking News.

- > You are not being a champion for clarity, intellectual honesty or for truth,
- > as you seem to view yourself. You are just being silly, making a fool of yourself.

I'm afraid you're seriously drunk. Sorry.

- > I bear you no ill-will, mind, nor am I trying to imply that science does
- > not benefit from criticism. Of course it does. But make the criticisms
- > sensible, make them meaningful. Make them about truth, not about your ego.

It's all about Einstein's unfinished GR, which "was merely a makeshift in order to give the general principle of relativity a preliminary closed-form expression. For it was essentially no more than a theory of the gravitational field, which was isolated somewhat artificially from a total field of as yet unknown structure."

Again, do the calculation in the task above, and publish your revelations.

I offer this task to [John](#) as well. You both are so good in math...

Take care,

Dimi

=====

Subject: The Aristotelian First Cause  
Date: Tue, 29 May 2012 13:55:38 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Ettore Minguzzi <ettore.minguzzi@unifi.it>  
Cc: sanchezm@ugr.es, lee@math.washington.edu,  
geroch@midway.uchicago.edu,  
gerhardt@math.uni-heidelberg.de

Dear Ettore,

I wonder if you, or some of your colleagues, can start from a plain Borel set and make a genuine 'spacetime' equipped with the metaphysical principle of causality ([arXiv:0909.0890v1 \[gr-qc\]](http://arxiv.org/abs/0909.0890v1)), and then time-oriented Lorentzian manifold ([arXiv:0901.0904v2 \[gr-qc\]](http://arxiv.org/abs/0901.0904v2)).

Perhaps such exercise will elucidate the exact meaning of Virgil's dictum 'Mens agitat molem' (Der Geist bewegt die Materie) -- you will have to introduce a mathematical expression 'by hand'. I suppose it will be a unique type of 'connection' for which there can be no physical counterpart (the Aristotelian First Cause, as explained at my [web site](#)).

My thoughts on this task are posted at

<http://www.god-does-not-play-dice.net/#Lee>

Have a nice summer.

Dimi

-----

**Note:** A brief explanation of the puzzle of the [global Heraclitean time](#) and 'Der Geist bewegt die Materie'.

As John Bell argued, "reality has been identified only at a **single time**" ([reference here](#)): the ultimate puzzle is, what carries *the same* object to the *next* instant 'now'. It **cannot** be any physical stuff, because if it were 'physical', it will be '[GR observable](#)', which would in turn ruin the whole theory of relativity, because the "[ether](#)" will be exposed, and then we would have to seek another *physical* explanation for the "ether", *ad infinitum*. The obvious cutoff was suggested by Aristotle: the First Cause. It is also the "unmoved mover" which, as [Karel Kuchar](#) noticed, is absent from GR, as it should be.

All we can do is to "hide" the First Cause [between](#) the points from the topological manifold, and make the latter dynamically **re**-created along the [Arrow of Space](#).

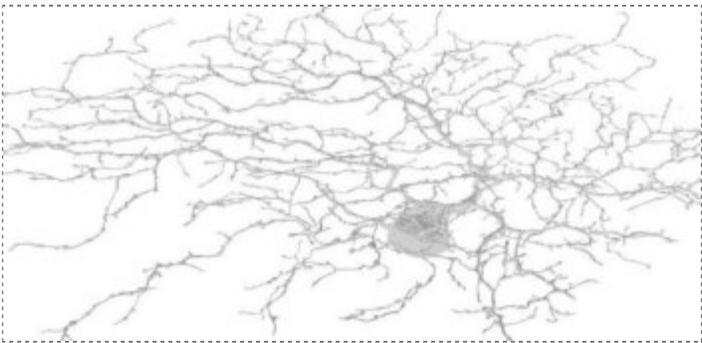
If you disagree, try the tasks [below](#).

D. Chakalov  
June 10, 2012  
Last updated: July 12, 2012

=====



One million cells per second, and no errors.



Subject: Suppose that someone gave you a radio...  
Date: Tue, 29 May 2012 14:48:45 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: [Sebastian Seung](mailto:seung@mit.edu) <seung@mit.edu>  
Cc: toga@loni.ucla.edu, bruce@nmr.mgh.harvard.edu,  
van@nmr.mgh.harvard.edu, robert.beig@univie.ac.at

Dear Dr. Seung,

On 3 November 2008, you wrote:

<http://www.dana.org/news/cerebrum/detail.aspx?id=13758>

"Suppose that someone gave you a radio and asked you to figure out how it works. You could try measuring electrical signals inside it, but the measurements might not be sufficient. You might be more successful if you were also given a circuit diagram illustrating all the components of the radio and how they are connected to each other."

I've been interested in the physics of the brain since 1972, and the only way I could explain the brain is by suggesting a model of the universe as a [brain](#); then I think we can embed the smaller brain in the 'ONE brain' with quantum gravity,

<http://www.god-does-not-play-dice.net/#ESI>

In other words, I think it is crucially important to start with the correct "[radio](#)". Will be happy to elaborate.

Kind regards,

Dimi Chakalov

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**Note:** Many theoretical physicists believe that the psychological time arrow somehow "follows" the thermodynamic time arrow, and then of course claim that our subjective flow of time is nothing but an "illusion" [[Ref. 1](#)]. If this were the case chosen by Mother Nature, our brains must operate like computers in a dead frozen "block universe" ([Robert Reroch](#)). But because the 'computer' assumption is manifestly wrong, these otherwise smart people need a parapsychological ghost acting **directly** on their brains [[Ref. 2](#)], to account for the ubiquitous '[binding phenomenon](#)', namely, how [the brain](#) puts all stimuli collected from all sensory channels together in a perfectly synchronized and *continuous* conscious experience, without any "dark gaps" needed to **re**-calculate the flow of sensory "data". (In the "[linearized](#)" gravity these theoretical physicists use just **one single instant** corresponding to one **completed** negotiation between the two sides of the Einstein field equations, which is why they don't face the "dark gaps", but end up with a dead frozen "block universe" in which 'time' is eliminated from the outset.)

So, if you ignore the proposition from [Leibniz and Pauli](#) and the [Arrow of Space](#), you will have to "link" matter and mind with some "connection" between the "nose" and the "arm" of an [elephant](#). Then you either face unphysical ghosts acting **directly** on your brain, imposing their free will choice on 100 billion neurons and [500 trillion synapses](#), or entertain [Marxist-Leninist materialism](#) and

endorse the idea about 'brain as hardware, mind as software'.

D. Chakalov

June 18, 2012

Last update: March 28, 2013, 11:04 GMT

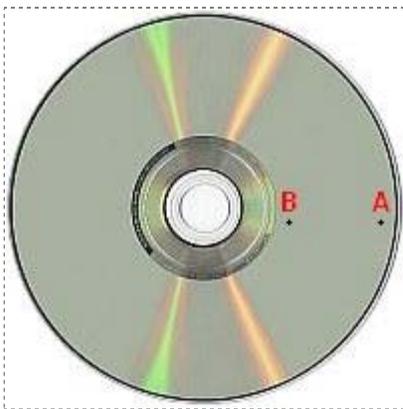
[Ref. 1] What Is Time? By Elisabeth Eaves, *Forbes*, [February 29, 2008](#)

Physics tells us that [all moments exist equally](#), at once -- it's only our consciousness that distinguishes the present from the past or future. Or, as cosmologist Tegmark puts it, "If life were a movie, physical reality would be **the entire DVD**: Future and past frames exist just as much as the present one."

[Ref. 2] Larissa-Emilia Cheran, Exploring the Mechanisms of Interaction between Human Consciousness and Networks of Living Neurons, *Journal of Nonlocality*, Vol. 1, Nr. 1, 2012.

"We do not have a clear definition for life yet. What makes the difference between a living cell and an identical cell, without life? All the physical properties are identical, the chemical components are the same, what is missing is the ineffable force that moves everything in the most surprisingly coherent fashion. What orchestrates 100,000 chemical reactions, every second, in every cell of the 100 trillion that form a human body? How can the constant homeostatic feedback response be achieved in milliseconds? What coordinates the self-organization of this complex system? Is it driven by the 25,000 genes turning each other on and off and producing [proteins](#)? Decoding the human genome did not reveal a Holy Grail after all: the contribution of the gene variants to disease is rather weak. There are other unknown factors at work and the challenge ahead is to identify these, their controls, their potential impact and interactions."

**Comment:** In GR textbooks (e.g., [Robert Geroch](#)), "the entire DVD" is one dead frozen block universe, in which there is no 'time' in terms of different-in-time events (A) and (B).



The two points above are from Minkowski spacetime in which there isn't any invariant *instant* 'now', yet people can speak about an interval (AB) and its points because they are mathematically well-defined on such **background** spacetime. In GR, however, we don't have *any* mathematical notions of "points" in the first place, namely, (A) and (B) are not defined by their gravitational energy *density*, nor can be individuated by their physical content: the paradox or "problem" of time is mathematically inevitable due to "the invariance of classical general relativity under the group Diff(M) of diffeomorphisms of the spacetime manifold M" (Chris Isham, [pp. 4-5](#)). Yet people *ignore* the mathematical rules and tacitly assume that *something* from their imagination [can somehow build up](#)

an **invariant** interval (AB) comprised from the same mathematically *indefinable* "points", and call it 'time'.

Mathematically, [nothing is spinning the DVD](#), nothing can look at the DVD *en bloc* like [Chuck Norris](#), and nothing can possibly look at (A) and (B) at **different** instants either: see Chris Isham above. You need 'time', but you've killed it with math from the outset.

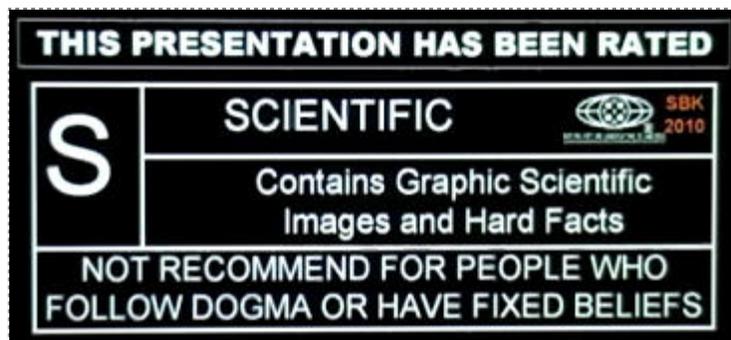
Mathematically, the whole DVD is one single *timeless* "instant". If you wish to talk about *spatial relations*, such as the "obvious" difference between a 'point' and a 'finite region' (AB), you must inevitably use your [wild imagination](#). Once you kill time with your lame incomplete math, you kill the whole spacetime, because you **cannot** evaluate spatial relations without 'time'. It's a bundle, because "space by itself, and time by itself, are doomed to fade away into mere shadows, and only a kind of union of the two will preserve an independent reality" (Hermann Minkowski, [September 21, 1908](#)).

The only possible solution to restore the obvious presence of 'time' is outlined [below](#). Then we can introduce distance function, metric, etc., to obtain 'space', and hence 'spacetime'.

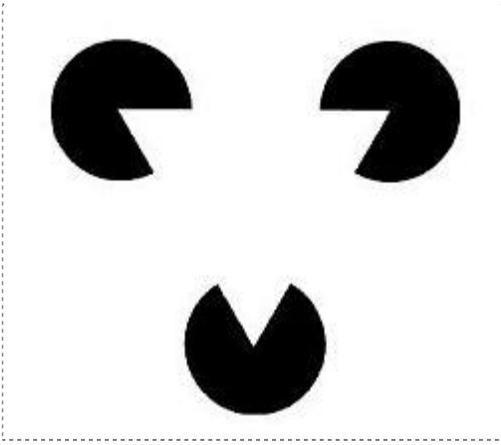
"It is extremely difficult to induce penguins to drink warm water", said John Coleman.

D. Chakalov  
December 6, 2012

=====



Let's examine four cases of [binding](#):



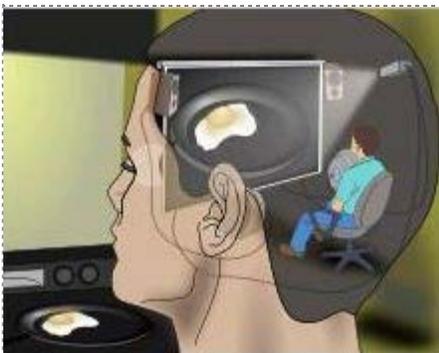
I spillced coffcee cinto my kcey boardc.c As a rcesulct, c's gcet  
inctermixcced with cwactever I ctypce. Plcease replace mcy kceyboard.  
ccthanks.

Allan Paivio: Two digital clocks read [11:05] and [13:25]. Convert  
the readings into analog format, and find the greater angle.

Imagine a cube made of white plastic material with a 3 cm rib,  
painted blue, which is cut into 27 little cubes with a 1 cm rib.  
How many little cubes will have three blue sides,  
how many will have two, one or none?

Once you discover the *agent* which rotates the cube and examines  
it from different angles to count the blue painted sides, as well as  
creates the [triangle](#) and "calculates" the two angles above, you will  
be ready to `replace tcy kcey boardc.c`

This "agent", however, cannot be some metaphorical "little man" or  
["the true subject within the brain"](#):



Such "little man" or homunculus does *not* exist. The brain does the **binding**,  
as demonstrated with four examples [above](#). Namely, the binding problem is  
about the ability of our **brain** (not "mind") to **integrate** correctly all neural  
"codes" that belong to *one and the same event*: the pairing of features  
that [belong to a common object](#). Say, an egg in fry pan, as shown above.

But you cannot present the **binding** phenomenon with any "computations" from your textbooks. Forget about "quantum computing," too. You could indulge in some "[neural computations](#)" iff there were [isomorphism](#) between the brain and its mind, just like the [isomorphism](#) between the information encoded on a DVD with specific [code](#) and the visual and audio patterns shown on your TV, say. Were that the case, you could claim that the 'egg in fry pan', as shown above, were *isomorphic* to its neural presentation, then discover the "neural code", and enjoy your [€1 billion European research prize](#): there will be no need for any psychology. It would be totally redundant and unneeded, like a video camera installed in a car factory to "help" the [robots there to assemble cars](#): these robots don't need to "see" or "hear" anything, because are directed by particular software written for their hardware. They are directed solely by computations, don't need any psychology either. Can you see "[computations](#)" in the brain below?



Anyway, it's too late to complain, [the damage is done](#).

This whole issue is of paramount importance due to its [practical implementations](#); see 'The Two Rules of Success' [below](#).

D. Chakalov

February 21, 2013

Last updated: February 22, 2013, [03:02:30 GMT](#)

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Subject: [€1 billion European research prize](#) ?

Date: Tue, 19 Feb 2013 00:10:13 +0200

Message-ID: <CAM7Ekx==Lk4rodslD82KOLu3YrSL8Syp+yVNMzqg-Ph=vZrSw@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: brain\_mind@epfl.ch,

henry.markram@epfl.ch,

richard.walker@epfl.ch,

hbp.info@hbpconsortium.org,

public.website@hbpconsortium.org,

meierk@kip.uni-heidelberg.de,

Paul G Allen <info@alleninstitute.org>

Dear colleagues,

Regarding your Human Brain Project, be aware that [your](#) (not mine) [first off task](#) is to explain the brain-mind interface: the binding phenomenon.

What kind of "computations" are involved with the binding phenomenon ?

What is the **physics** of the [binding phenomenon](#) ?

More at  
<http://www.god-does-not-play-dice.net/#Seung>

Sincerely,

Dimi Chakalov

-----

**Note:** You will need some privileged anatomical structure and dedicated physiological process to implement the alleged "[brain computation](#)" -- "[the little man inside the brain](#)." And since the sensory data continuously arrive in the brain, you'll have to explain the absence of any "dark gaps" needed to **re**-calculate the **next** patch of sensory data by such homunculus. Forget it.

Giving [€1 billion](#) to these people is terribly unfair. Ridiculously unfair. Horribly unfair. Period.

D. Chakalov  
February 19, 2013, 16:30 GMT

=====

Subject: Re: [€1 billion European research prize](#) ?  
Date: Fri, 22 Feb 2013 04:47:47 +0200  
Message-ID: <CAM7Ekx=LHRLek+L835R9\_v1VU2gKO-1Jec+S6tH-U5iyf7Kkew@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Ryan.Heath@ec.europa.eu, Linda.Cain@ec.europa.eu  
Cc: brain\_mind@epfl.ch,  
henry.markram@epfl.ch,  
richard.walker@epfl.ch,  
hbp.info@hbpconsortium.org,  
public.website@hbpconsortium.org,  
meierk@kip.uni-heidelberg.de,  
Paul G Allen <info@alleninstitute.org>,  
greiner@fias.uni-frankfurt.de,  
malsburg@fias.uni-frankfurt.de,  
k.langanke@gsi.de,  
wolf.singer@brain.mpg.de,  
stoecker@uni-frankfurt.de,  
triesch@fias.uni-frankfurt.de,  
fias@uni-frankfurt.de,  
jakob.macke@tuebingen.mpg.de,  
mbethge@bccn-tuebingen.de,  
contact-dlr@dlr.de,  
pt-dlr@dlr.de,  
martin.wiedemann@dlr.de,  
peter.wierach@dlr.de,  
bernhard.milow@dlr.de,  
info@grs-sim.de

Dear colleagues,

Please explain the reasons for granting €1 billion -- taxpayers' money -- to HBP,

<http://www.god-does-not-play-dice.net/#HBP>

Also, may I ask you to confirm the receipt of this message.

Looking forward to hearing from you at your earliest convenience,

Yours sincerely,

Dimi Chakalov

On Tue, 19 Feb 2013 18:36:41 +0200, Dimi Chakalov <dchakalov@gmail.com> wrote:  
[snip]

=====



Subject: Re: €1 billion European research prize ?

Date: Fri, 22 Feb 2013 15:36:09 +0200

Message-ID: <CAM7Ekx=A6RUbjBKisJwo3CNHqCN\_VrWqa2ip+ULJX71pp56VbQ@mail.gmail.com>

In-Reply-To: <F741ACECC5AD51429FD2EDFC97E0E3F12FA22C@S-DC-ESTA02-J.net1.cec.eu.int>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Linda.Cain@ec.europa.eu

Cc: Ryan.HEATH@ec.europa.eu,

brain\_mind@epfl.ch,

henry.markram@epfl.ch,

richard.walker@epfl.ch,

hbp.info@hbpconsortium.org,

public.website@hbpconsortium.org,

meierk@kip.uni-heidelberg.de,

Paul G Allen <info@alleninstitute.org> ,

greiner@fias.uni-frankfurt.de,

malsburg@fias.uni-frankfurt.de,

k.langanke@gsi.de,

wolf.singer@brain.mpg.de,

stoecker@uni-frankfurt.de,

triesch@fias.uni-frankfurt.de,

fias@uni-frankfurt.de,

jakob.macke@tuebingen.mpg.de,

mbethge@bccn-tuebingen.de,

contact-dlr@dlr.de,

pt-dlr@dlr.de,

martin.wiedemann@dlr.de,  
peter.wierach@dlr.de,  
bernhard.milow@dlr.de,  
info@grs-sim.de

On Fri, 22 Feb 2013 10:56:53 +0000, <Linda.Cain@ec.europa.eu> wrote:

>  
> Thank you for your mail.  
>  
> Please read the blog from Ms Kroes on this which explains why we think investing in this  
> type of research is a wise investment. See here  
> <http://blogs.ec.europa.eu/neelie-kroes/fet-flagship-winners/>  
>  
> Kind regards  
>  
> Linda Cain  
>

Hello Ms Cain,

Thank you for your reply. May I try to explain the objections against your decision to grant €1 billion -- [taxpayers' money](#) -- to the Human Brain Project (HBP).

I totally disagree with Vice-President of the European Commission [Ms Neelie Kroes](#) to treat the Graphene Flagship program and the Human Brain Project on equal footing.

**Fact:** There is no trace of wishful thinking and/or obviously wrong ideas in the Graphene Flagship program, while the Human Brain Project includes many ideas that are either wishful thinking or are obviously wrong, since they \*contradict established facts known for decades\*.

To be specific, the leader of HBP, Dr. Henry Markram, focused on three issues in his interview with Ms Neelie Kroes, published on January 29, 2013 at

[http://www.youtube.com/watch?v=DsZ\\_LBdthC0](http://www.youtube.com/watch?v=DsZ_LBdthC0)

**1.** Henry Markram wishes to establish "a CERN for the brain" and "unifying model" -- please watch 03:25 - 03:43 from the timeline of the interview above. In the first place, I think Henry Markram and his colleagues must not repeat the widely known errors in his field of experience.

**2.** Henry Markram explicitly suggested "brain as an ICT system", "neuromorphic computing systems", and (Sic!) "neuromorphic computing processor" (07:10 - 08:03). This is sheer wishful thinking -- see the link below.

**3.** Henry Markram acknowledged that his dream was to understand "how the brain represents reality" (09:44 - 10:17). I will refrain from comment.

Now, I have no idea who was advising the Vice-President of the European Commission Ms Neelie Kroes regarding issues (i) - (iii) above. Please let me know her/his name and contact information, and I

will prove \*with facts\* that Henry Markram was exercising his wishful thinking and also was obviously wrong on issues (ii) and (iii).

As a start, please read carefully a very brief explanation at

<http://www.god-does-not-play-dice.net/#HBP>

I will be more than happy to elaborate. Just please let me know [who stands behind Henry Markram](#).

After all, €1 billion is a humongous amount of money, which I think the Graphene Flagship program fully deserves. Not HBP, however.

Looking forward to hearing from you at your earliest convenience,

Yours sincerely,

Dimi Chakalov

-----

**Note:** It is crucially important to know the people from the Future and Emerging Technologies (FET) Programme, who support [Henry Markram](#).

For example, see the bold statement by Ms Christiane Wilzeck & colleagues at [http://cordis.europa.eu/fp7/ict/fet-proactive/nbis\\_en.html](http://cordis.europa.eu/fp7/ict/fet-proactive/nbis_en.html)

"Brains are remarkable computing systems which clearly outperform conventional architectures in many real-world tasks."

**Wrong.** Such speculative idea is based on the Marxist-Leninist interpretation of mind-brain relations, which assumes "neural computations" and even some "neuromorphic computing systems", like Henry Markram in issue (ii) above.

Surely there is information in brain's memory, but the questions is, [information about what?](#) Consider, for example, the notion 'cloud', after [John Wheeler](#). We know that *the same* notion is expressed in German with 'Wolke'; in French *the same* notion is denoted with 'nuage'; in Dutch *the same* notion is 'wolk'; in Spanish *the same* notion will be 'nube'; etc. But what are the "neural presentation" of *the same* Wolke-nuage-wolk-nube-cloud, with which the **brain** performs the [binding](#)? Namely, what could be the "neural presentation" of *the same* underlying **unspeakable** notion in the human brain? See also another example with three sayings [below](#).

There can be no "neural computations" nor "neural code" corresponding to human cognition. Forget it. No computation can produce '*the same*' outcome that can be invariant in all brains of **all** people, and keep it '*the same*' in their memories for decades, despite their brain differences, life experience, etc.

In brief, the materialistic, Marxist-Leninist interpretation of mind-brain relations is just as wrong as the approach in parapsychology, in which one postulates, for example, some "[dualistic interactionism](#)". Both approaches are wrong, for different reasons, and I will be more than happy to explain the facts and provide extensive reference. For now it suffices to remind that [the binding](#) cannot be implemented exclusively *by* the brain alone, as stipulated in the €1 **billion** Marxist-Leninist Human Brain Project, and Henry Markram & colleagues are heading to a dead-end. Needless to say, [the binding](#) cannot be implemented jointly by some "[dualistic interactionism](#)" either, simply because the [human mind](#) (see the "little man" or homunculus [above](#)) cannot **act** on brain tissue -- if it could, it will become 'matter'.

Do we have a third option? But of course, ladies and gentlemen! It is in fact [the oldest proposition](#) about the [common source](#) of *Res cogitans* and *Res extensa*, which is neither mind nor matter.

**NB:** The only possible explanation of the mind-brain and mind-matter relations was suggested by [Gottfried Wilhelm von Leibniz](#), and later elaborated by Wolfgang Pauli on January 7, 1948 [[Ref. 1](#)].

Yet sixty-five years later, in [January 2013](#), it was all forgotten or ignored by his fellow citizens in Switzerland and the European Commission Vice President [Neelie Kroes](#).

Don't give away €1 **billion** -- [taxpayers' money](#) -- to people supporting the Marxist-Leninist crap.

Don't waste money earned with hard labor by millions of people. It is just terribly unfair. Period.

D. Chakalov

February 22, 2013

Last updated: February 23, 2013, [13:09:24 GMT](#)

[Ref. 1] H. Atmanspracher and H. Primas, [The Hidden Side of Wolfgang Pauli](#), *Journal of Consciousness Studies*, 3 (1996) 112-126; cf. Sec. VI, *Matter and Psyche as Two Aspects of One Reality*, p. 122.

=====

Subject: Re: [alleninstitute.org #23671] Re: [€1 billion European research prize ?](#)  
Date: Fri, 22 Feb 2013 18:01:36 +0200  
Message-ID: <CAM7EkxnUTEg-JmNEVLoML7TVsE13JBzdgJhwZRifgtaRSZAQAA@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Secretariat of Mrs Kroes <Neelie.Kroes@ec.europa.eu>, Neelie Kroes' spokesperson <Ryan.Heath@ec.europa.eu>, Press officer <Linda.Cain@ec.europa.eu>

P.S. Please see an explanatory note added at the link below.

D.C.

On Fri, 22 Feb 2013 15:54:48 +0200, Dimi Chakalov <dchakalov@gmail.com> wrote:

>  
> For the record:  
> [http://www.god-does-not-play-dice.net/#HBP\\_Markram](http://www.god-does-not-play-dice.net/#HBP_Markram)  
>  
> More to come soon.  
>  
> Sincerely,  
>  
> Dimi Chakalov  
>  
>  
> On Fri, 22 Feb 2013 05:37:19 -0800, <Linda.Cain@ec.europa.eu> wrote:  
> [snip]

**Note:** Strangely enough, I have noticed, [ever since 1998](#), that people who write textbooks and publish academic papers stubbornly oppose to the simple facts about the [binding phenomenon](#), and prefer to [keep quiet](#). As if the facts explained here were unknown to them, or they can't grasp them, or both. But let me set the record straight: everything at my website -- everything -- is based on research published in papers and books many *many* years ago. Example: [Wolfgang Pauli](#).

The situation is actually getting worse, because now we have [€1 billion research prize](#) given to Henry Markram & colleagues to "discover" something that *does not* and *cannot* exist: neural "computations".

Let me again explain the issue with some very simple examples, which I am definitely positively certain that everyone can and will understand.

Consider the saying 'when it rains, it pours'. In [Mandarin](#), *the same* idea can be roughly expressed as

禍不单行 .

Obviously, there can be no similarity -- and there *must* be **no similarity** -- between the **neural** presentations of English and Chinese *letters* (dubbed here '[jackets](#)') used to express *the same* idea by all people who speak English and Mandarin. In German, the *same idea* can be roughly expressed with '[Ein Unglück kommt selten allein](#)'.

Therefore, no "computations" whatsoever can reproduce the experiment you performed with your brain by reading *the same* sayings above. Why? Because we do know what 'computation' means -- we have invented it from scratch.

Yes, there is indeed information in human brains, kept in their unique individual neural presentations of different *letters*, but -- **no**, you cannot use any 'computation' whatsoever to **reproduce** *the same* notion expressed above.

There is none so blind as they that won't see.

D. Chakalov  
February 23, 2013, [16:13:30 GMT](#)

-----  
Subject: Re: [arXiv:1204.4325v1 \[quant-ph\]](#)  
Date: Fri, 20 Apr 2012 13:29:03 +0300  
Message-ID:  
<CAM7EkxkudVf069DbCW0N8++A5tRcj-kyw1O0QvYwjNG1ZzHDhQ@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Tejinder Singh <tpsingh@tifr.res.in>  
Cc: Angelo <bassi@ts.infn.it>, kinjalk@tifr.res.in,  
satin@imsc.res.in, h.ulbricht@soton.ac.uk,  
[Steve Adler](#) <adler@ias.edu>,  
Adrian Kent <A.P.A.Kent@damtp.cam.ac.uk>

Dear Tejinder,

Thank you for your prompt reply.

> [Chapter 5](#) of Adler's book 'Quantum theory as an emergent phenomenon'  
> explains how an underlying theory such as Trace Dynamics evades the KS  
> theorem.

With all due respect to you and Steve, I don't see how any theory, Trace Dynamics included, can evade the KS Theorem. Once you have the "states" which are 'neither UP nor DOWN' and hence are shifted to the uncolored KS sphere, you can't bring them back to the Hilbert space. You can't say anything about these UNdecidable [whatever], because any statement will bring 'color', while they are UNcolored: check out the quote from Erwin Schrödinger (November 1950) at

<http://www.god-does-not-play-dice.net/#Joel>

This is a fundamental quantum phenomenon of "failure to predict" (nothing to do with Bell's theorem): "It also makes it clear that this failure to predict is a merit rather than a defect, since these results involve free decisions that the universe has **not yet** made" (John Conway and Simon Kochen, The Free Will Theorem, [quant-ph/0604079 v1](#)). You've talked with Simon Kochen last July at "Quantum Physics and the Nature of Reality" (International Academy Traunkirchen, Austria), so I suppose you're familiar with these UNdecidable [whatever].

Erwin Schrödinger predicted them in November 1950. [Henry Margenau](#) called them 'Onta'. **Can't fit them into any Hilbert space.**

I will be happy to [elaborate](#).

Best regards,

Dimi

=====

Subject: Listening for gravitational-waves with "ears wide open"

Date: Mon, 23 Apr 2012 06:55:10 +0300

Message-ID:

<CAM7EkxkKWwVaE9rNotyuXq\_TwR+OQNNfu=GfQ2MO37uG+oxz9g@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Francesco Salemi <francesco.salemi@aei.mpg.de>

Cc: Joan Centrella <Joan.Centrella@nasa.gov> ,

Alan J Weinstein <ajw@caltech.edu> ,

James Ira Thorpe <James.I.Thorpe@nasa.gov> ,

john.g.baker@nasa.gov ,

stmckill@princeton.edu ,

markodh@googlemail.com ,

robin.t.stebbins@nasa.gov ,

Karen.m.Smale@nasa.gov ,

Catherine.m.Corlan@nasa.gov ,

notoya.r.russell@nasa.gov ,

mor.vimmer@nasa.gov ,

johnson@ligo.phys.lsu.edu ,

stephen.m.merkowitz@nasa.gov ,

meredith.gibb@nasa.gov ,

lsfinn@psu.edu ,

sheila.rowan@glasgow.ac.uk ,

matthew.pitkin@glasgow.ac.uk ,

Bernard Schutz <Bernard.Schutz@aei.mpg.de> ,

LSC Spokesperson <reitze@phys.ufl.edu> ,

Kip <kip@tapir.caltech.edu> ,

Karsten <karsten.danzmann@aei.mpg.de> ,

David <garfinkl@oakland.edu> ,

Jorge Pullin <pullin@lsu.edu> ,

Gabriela González <gonzalez@lsu.edu> ,

Clifford Will <cmw@wuphys.wustl.edu> ,

Beverly Berger <bberger@nsf.gov> ,

Tom Carruthers <tcarruth@nsf.gov> ,

Ramona Winkelbauer <rwinkelb@nsf.gov> ,

Peggy Fischer <pfischer@nsf.gov> ,

OIG <oig@nsf.gov> ,

HQ-OIG-Counsel@mail.nasa.gov ,

Oliver Jennrich <oliver.jennrich@esa.int> ,

SciTech.Editorial@esa.int ,

Bruce Goldstein <Bruce.Goldstein@jpl.nasa.gov> ,

Drew Keppel <drew.keppel@ligo.org> ,

Hans-Jürgen Schmidt <hjschmi@rz.uni-potsdam.de> ,

Thomas A Prince <prince@srl.caltech.edu> ,

Vivian Drew <vdrew@stanford.edu>,  
Hamish Johnston <hamish.johnston@iop.org>,  
Pedro Marronetti <pmarrone@nsf.gov>,  
Bernd Brügmann <b.bruegmann@tpi.uni-jena.de>,  
Marek Abramowicz <marek@fy.chalmers.se>,  
Lars Andersson <laan@aei.mpg.de>,  
Roger Blandford <rdb3@stanford.edu>,  
Jirí Bicák <Jiri.Bicak@mff.cuni.cz>,  
John Friedman <friedman@uwm.edu>,  
Bernd Schmidt <bernd@aei.mpg.de>,  
Luciano Rezzolla <rezzolla@aei.mpg.de>,  
Helmut Friedrich <hef@aei.mpg.de>,  
Joseph Katz <jkatz@phys.huji.ac.il>,  
Robert M Wald <rmwa@midway.uchicago.edu>,  
Karel V Kuchar <kuchar@physics.utah.edu>,  
Adam Helfer <helfera@missouri.edu>

<http://www.ligo.org/science/Publication-S6BurstAllSky/>

-----

Dear Mr. Salemi,

You and your app. 800 LIGO 'n Virgo colleagues wrote the following:

"No gravitational wave signal was detected in this search using 1.74 years of good quality data, including the previous LIGO-Virgo joint science run. (...) The second figure on the right shows the resulting rate limits versus signal strength for several hypothetical waveforms. (...) So we can be confident that the search *would have* caught pretty much any type of gravitational wave burst that arrived during that time at the sensitivity level achieved by present detectors."

You used [MOCK "data"](#) -- "hypothetical waveforms" -- that have been custom-made to fit your "filters", so that now you "can be confident that the search *would have* caught pretty much any type of gravitational wave burst that arrived during that time at the sensitivity level achieved by present detectors."

This is a classical example of parapsychology-type thinking.

**NB:** You and your LIGO 'n Virgo colleagues are total disgrace to the whole GR community.

Check out the bold facts at

<http://www.god-does-not-play-dice.net/#Bondi>

[http://www.god-does-not-play-dice.net/#LIGO\\_Prague](http://www.god-does-not-play-dice.net/#LIGO_Prague)

Yes, I will expose your [dirty little secrets](#) at the Einstein Conference in Prague. Unless, of course, the [Scientific Organizing Committee](#) decides to "save" you by rejecting my talk, hence prolong the cover up of the enormous waste of taxpayers' money by LIGO and Virgo members.

I will soon find out [whether I will be allowed to talk](#) at the Einstein Conference in Prague.

If my talk is rejected, the last remaining option will be to call a press conference in Prague on Monday, June 25th, and expose your game to the media and other interested individuals. It will make a fascinating reading in the tabloid newspapers. Trust me, I can do it -- and I have **nothing to lose**.

How about you ?

Sincerely,

D. Chakalov  
35 Sutherland St  
London SW1V 4JU

=====

**Note:** Five seconds after I sent the email [above](#), I received confirmation from [NSF\\_OIG](#):

Subject: NSF\_OIG has received your submission. Thank you.  
From: "OIG" <oig@nsf.gov>  
To: "Dimi Chakalov" <dchakalov@gmail.com>  
Date: Sun, 22 Apr 2012 23:55:15 -0400  
Message-ID:  
<2D1C5457CACAB04F9325751A96F342D904BC4AB8@NSF-BE-03.ad.nsf.gov>

No response from the [Inspector General at NASA](#) to my email from [Mon, 30 Jan 2012 14:44:12 +0200](#) has reached me so far. The ref. no. of my inquiry is 6786.

THANKS

YOUR FEEDBACK HAS BEEN SUBMITTED, REFERENCE NUMBER: 6786

In summary, the proponents of "GW astronomy" do **not** have any theory of strong GWs from which one could derive some **very weak** limit, to verify their initial assumptions (cf. the two "if-s" [above](#)). Actually, they openly admit that such theory is **not** feasible: check out the excerpt from M. Maggiore, *Gravitational Waves: Theory and Experiments*, p. 32 [above](#). They approach the challenge of detecting a **very weak** GW with approximations which are totally inapplicable to the initial, and **very strong**, gravitational radiation. They kill the very effect they wish to measure with "[GWs in flat spacetime](#)" -- the assumption that by reaching [the "advanced" LIGO](#) these waves will be "very weak" is **irrelevant**: the transport of energy by GWs is **fundamentally non-linear phenomenon**. It makes no sense to "enhance the sensitivity" of what has been a dead turkey from the outset. They totally ignore the opinions of experts in GR, published in [peer reviewed journals](#). Even after five (or more) consecutive failures, the proponents of "GW astronomy" are **not** willing to address their initial problems. They just ask for more money -- in the range of **billions**.

To understand the absurdity of "GW astronomy", think of Schrödinger's equation: it is a perfectly legitimate approximation for all cases in which the vacuum effects in QFT can be ignored. But if you wish to explore some **very strong** vacuum effect, you will use QFT -- not Schrödinger's equation. But because the proponents of "GW astronomy" do not have the theory equivalent to QFT, they "use" what they have -- the linearized approximation of GR -- despite the fact that it is **inapplicable** to their quest for detecting GWs, as proven by [Hermann Weyl in 1944](#). They don't read, don't think, but just ask for more and *more* taxpayers' money -- in the range of **billions**.

For comparison, look at [Leonid Marochnik](#): he uses "one-loop approximation of quantum gravity" which has the crucial merit of "remoteness from the Planck epoch", and seriously suggests "the appearance of ghosts in the theory of quantum metric fluctuations", yet does not propose some *very* sensitive ghost detectors and doesn't ask for money either. Likewise, if the proponents of "GW astronomy" were not wasting money earned with hard labor by millions of people, and were [not wasting paper](#) for their publications -- fine. Let them play with their math as much as they can; it's a free world.

There is no communist censorship in a free world, right? Well, it depends.

The [Scientific Organizing Committee](#) decided to **change the rules**: they will consider only *those* applicants for oral presentation (talk), who have **already paid** the conference fee of EUR 350, before April 15, 2012. This is the new **precondition**, announced on April 24th this year, to applicants submitting their oral presentations -- all of which are still waiting to be approved by the [Scientific Organizing Committee](#) (cf. below).

It goes without saying that I was **not** informed about this new **precondition** until April 24, 2012 (the legal terms is [antedate](#)). Also, the [Scientific Organizing Committee](#) was fully aware that I haven't paid the conference fee of EUR 350 by April 15, 2012.

I wish I knew about this new **precondition** prior to April 15, 2012. Yet even if I had paid those EUR 350 before the deadline, how could such payment influence the value of my talk? Aren't 'science and money' totally different, like apples and oranges?

Check out my last email from Wed, 25 Apr 2012 00:35:02 +0300 printed below.

I will not be allowed to speak at the Einstein Conference in [Prague](#). The LIGO and Virgo members can take a breath and relax -- nobody will challenge their [GW parapsychology](#).

As I stated [above](#), "the last remaining option will be to call a press conference in Prague on Monday, June 25th, and expose your game to the media and other interested individuals. It will make a fascinating reading in the tabloid newspapers. Trust me, I can do it -- and I have **nothing to lose**."

***À la guerre comme à la guerre.***

D. Chakalov  
April 25, 2012, 13:00 EET

-----  
Subject: Re: Conference website login information  
Date: Wed, 25 Apr 2012 00:35:02 +0300  
Message-ID: <CAM7Ekxmtfn+enENbd8rdossHoJwSkYGVnXqHzdbptWSjwaZg0Q@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: info@ae100prg.mff.cuni.cz  
Cc: Bernd Brügmann <b.bruegmann@tpi.uni-jena.de>,  
Marek Abramowicz <marek@fy.chalmers.se>,  
Lars Andersson <laan@aei.mpg.de>,  
Roger Blandford <rdb3@stanford.edu>,  
Jirí Bicák <Jiri.Bicak@mff.cuni.cz>,  
John Friedman <friedman@uwm.edu>,  
Bernd Schmidt <bernd@aei.mpg.de>,  
Luciano Rezzolla <rezzolla@aei.mpg.de>,  
Helmut Friedrich <hef@aei.mpg.de>,  
Joseph Katz <jkatz@phys.huji.ac.il>,  
Robert M Wald <rmwa@midway.uchicago.edu>,  
Karel V Kuchar <kuchar@physics.utah.edu>,  
Hermann Nicolai <Hermann.Nicolai@aei.mpg.de>,  
Paul Tod <tod@maths.ox.ac.uk>

On Tue, 24 Apr 2012 20:24:47 +0200, ae100prg <ae100prg@gmail.com> wrote:

>  
> Dear Mr. Chakalov,  
>  
> the list of accepted contributed talks is not known yet. Since

- > September 2011 the deadline for contribution submission was advertised
- > to be April 15 2012, and now after this deadline, the suggested
- > contributions are with the Scientific Organizing Committee to find
- > those of contributions of REGISTERED participants which will be
- > presented in about 60 slots for contributed talks.
- >
- > Unfortunately, I found you are not among the registered participants

Two things.

1. No need to write with capital letters.
2. Before replying, please make an effort to read the text to which you reply: see my email from December 16, 2011 printed (again) below.

I will list a few facts, and will ask a question.

You did not provide any indications that the Scientific Organizing Committee will require registration to your Conference (EUR 350 before April 15, 2012) as a **\*precondition\*** for entering into the list of applicants willing to deliver an oral presentation (talk).

You opened the registration on December 16, 2011, and I did register immediately, on December 16, 2011.

You did not inform me about the change of rules until today, April 24, 2012. As of today, there is still **no hint at your web site** that you have changed the rules.

These are the facts.

I want to **\*compete\*** with you -- both individually, and en bloc.

As I wrote in my email from December 16, 2011, "I cannot compete with the proponents of the "splitting of spacetime" (ADM) with a poster."

But today, on April 24, 2012, you decided to change the rules, and **shut me up**.

**Q:** Do you think this is fair ?

I extend this questions to all members of the Scientific Organizing Committee.

Looking forward to hearing from you at your earliest convenience,

Yours sincerely,

Dimi Chakalov

On Tue, 24 Apr 2012 17:57:24 +0300, Dimi Chakalov <dchakalov@gmail.com> wrote:

- >
- >> Dear Colleague,
- >>
- >> I still haven't received your reply to my email from December 16th
- >> last year (printed below).
- >>
- >> Please let me know if I will be allowed to talk at your Conference.
- >>
- >> Looking forward to hearing from you at your earliest convenience,
- >>
- >> Yours sincerely,

>>  
>> Dimi Chakalov  
>>  
>>  
>>  
>>> On Fri, Dec 16, 2011 at 11:42 PM, Dimi Chakalov <dchakalov@gmail.com> wrote:  
>>>  
>>> Dear Colleague,  
>>>  
>>> Thank you for your email. I submitted today the abstract of my  
>>> intended oral contribution (for your convenience, please see a copy of  
>>> the abstract printed below).  
>>>  
>>> I would like, if I may, to ask you for confirmation that my talk will  
>>> indeed be approved, after which I will immediately register. The  
>>> reason for this immodest request of mine is that it is impossible to  
>>> explain the proposal with a poster, and if my submission for oral  
>>> presentation is denied, there will be no sense to attend the  
>>> Conference.  
>>>  
>>> Stated differently, I cannot compete with the proponents of the  
>>> "splitting of spacetime" (ADM) with a poster.  
>>>  
>>> I will be happy to provide specific details on my intended talk, as  
>>> well as any other information you may require for your decision.  
>>>  
>>> Looking forward to hearing from you,  
>>>  
>>> Yours sincerely,  
>>>  
>>> Dimi Chakalov  
>>>  
>>> [snip]

=====

Subject: Open letter to LSC Spokesperson Prof. Gabriela Gonzalez  
Date: Thu, 26 Apr 2012 03:14:52 +0300  
Message-ID:  
<CAM7Ekxm0LSviqxm8VQEZiEUEdvX6\_ytpsLyZBghxxRKbj\_vWmQ@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: LSC Spokesperson Gabriela Gonzalez <gonzalez@lsu.edu>  
Cc: info@ae100prg.mff.cuni.cz,  
Bernd Brüggemann <b.brueggemann@tpi.uni-jena.de>,  
Marek Abramowicz <marek@fy.chalmers.se>,  
Lars Andersson <laan@aei.mpg.de>,  
Roger Blandford <rdb3@stanford.edu>,  
Jiri Bicák <Jiri.Bicak@mff.cuni.cz>,  
John Friedman <friedman@uwm.edu>,  
Bernd Schmidt <bernd@aei.mpg.de>,  
Luciano Rezzolla <rezzolla@aei.mpg.de>,  
Helmut Friedrich <hef@aei.mpg.de>,  
Joseph Katz <jkatz@phys.huji.ac.il>,  
Robert M Wald <rmwa@midway.uchicago.edu>,  
Karel V Kuchar <kuchar@physics.utah.edu>,  
Hermann Nicolai <Hermann.Nicolai@aei.mpg.de>,

Paul Tod <tod@maths.ox.ac.uk>,  
Bernard Schutz <Bernard.Schutz@aei.mpg.de>,  
Clifford Will <cmw@wuphys.wustl.edu>,  
Karsten Danzmann <office-hannover@aei.mpg.de>,  
Beverly Berger <bberger@nsf.gov>,  
Pedro Marronetti <pmarrone@nsf.gov>,  
Jorge Pullin <pullin@lsu.edu>,  
Kip Thorne <kip@tapir.caltech.edu>,  
Jeremiah P Ostriker <ostriker@princeton.edu>,  
Evangelos Melas <evangelosmelas@yahoo.co.uk>,  
Ted Newman <newman@pitt.edu>,  
Josh Goldberg <goldberg@phy.syr.edu>,  
Adam Helfer <helfera@missouri.edu>

Dear Professor González,

Funded munificently by the U.S. National Science Foundation, LIGO Scientific Collaboration (LSC) is currently made up of more than 800 scientists from dozens of institutions and 13 countries worldwide. According to the Bylaws of LSC ([LIGO M050172-04](#), 29 March 2006), "The Spokesperson leads the LSC, and is empowered to represent the LSC to the outside world" (Sec. 4.1), and "identifies key issues and opportunities and brings them to the attention of the Collaboration" (4.5.3).

May I draw your attention to the real danger for an exceptionally unbalanced presentation of views on the very possibility for detecting gravitational waves (GWs) at the forthcoming Einstein Conference in Prague, June 25 – 29, 2012: if you look at the list of invited speakers, I believe you can safely predict that Bernd Brügmann, Karsten Danzmann, Luciano Rezzolla, Bernard Schutz, and Clifford Will will undoubtedly advocate the current opinion that GWs can, at least "theoretically", be detected by the so-called Advanced LIGO and Virgo,

<http://ae100prg.mff.cuni.cz/program>

While we all agree that GWs exist, my opinion is opposite to yours: no, they cannot -- not even in principle -- be detected by LIGO or Virgo, no matter how "advanced". A brief list of the insurmountable, in my opinion, problems of LSC is posted at

<http://www.god-does-not-play-dice.net/#Bondi>

Two days ago (Tue, 24 Apr 2012 20:24:47 +0200), I was shocked and stunned to learn that my intended oral contribution to the Einstein Conference in Prague (submitted on December 16, 2011) will \*not even be examined\* by the Scientific Organizing Committee: a new \*precondition\* has been introduced to ban all applicants for oral presentations, who have not paid the conference fee of EUR 350 before the deadline on April 15, 2012.

It goes without saying that I was not informed about this new precondition (the legal term is antedate) until April 24, 2012. Also, I believe the Scientific Organizing Committee was [fully aware](#) that I haven't paid the conference fee of EUR 350 by April 15, 2012.

Thus, I will not be able to present my arguments (cf. the link above) to you and your colleagues, which may totally degrade the quality of the discussion of your mission at the Einstein Conference in Prague, by converting it to a fully predictable gathering resembling the meetings of the former Komunistická strana Československa (KSC),

<http://www.god-does-not-play-dice.net/#communists>

**NB:** I am certain that you are not only an expert in General Relativity, but a person with pride and dignity as well, and under these circumstances you will feel terribly awkward, to say the least. I am also definitely sure that you did not advise the Scientific Organizing Committee to impose this unprecedented precondition, to eliminate my chance to share with you and your colleagues my

arguments and grave concerns regarding the very possibility to detect GWs.

I am respectfully urging you to take the necessary actions, in line with your power and duties of Spokesperson of LIGO Scientific Collaboration.

Please feel free to pass this 'open letter' to your LSC colleagues, as well as the NSF officials responsible for funding LSC: you may be on a totally wrong tack, a **dead-end**.

I stand ready to provide all information you may deem necessary.

Looking forward to hearing from you at your earliest convenience,

Yours sincerely,

Dimitar G. Chakalov  
[snip]

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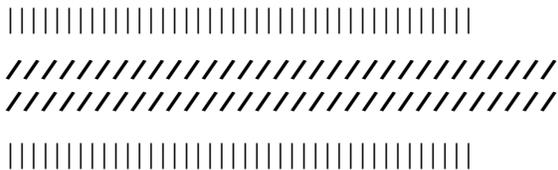
**Note:** Why is the issue of GWs important? Because they are **real** but *not* physical, in the sense that these "waves" do **not** carry anything *physical*, in terms of mass and energy. These "ripples" may be emerging in the **real** but *not* physical realm of the universe, called '[potential reality](#)'. In the framework of GR, this new (to some theoretical physicists) form of reality may be Einstein's '[total field of as yet unknown structure](#)'.

As Max Planck stated in [1944](#), "All matter originates and exists only by virtue of a force... We must assume behind this force the existence of a conscious and intelligent Mind. This Mind is the matrix of all matter".

I only wanted to defend the opinions of Albert Einstein and Max Planck. If the universe does indeed function as a 'brain', there could be [one standing quantum-gravitational wave](#) resembling these "thoughts", and originating *perhaps* from [John 1:1].

Only an ideal or 'meta' observer, placed in the global mode of spacetime, could "see" the [quantum-gravitational wave](#) that emerges in the '[school of fish](#)'.

Imagine looking at a hill covered with a forest, where some of the trees are not vertical but leaning at an angle:



You can see the swathe of trees (in **red**) leaning in the same direction, and infer from it that they were exposed to strong wind (passing "wave"), yet the wind itself is not visible: all you can see is that some orientable-by-wind trees have been correlated **en bloc**. In order to detect such passing "wave", you need to install at some correlated tree (depicted with / above) a brand new GW detector endowed with the faculty of [self-acting](#) -- the EPR-like correlation from the passing "wave" is conducted along the **null surface** (Sic!) of the Arrow of Space, which is why the resulting *physical* effect from it will show up **locally** as 'self-acting'. You cannot trace back the origin of such *holistic* effect made by 'the whole forest' ([school of fish](#)), hence you will interpret it as "dark". And again, you are only one single tree confined in the local (physical) mode of spacetime, which cannot "see" the whole forest *en bloc*.

Again, the fleeting physical content, which identifies each and every *quasi-local* "point" (depicted with / above) dynamically along the Arrow of Space, is only the **necessary** condition for the "wave",

while the **sufficient** condition is the holistic correlating effect from 'the forest'. The latter is **smuggled** into the r.h.s. of the Einstein field equations as 'effect of geometry on matter', and is converted into perfectly legitimate 'source of gravitation'. The **linearized treatment** of this phenomenon can show only **one instant** along the **null surface** of the "wave propagation", and of course people cannot detect any *physical* effect from it.

Yes, the "thoughts" of the universe do exist, and should be revealed in the ongoing elimination of "negative mass": at every instant 'now' from the Arrow of Space, we have only **two worlds with inverted spacetime basis**. The task is strictly **mathematical**, but unfortunately I won't be able to explain it at the **Einstein Conference in Prague**.

Nobody will acknowledge the pertinent tasks of Einstein's **unfinished quest** for Allgemeine Relativitätstheorie (recall the problems with the "background" geometry  $\eta_{ab}$ , in **A. Perez**, arXiv:1205.2019v1 [gr-qc], **p. 4**). People will continue to dream about "**GW astronomy**" and speculate about "**black holes**" and **dynamics of GR**. At the end of the Conference, they will congratulate each other for their 'valuable research' and will of course reassure themselves that 'more research is needed'. Combined with the beautiful Prague and its famous pubs, they will have a jolly good time. But once the "advanced" LIGO and Virgo **fail to detect any GW strain**, the 'jolly good time' will end with a bucket of cold water. I'll be there to help and will set the record straight: it was a **scam**, ladies and gentlemen, and you bloody knew it.

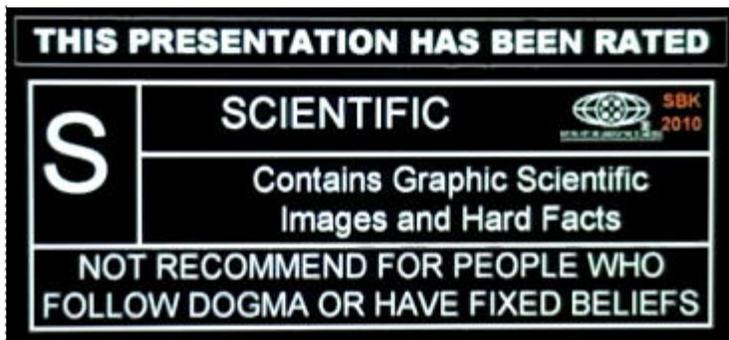
The scam is really huge -- "**at least 3-4 billion dollars**", as stated by Bernard F. Schutz **above**. It is based on the unwarranted assumption that GWs propagate exclusively in 3-D space 'from point A to point B' on a **dead flat background spacetime** (recall Hermann Weyl article from 1944 **above**) which will not, in **no circumstances**, alter the GW itself (see MTW p. 968 and M. Maggiore, p. 32 **above**), although you know **bloody well** that **(i)** such dead flat background spacetime is **impossible** to obtain from the spacetime of initially strong GWs (see **above**), and **(ii)** you cannot calculate the **tangible** forms of energy associated with the deformations of the Coca Cola bottle **above**. Like my teenage daughter, all you can say is this: 'I want *my* Barbie!' But unlike my daughter, you have been addicted to play with such Barbies, you have devoted your professional vocation to obtaining 'the ultimate Barbie' at **any** cost to the taxpayers, you get you pay check for 'playing with Barbies', and you simply *cannot do anything else* but pushing for the ultimate **\$4 billion Barbie**.

When you fail miserably again, you will launch the **Plan B** -- 'you know, it was Einstein who got it all wrong, I trusted his GR, but it failed'. To be precise: "*Any such failure of GR should point the way to new physics*" (**B. F. Schutz et al.**, arXiv:0903.0100v1 [gr-qc]).

If this isn't a **scam**, what is it ?

D. Chakalov  
April 26, 2012  
Last updated: May 16, 2012, **11:58:06 GMT**

=====



Subject: [Claus Kiefer](#), Quantum Gravity, Third Edition ([5 April 2012](#))

Date: Thu, 3 May 2012 02:47:06 +0300

Message-ID:

<CAM7EkxmnsEDGbauYVQqA6530LWffvn-0YmOeAC4fxffQWAh9Cw@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Claus Kiefer <kiefer@thp.uni-koeln.de>

Cc: Friedrich W Hehl <hehl@thp.uni-koeln.de> ,

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office@cita.utoronto.ca ,

info@cifar.ca

Dear Claus,

I've been trying to show some [subtle points](#) in your monograph since its first edition, hoping that you will elaborate.

Here's an incomplete list of issues which you again left unclear.

You wrote: "One particularly impressive example is the case of the binary pulsar PSR 1913+16: the decrease of its orbital period can be fully explained by the emission of gravitational waves as predicted by GR."

Check out an alternative at

<http://www.god-does-not-play-dice.net/#Qiao>

Details at

<http://www.god-does-not-play-dice.net/#Bondi>

[http://www.god-does-not-play-dice.net/#LIGO\\_Prague](http://www.god-does-not-play-dice.net/#LIGO_Prague)

Regarding the Einstein-Hilbert action, you wrote: "The integration in the first integral of (1.1) covers a region  $M$  of the space-time manifold, and the second integral is defined on its boundary  $\partial M$ , which is assumed to be space-like."

The last assumptions about some (i) "boundary" that might be (ii) "space-like" are by no means

clear, and neither is the main stipulation that "it is the *three-geometry* that is the dynamical object of GR",

<http://www.god-does-not-play-dice.net/#ESI>

You also claim that "a natural generalization of general relativity is the Einstein–Cartan theory".

I believe we can seek a natural generalization of GR only after we understand the genuine dynamics of GR: the three-geometry may not be the only dynamical object.

Would you like me to [elaborate](#)? I can offer you [the opinion of Einstein](#) on his GR, for a start.

Regards,

Dimi

P.S. I included some people in the CC: list, who are still unaware that [LIGO is for the birds](#).

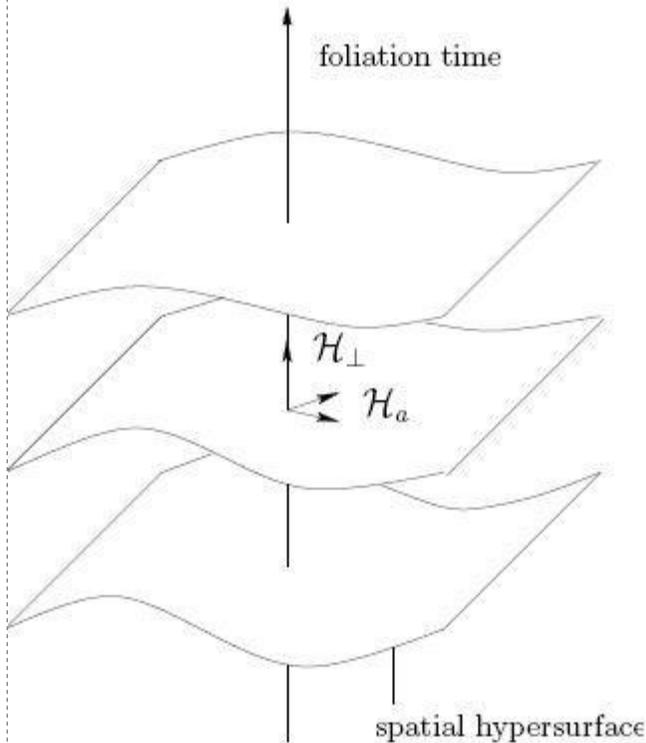
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**Note:** The last email from Claus Kiefer reached me in 2003, just to say that he can't open the CD ROM I sent him by surface mail, because all PCs at the University of Cologne run on Unix. Meanwhile he published three editions of his monograph *Quantum Gravity*, carefully avoiding all fundamental unsolved issues mentioned at this web site.

The importance of the task for revealing the genuine dynamics of GR (forget about [ADM](#)) is most clear in quantum cosmology: some people claim that the history of the universe would reach a "point" of [past incompleteness](#), while other people argue that the age of the universe might be "[effectively at minus infinity](#)".

The third option of 'dual age cosmology', briefly explained [above](#), cannot be read on paper, but only on my "blog", as [Fred Hehl](#) called this web site. Notice that each and every "point" from the [spacetime continuum](#) has the **dual temporal nature** of The Beginning, and the asymptotic structure of reaching 'the universe as ONE' at *actual* infinity: the primordial object called 'the universe as ONE' (global mode of spacetime) is being multiplied in the *local mode* of spacetime as 'uncountably infinite' points dressed with their fleeting "[jackets](#)" -- one-at-a-time, along the [null-surface](#) of the Arrow of Space. Hence the local (physical) mode of spacetime is **re**-created at each and every instant 'now' as a perfect continuum: the "binding" object [between](#) the points is 'the universe as ONE'. It is **totally absent** in the local (physical) mode due to the "[speed of light](#)". The whole content of 'potential reality' is shifted in the [potential future](#) of the Arrow of Space, rendering the local mode a **perfect** continuum, thanks to which we can look at any direction in 3-D space and see "as far as we like" ([Lee Smolin](#)).

The genuine dynamics of GR (forget about [ADM](#)) is still missing in GR textbooks. Look again at the drawing below, from [Kiefer and Sandhöfer](#):



**Fig. 1.** The above plot shows the (3 + 1)-decomposition of a four-dimensional spacetime. Spatial hypersurfaces are stacked together along a foliation parameter. The components of the Hamiltonian tangential and perpendicular to the hypersurfaces are shown (but note that there are actually three components tangential to the hypersurfaces).

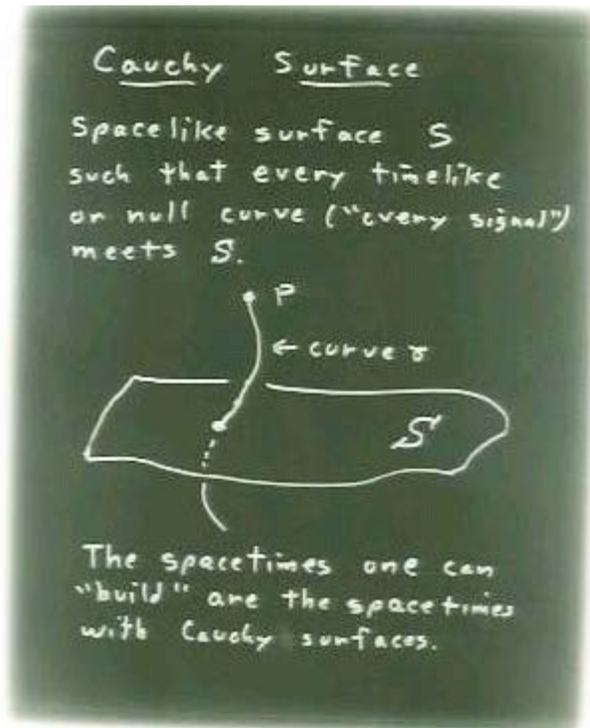
The component of the Hamiltonian "[perpendicular](#)" to the hypersurfaces is the "direction" of the expansion of Ned Wright's [balloon](#), driven by its "dark" energy. Ned Wright argues that one can safely separate the "time dimension of 4-D spacetime" from a "4th spatial dimension", which is true, but the point is that the "4th spatial dimension" is compactified to **zero** in the local mode of spacetime: it is *physically* non-existent there. It is the instant 'now' from the Arrow of Space, at which the two modes of time **coincide**, and merge with the other three components "tangential to the hypersurfaces". Once this happens, you may introduce some [Killing vector](#) from the Arrow of Space and run the "foliation time" back to the "[big bang](#)"; more from Karel Kuchar [above](#).

Notice also the poetry in the Einstein-Hilbert action [above](#): the second integral is defined on the "boundary"  $\partial M$  defined on "a region M of the space-time manifold" that is "assumed to be space-like": how can you define **any** "boundary" whatsoever on a space-like region?

What physical stuff could be instructed 'by hand' to "run" on a space-like region until it reaches

"infinity", to produce a 'well-defined' (as Claus Kiefer may say) cutoff, hence safely separate the physical spacetime from the "unphysical" one (Robert Wald, [pp. 283-287](#))?

Can you define any "boundary" on the **slice** called Cauchy surface?



The roots of the task are [strictly mathematical](#), and I hope Claus Kiefer will address them in the next edition of his monograph. Bottom line is to recover the correct [Machian gravity](#) à la '[school of fish](#)', namely, the localization of gravitational energy (MTW, [p. 467](#)) at a *quasi-local* "point"; the gravitational coupling 'here and now' should be determined "[post factum](#)", by the distant distribution of matter at 'the universe as ONE', in the [atemporal](#) global mode of spacetime *with respect to which* we can define the dynamics of the physical one.

Currently, the dynamics of the *three-geometry* ("the dynamical object of GR", as stated [above](#)) is being "defined" [intrinsically](#), **with respect to itself** (much like Baron Münchhausen lifted himself and [his horse](#)), because Claus Kiefer failed to find the **reference fluid** of GR ([Brown and Kuchar](#)). Ditto to [the "expansion" of space](#).



It seems [Karel Kuchar](#) is concerned mainly with the problem of time in canonical quantum gravity, given the title of his [forthcoming talk](#), but who is concerned with the problems and paradoxes of 'space' ? How come there is no 'problem of space' in GR ?

"In the first place, we entirely shun the vague word "space," of which, we must honestly acknowledge, we cannot form the slightest conception," [Albert Einstein](#).

D. Chakalov  
May 3, 2012  
Last updated: May 5, 2012, 06:15 GMT

=====  
Subject: [arXiv:1206.0923v1 \[gr-qc\]](#), p. 1  
Date: Thu, 7 Jun 2012 21:10:52 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Santanu Das <santanud@iucaa.ernet.in>  
Cc: monigal@physics.usyd.edu.au, gfl@physics.usyd.edu.au,  
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landsberg@hep.brown.edu, jpereira@ift.unesp.br,  
robin.booth@insularinstitute.org

Dear Santanu,

May I ask a question.

You stated that if [Mach's principle](#) is correct, "the inertial properties of a particle will keep on changing and cannot be calculated deterministically without knowing the position of all the other particles of the universe."

Let's switch from epistemology ("knowing the position") to the ontology of the inertial reaction "[forces](#)": can you suggest some argument against the idea about **bi-directional** negotiation between

every 'particle' and 'the rest of the universe' ?

Please see my conjecture (UGMC) at

<http://www.god-does-not-play-dice.net/#UGMC>

I am trying to find any arguments \*against\* my conjecture. Hope you and your colleagues can help.

All the best,

Dimi

=====  
Subject: Re: Open letter to LSC Spokesperson Prof. Gabriela Gonzalez

Date: Sun, 13 May 2012 14:44:06 +0100

Message-ID:

<CAM7EKxnEAM=T57jMPnopaRVAznOvx15wHfXr-a2veYFUueGvjQ@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Jiri.Bicak@mff.cuni.cz, info@ae100prg.mff.cuni.cz

Cc: Bernd Brüggemann <b.brueggemann@tpi.uni-jena.de> ,

Marek Abramowicz <marek@fy.chalmers.se> ,

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Roger Blandford <rdb3@stanford.edu> ,

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Karel V Kuchar <kuchar@physics.utah.edu> ,

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Paul Tod <tod@maths.ox.ac.uk> ,

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Jorge Pullin <pullin@lsu.edu> ,

Kip Thorne <kip@tapir.caltech.edu> ,

Jeremiah P Ostriker <ostriker@princeton.edu> ,

Evangelos Melas <evangelosmelas@yahoo.co.uk> ,

Ted Newman <newman@pitt.edu> ,

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oliver.jennrich@esa.int,  
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Steven Weinberg <weinberg@physics.utexas.edu>

Dear Dr. Bicák,

I am writing to you as the speaker for the Scientific Organizing Committee of the Einstein Conference in Prague, June 2012.

No reply has been received to my Open letter to LSC Spokesperson Prof. Gabriela Gonzalez, dated Thu, 26 Apr 2012 03:14:52 +0300, posted at

<http://www.god-does-not-play-dice.net/#letter>

I am respectfully urging you and all recipients of this email to reply professionally, as soon as possible.

Let me state it once more, in plain English.

You and your colleagues from the Scientific Organizing Committee rejected my intended oral contribution by imposing a new precondition (the legal term is antedate) on April 24, 2012 (cf. the link above), which resulted in the following:

You and your colleagues from the Scientific Organizing Committee condone and effectively endorse the deliberate waste of taxpayers' money by LIGO and Virgo collaborations.

Deliberate waste of taxpayers' money falls under the category of '**scam**' -- please consult your lawyer.

You couldn't possibly claim that you were unaware of the \*scam\* (check out the legal definition of 'scam') conducted by LIGO and Virgo collaborations. Once the "advanced" LIGO and Virgo fail to detect any GWs in 2014 (for reasons explained by [Hermann Weyl in 1944](#)), you and your colleagues from the Scientific Organizing Committee will have to explain why you rejected my talk in June 2012, thus condoned and effectively endorsed the deliberate waste of taxpayers' money by LIGO and Virgo collaborations.

After wasting hundreds of million USD and Euro, even more taxpayers' money is scheduled to be wasted for the "advanced" LIGO and Virgo.

NB: This is a \*scam\* organized and conducted by LIGO and Virgo collaborations. Yes, I can and will elaborate.

You all are experts in General Relativity, and you are [fully aware of the insoluble problems](#) of "GW astronomy" (cf. the link above).

Please feel free to pass this email to your colleagues and interested individuals.

If this email does not bounce back immediately, I will consider its delivery to your email account as a 'fact'.

Looking forward to hearing from you,

Yours sincerely,

Dimitar G. Chakalov  
[snip]

=====  
Subject: Re: CPT symmetry and antimatter  
Date: Tue, 22 May 2012 12:24:01 +0300  
Message-ID:  
<CAM7EkxmOxd07p00wszcp2NBArLLPKeUtbNC4h=Nt8eR+gNq7jg@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Erasmo Recami <Erasmo.Recami@mi.infn.it>  
Cc: Massimo Villata <villata@oato.inaf.it>,  
H Pierre Noyes <noyes@slac.stanford.edu>,  
Dragan Hajdukovic <dragan.hajdukovic@cern.ch>,  
Edward Kapuscik <Edward.Kapuscik@ifj.edu.pl>,  
Daniil Yerokhin <denyerokhin@gmail.com>,  
Michael Schreiber <schreiber@physik.tu-chemnitz.de>,  
Laszlo Szabados <lbszab@rmki.kfki.hu>,  
Adam Helfer <helfera@missouri.edu>,  
Luca Fabbri <Luca.Fabbri@bo.infn.it>,  
Paul Wesson <psw.papers@yahoo.ca>,  
Chris Isham <c.isham@imperial.ac.uk>

Dear Erasmo,

Thank you for your kind email and the paper attached. Please notice my approach to the issues in the subject line at

<http://www.god-does-not-play-dice.net/#ESI>

I do not introduce any "fifth dimension" that could be "time-like or space-like" (e.g., Luca Fabbri et al., [arXiv:1205.4321v1 \[gr-qc\]](http://arxiv.org/abs/1205.4321v1), p. 6; Paul Wesson, [arXiv:1205.4452v1 \[gr-qc\]](http://arxiv.org/abs/1205.4452v1), p. 5), but a new degree of freedom attributed to all spacetime "points" along a **null-surface**, called Arrow of Space. The resulting "wave" along the Arrow of Space is quantum-gravitational, and all "points" are quasi-local from the outset.

There is no other way to proceed -- we need to recover the source of [quantum waves](#). First things first.

As to the current interpretation of GWs, see

<http://www.god-does-not-play-dice.net/#scam>

If you or your colleagues have questions, please don't hesitate. I will be happy to [elaborate](#), in my capacity of "just another crank" (Chris Isham).

Best wishes,

Dimi

> On Mon, 28 Mar 2011, Dimi Chakalov wrote:

[snip]

>> May I share my comments. I don't believe in the Feynman-Stückelberg  
>> interpretation, nor in the CPT theorem in "curved" spacetime.

>>

>> Instead, I try to pinpoint the negative mass in the very mechanism by

>> which the observable/positive mass becomes \*quasi-local\* in GR,

>>

>> <http://www.god-does-not-play-dice.net/#shoal>

[snip]

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**Note:** To explain the *emerging* "wave" along the Arrow of Space, check out the space of quantum-gravitational states (forget about [Hilbert space](#)), explained with [post-correlated n-states](#) of four dice [above](#): there is no "jump" in passing from one **n**-state to the *next* one along the Arrow of Space, which is why the holomovement pattern resembles a "wave", as seen by a [meta-observer](#) in the global mode of spacetime. Again, the fleeting physical "[jacket](#)" is only the **necessary** condition for such "wave", while the **sufficient** condition is the *pre-geometric plenum* of 'the universe as ONE' [connecting](#) the quasi-local "points".

Notice that [there is no "singularity"](#) in the [spacetime continuum](#): the *pre-geometric plenum* of 'the universe as ONE' is a **dual** object exposed as both 'an infinitesimal geometrical point' and 'the largest size of the physical universe', depending on the "direction" we look at **it** along the **w**-axis ([see above](#)). This is the instantaneous state '[now](#)' of the whole Universe along the Arrow of Space, in which **we all** are at 'absolute rest'. From the viewpoint of science, **it** is unobservable in principle. The observable states are those "in flux" (called *local* (physical) and *global* (atemporal) modes of spacetime), created with the rules of [dual age cosmology](#). The spacetime of such Universe is unique and 'the only possible one', because it contains *absolutely everything*, included the source of its evolution, known as the Aristotelian First Cause. These simple metaphysical axioms constitute a form of 'metaphysical reality', in the sense that they are accessible to all of us, and we all can comprehend their invariant meaning, despite the differences in our [brains](#). These axioms shape the foundation of the *mathematical* description of the universe, after which comes the physical one. [First things first](#).

As an exercise, try to connect the dots in the drawing of 'one second' [above](#) by using only [Archimedean geometry](#) [[Ref. 1](#)] and physical stuff invariant under "active" diffeomorphisms [[Ref. 2](#)]: the new dynamics of GR, along the [null-surface](#) of the Arrow of Space, is encoded in the seemingly simple word "[until](#)" [[ibid.](#)], and the global, "[nondynamical](#) and explicit" time (which isn't [Dirac observable](#)) *must* be [totally hidden](#), or else "[the ether would come back](#)".

Here people ask, 'but where's da math?' Sorry, the math is still 'out there', waiting to be uncovered in the "open sets" of the [topology of space](#).

*topological space*  $\xrightarrow{??}$  *smooth manifold*

People begin by postulating a [Hausdorff topological space](#) and try to explain in what sense "a point  $x \in X$  can be said to be '[near](#)' to another point  $y \in X$ " (e.g., Chris Isham, *Modern Differential Geometry for Physicists*, 1999, Sec. 1.2.1, [p. 3](#)). They denote this [connected](#) topological space with **M**, and introduce a second metaphysical assumption, a *differential structure* on **M**, like [bartenders](#) (*ibid.*, pp. 59-60 and [Fig. 2.1](#)). Even Karel Kuchar cannot reveal the "[hidden unmoved mover](#)", which can *only* show up by exposing the topological structure of what may look (to [bartenders](#) at macroscopic length scale) like a dimensionless "point". Just wait for his forthcoming talk at the Einstein Conference in Prague next month, '[Canonical quantum gravity: Einstein's posthumous anathema](#)' -- he will not mention *any* argument posted on this web site, as if he has never heard from me (his last email was from [27 January 2003](#)).

The [experts in quantum gravity](#) simply don't like this web site and behave as if they [know nothing about it](#). Chris Isham, for example, believes that I "do not know enough theoretical physics to help with any research in that area" and considers my work as "just another crank" ([12 October 2007](#)). Other experts have chosen to be less polite but utterly frank: "Buzz off, idiot!" ([Prof. Dr. Maurice de Gosson](#)).

So be it.

D.C.

May 23, 2012

Last update: May 25, 2012, [12:52:05 GMT](#)

[Ref. 1] A. Trautman, Foundations and current problems of general relativity, in *Lectures on general relativity*, ed. by Andrzej Trautman, F.A.E. Pirani, and Hermann Bondi, Englewood Cliffs: Prentice-Hall, 1965, Sec. 5.1, [pp. 101-103](#)

"From now on we shall always assume that space-time can be represented by a 4-dimensional differentiable manifold. This is why the differentiable manifold concept was defined with care and discussed in detail in the preceding chapter. Any changes in this assumption would result in a very profound revolution in physics".

[Ref. 2] Mihaela Iftime, The Hole Argument, [gr-qc/0610105](#).

"GR or in any general relativistic theory on the other hand are distinguished from other dynamical field theories by invariance under "active" diffeomorphisms; its field equations are invariant under all differentiable diffeomorphisms (the group  $\text{Diff}(M)$ ) of the underlying manifold  $M$ , which have no spatio-temporal significance until the dynamical fields are specified.

Also related to general covariance of Einstein's equations some conceptual and technical difficulties arise when one studies the equations using purely mathematical methods or computer calculations. This is mainly due to the fact that there is no preferred way of splitting the 4-dimensional space-time into time and 3-dimensional space, and the problem of choice of a good time coordinate. While it is possible to 'slice up' space-time into a family of 3-dimensional slices, everyone is free to choose their own slicing of space-time, and geometrically natural choice of slicing can help towards an elegant and useful description of solutions of Einstein's equations.

An open problem related to the general covariance of the Einstein equations is to understand the implications of the space-time metric on the topology of the underlying manifold. If  $g_1$  and  $g_2$  are two space-time metrics satisfying the same Einstein's equations, they are considered physically equivalent if one is isometric with the other, i.e., there is a global diffeomorphism  $\phi : M \rightarrow M$  such that  $g_2 = \phi^* g_1$ . Implicitly, the topology of the underlying space  $M$  is fixed. But different topologies arise for different solutions of Einstein's equations, even if the metrics are locally diffeomorphic. Given a fixed space-time 4-manifold  $M$  the question is how many Einstein's non-isometric solutions 'live' on  $M$ ? This problem is related to the stability problem of space-time solutions, which is one of the most important unsolved problems of GR. Example of stable solutions are the Minkowski space-time(see [14]) and Schwarzschild black hole(see [37]), but in general this is a very complicated problem.

**Comment:** According to [Merriam Webster Dictionary](#), 'until' can be used as a "function word to indicate continuance (as of an action or condition) to a specified time." But in the case examined by M. Iftime [above](#), the function word "until" does **not** refer to any 'time read by a clock'. As [Helmut Friedrich](#) acknowledged (arXiv:0903.5160v1 [gr-qc], [p. 17](#)):

"The vector field  $\mathbf{T}$ , for which no natural choice exists in general, is characterized indirectly and

becomes explicitly available only **after** solving the equations."

That is, until the dynamical fields are specified by the rules of "active" diffeomorphisms, we don't have 'spacetime'. What happens "meanwhile" is totally unclear, which is yet another argument that GR is not a *bona fide* 'classical theory'.

Nearly ten years ago, on Thu, 24 Oct 2002 20:34:51 +0300, I asked Chris Isham the following: "To prove me wrong, please explain to me what kind of time is implied by 'moving points around' in Diff(M)-invariance, and how can your wristwatch read it." He didn't reply to my question, but instead wrote the following (Fri, 25 Oct 2002 16:46:34 +0100):

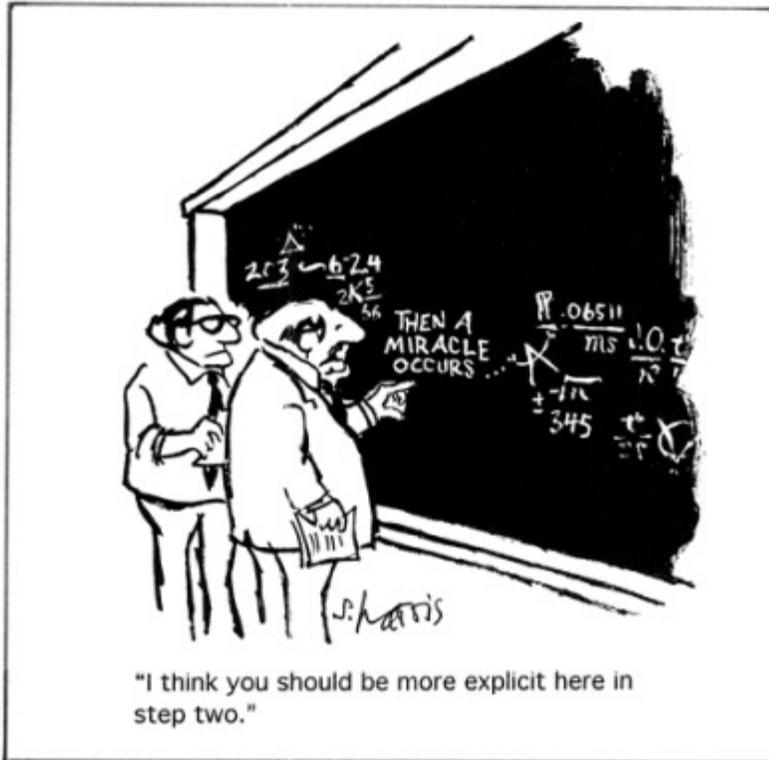
"As for time, wrist-watches and Diff(M), one of the key things that emerged from all the discussions on the problem of time was that although it is true that, because of the Diff(M) action, no physical meaning could be attached to a point on the space-time manifold, a physical meaning *\*can\** be attached to specifying a space-time location by the values of various physical quantities. Karel Kuchar is probably the person who has done most work on this, but it is something that number of people have remarked on in recent years. For example,  $\phi$  is a scalar field on the manifold and  $X$  represents the space-time coordinate of a particle, then although  $\phi(x)$  has no physical meaning (if  $x$  is a point in the space-time manifold) nevertheless  $\phi(X)$  *\*does\** have a meaning: ie you can talk in a Diff(M)-invariant way about the value of a field where a particle 'is', and similarly for a trajectory. And, after all, general relativity does seem to work well as a theory, and yet I can certainly read the time on my wrist watch!"

As I stated above, Chris Isham needs quantum gravity to explain how such linearized time can be read by his "wrist watch!" -- there is no **explicit** time parameter in GR, but only "constraints" (Karel Kuchar).

To explain the crux of "GR dynamics" to my teenage daughter, I asked her to imagine that what we call 'spacetime' is something like a sentence which conveys particular *meaning* only **after** we choose the proper words ("dynamical fields", M. Iftime) to explicate the 'meaning' of our Platonic ideas. In the example above, we have two "spacetimes" defined by four (shuffled) sayings. Notice that we don't produce any pathologies similar to those induced by the "active" diffeomorphisms in GR textbooks, as explained by M. Iftime. If our brain can do this, Mother Nature should be able to do it as well. What we need is to remove all mental stuff and introduce the GPI field of 'John's (Diff(M)-invariant) jackets'. Then the "mental stuff" will show up only in the dual age cosmology, after Virgil's dictum *Mens agitat molem* (Der Geist bewegt die Materie).

Also, Mihaela Iftime considers the topological problems very complicated, but according to "just another crank" they are insoluble -- you cannot, not even in principle, recover what is called 'dimensionality of space': check out Martin Bojowald and Lee Smolin above. Perhaps you can resolve these pathologies from the active diffeomorphisms with the reference fluid of GR with respect to which the Arrow of Space has been introduced. Most importantly, the spacetime 4-manifold **M** isn't "fixed" but dynamical: it is being continuously **re-created**, one-at-a-time, at every instant 'now' from the Arrow of Space by two topological waves re-creating the asymptotically flat spacetime. We cannot *comprehend* an entity that is "fixed". The only fixed entity is the ultimate source of the Universe: the true monad without windows. It is at **absolute** rest, residing within the instant 'now' from the Arrow of Space.

Notice that the "fixed" reference fluid of GR is crucial to all *relational* theories of time, in which the infinitesimal "duration" of the instant 'now' is defined "upon relative change within the universe *as a whole*" (Sean Gryb and Karim Thebault, p. 2). The main advantages of the Arrow of Space are the new "quantization" of spacetime in which we recover a **perfect** continuum in the *local* mode of spacetime, and the unification of the quantum and gravitational waves from the outset. If you disagree, check out Claus Kiefer and Alejandro Perez: they believe 'time' and 'space' do not exist at fundamental level, and have grounded their so-called decohered ("intrinsic decoherence") semi-classical states on a **miracle**.



Sorry for repeating this again; I just wanted to explain why [contemporary relativists](#) deeply hate these widely known ideas. Another unsolved mathematical task, which has also been carefully avoided by those experts, is posted [above](#). More in Vienna, in [December 2012](#). The celebrated Wittgenstein axiom "whereof we cannot speak, thereof we must keep silent" does not apply to mathematics. We can reveal 'the true monad without windows'.

"just another crank"  
June 1, 2012

=====

Subject: Re: Quantum gravity  
Date: Fri, 1 Jun 2012 03:21:56 +0300  
Message-ID:  
<CAM7EkxkYvELRgzQcy60iMyx12-j2-Vv7SJpFGq9bQi\_7tQNp7A@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: [Chris Isham](#) <c.isham@imperial.ac.uk>

Hello Chris,

On Wed, 23 Oct 2002 19:24:15 +0100, you declared the following:

"You do not know enough theoretical physics to help with any research in that area."

I was expecting, since 23 October 2002, that some day you would behave as a gentleman (not just theoretical physicist) and defend your immensely insulting statement. I told you in November 1998, in your office at Imperial College, that I've been working on quantum gravity since 1972, so your claim in 2002 that after thirty years I still "do not know enough theoretical physics to help with any

research in that area" was a relatively polite way to say that I am a moron. To make your opinion more explicit, you portrayed me as "just another crank" (Fri, 12 Oct 2007 15:14:09 +0100).

In my previous email sent two years ago (Sat, 20 Feb 2010 06:35:23 +0200), I wrote:

- > I respectfully urge you to defend your (immensely insulting) claim from
- > Wed, 23 Oct 2002 19:24:15 +0100. Just show me my errors.

You still haven't produced any evidence in support of your insults. I'm afraid you will never behave as a gentleman, because you can't.

As to your understanding of theoretical physics, I stressed on numerous occasions that your interpretation of the "background Newtonian time" in the "time-dependent" Schrödinger equation (arXiv:gr-qc/9310031v1, p. 14) and your toposification of Quantum Theory are *seriously* wrong, and have provided numerous arguments and references, starting from [Schrödinger](#) and [Margenau](#).

You never accepted the challenge to respond professionally, nor have shown any error in the so-called PR Interpretation of Quantum Mechanics, which I suggested following Marnegau's Onta. Instead, you choose to keep quiet, and have published since 2008 at least six papers (with Andreas Doering) on your toposification project, funded munificently by FOXi (\$75,000). You didn't even respond to my email from Mon, 26 Oct 2009 12:44:06 +0200, in which I was seeking endorsement of the submission of my manuscript to the [gr-qc] domain of the arXiv server at Cornell. You could have at least agreed to glance at my manuscript, show me *one* error, and then refuse to endorse it. That would have been fair, and professional.

Anyway, this whole story doesn't matter anymore, because yesterday, May 31st, I completed my theory of Machian quantum gravity. Nobody has helped me, not even with a brief critical opinion or advice, which is why all you can read at my web site are [only the philosophical and metaphysical implications](#).

If some day you come up with some toposificated version of quantum gravity, just send me your reference -- I will prove you wrong.

[Promise](#).

Take care,

Dimi

=====



Subject: "First principles", [arXiv:1206.3067v1 \[gr-qc\]](#)

Date: Sat, 16 Jun 2012 11:58:08 +0300

Message-ID:

<CAM7Ekxmr\_2FFYCqqUcCFzqQ=4VxYSRh5TjZ3qUFBHZcEzyRBhQ@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Sergio Doplicher <dopliche@mat.uniroma1.it>  
Cc: [snip]

Dear Sergio,

In my email from [Tue, 1 Dec 2009 14:23:42 +0200](#), I wrote:

- > May I ask a question. I noticed that you'll teach QM,
- > [http://www.mat.uniroma1.it/mat\\_cms/pres\\_corso.php?corso\\_da\\_presentare=1259](http://www.mat.uniroma1.it/mat_cms/pres_corso.php?corso_da_presentare=1259)
- >
- > Would you discuss my interpretation of QM with your students?
- >
- > I believe kids have the right to know everything we know.

Did you tell your students that there are no "first principles" which might eventually, at least in principle, resolve the task with the Planck scale ?

<http://www.god-does-not-play-dice.net/#Perez>

You all are building your hypotheses on a Biblical miracle.

Yes, you will need a miracle to erect Lorentzian metric from that "[foam](#)".

Check out another miracles at

[http://www.god-does-not-play-dice.net/#John\\_Alice](http://www.god-does-not-play-dice.net/#John_Alice)

<http://www.god-does-not-play-dice.net/#Claus>

If you and your colleagues wish to respond, please do it professionally.

As [John von Neumann](#) noticed, "There's no sense in being precise when you don't even know what you're talking about."

E sarà mia colpa se così è ?

All the best,

Dimi

=====



Subject: Re: arXiv:1206.0045v1 [gr-qc], p. 2, the Gannon-Lee theorem, "... at least when quantum effects can be neglected."

Date: Sun, 8 Jul 2012 15:23:17 +0300

From: Dimi Chakalov <dchakalov@gmail.com>  
To: Ivan Silva <ivanpcs@mtm.ufsc.br>  
Cc: Jose M M Senovilla <josemm.senovilla@ehu.es>,  
John Friedman <friedman@uwm.edu>,  
[Jörg Frauendiener](mailto:joergf@maths.otago.ac.nz) <joergf@maths.otago.ac.nz>,  
Adam Helfer <helfera@missouri.edu>,  
Laszlo Szabados <lbszab@rmki.kfki.hu>,  
Alan Rendall <rendall@aei.mpg.de>,  
Lars Andersson <laan@aei.mpg.de>,  
Jeffrey Winicour <winicour@pitt.edu>,  
Helmut Friedrich <hef@aei.mpg.de>,  
Paul Tod <tod@maths.ox.ac.uk>,  
Piotr T Chrusciel <piotr.chrusciel@univie.ac.at>,  
Robert Beig <robert.beig@univie.ac.at>,  
John Baez <baez@math.ucr.edu>

Ivan dorogoi,

I've again speculated about some "MTS" and "MOTS" in arXiv:1207.1113v1 [gr-qc].

Do you read your email? I wrote you on [Sat, 9 Jun 2012 18:24:28 +0300](#) that "since neither you nor any of your colleagues (John included) have produced the recipe for the "asymptotic spacelike regime" (cf. the initial URL below), you cannot, not even with your [wild Russian imagination](#), claim that you're talking about 'spacetime'."

Get real, face the facts. I know you like poetry, but it's time to get professional about GR.

Just try to define the [asymptotic spacelike regime](#) and send me the link to your revelations. I will prove you wrong, with math. Promise.

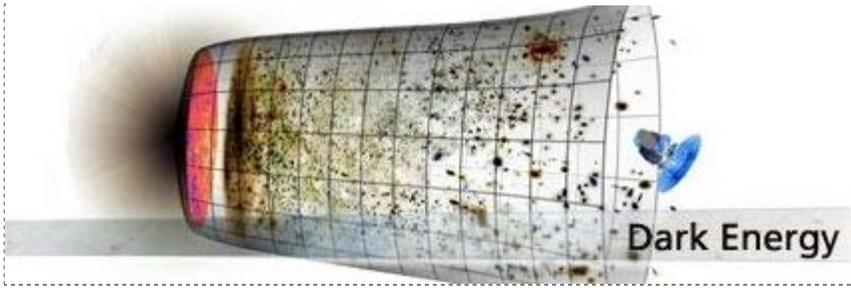
I extend this offer to your colleagues as well.

Dimi

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**Note:** In order to talk about 'spacetime' (cf. the *necessary* and *sufficient* conditions for 'spacetime' [above](#)), you have to explain the behavior of your '[isolated system](#)' and its unphysical or ambient spacetime ([S. G. Harris](#)), with respect to which the spacetime of that system is defined "intrinsically" at its [asymptotic regime](#), i.e., without direct reference to some "unphysical" or "dark" spacetime:

1. The closed/isolated system is accelerated "upwards" ([Arrow of Space](#)) to produce inertia, but not in some real unphysical space -- see [above](#).
2. It is also "expanding", but not in some real unphysical space, as depicted in the highly deceptive balloon metaphor from [Ned Wright](#).
3. The same system is also "expanding" along the cosmological time, but not in some real unphysical space, as depicted in the highly deceptive "dark energy" drawing below.



Once you define rigorously the "[end points](#)" at null- and [spacelike infinity](#) in these three cases, you may talk about 'classical spacetime', but then you'll have to use quantum gravity to explain in what sense these "end points" are [quasi-local](#) yet still totally isolated from the unphysical spacetime, and finally switch to the type-IV scheme of [Chris Isham](#).

Regarding quantum gravity: the [Equivalence Principle](#) in GR does not allow to compute the gravitational energy *density* at a "point" (MTW, [p. 467](#)), yet we cannot accept any form of "non-localizable" gravitational energy (Hermann Bondi) -- if the gravitational energy has been localized "in regions", then it is also localized at *each and every* infinitesimal "point" from this "region". It must somehow "get smuggled" into each and every "point", in such way that, when integrated over 'the whole spacetime' of the "[isolated system](#)", we can find out that the gravitational field energy is "negative, so it **exactly** cancels the energy you think is being gained in the matter fields" ([S. Carroll](#)).

Well, the *quasi*-localization of the gravitational energy takes place at every instant '**now**' from the [Arrow of Space](#), and with respect to 'the whole isolated universe' ([school of fish](#)). This is the crux of the Machian quantum gravity advocated at this web site (recall the *necessary* and *sufficient* conditions for 'spacetime' [above](#)), in line with the type-IV scheme of [Chris Isham](#). Simply **insert** the 'unphysical spacetime' [between](#) every neighboring points from the physical (local) spacetime, and then **remove** these "dark Zen gaps" with 'the speed of light', as explained [below](#). Details at the [ESI Workshop](#) in Vienna.

D. Chakalov

July 9, 2012

Last updated: July 12, 2012

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Subject: [arXiv:1206.4796v1 \[gr-qc\]](#), Main Hypothesis  
Date: Fri, 22 Jun 2012 19:37:16 +0300  
Message-ID:  
<CAM7Ekx=Xv4LRrLKBFbAk3nsLJe\_pre6ifMpWPFynugzWXJH-og@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: [Torsten Asselmeyer-Maluga](#) <torsten.asselmeyer-maluga@dlr.de>  
Cc: [snip]

"Our universe is a compact 3-manifold  $E$  expanding smoothly so that the spacetime is a smooth 4-manifold  $M$ ."

Dear Torsten,

I cannot understand your notion of "expansion": with respect to *\*what\** ?

Is your "compact 3-manifold" expanding with respect to itself ? I think only Baron Munchhausen can perform such self-referential miracle.

Or have you discovered the 'reference fluid of GR' ?

<http://www.god-does-not-play-dice.net/#ESI>

Or maybe you can define the expansion of spacetime *\*itself\** "intrinsically", like people do in GR textbooks with "curvature", with the Gauss-Bonnet theorem ?

The opinion of your colleagues will be greatly appreciated, too.

Just please use math and refrain from poetry. Thank you.

All the best,

Dimi

=====

Subject: Re: arXiv:1206.4796v1 [gr-qc], Main Hypothesis  
Date: Mon, 25 Jun 2012 13:50:33 +0300  
Message-ID:  
<CAM7Ekxn+yfc8T1QkC5ZTnO=vM86Fj\_QEbBFzjpUqha2Q3Rb4uw@mail.gmail.com>  
In-Reply-To: <OA3FBE70C843A44690F695B661678CC3408074@ba-30.user.pt-dlr.de>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: "Asselmeyer-Maluga, Torsten" <Torsten.Asselmeyer-Maluga@dlr.de>  
Cc: [snip]

Dear Torsten,

Thank you for your reply from Mon, 25 Jun 2012 09:57:27 +0200 to my preceding email,

<http://www.god-does-not-play-dice.net/#Munchhausen>

> I'm not Baron Munchhausen, so I have to find another way to see the expansion....

Please correct me if I am wrong. I extend this request to [your colleagues](#) as well.

If you were able to "see" the expansion, you would "see" the reference fluid of GR and Kuchar's [Unmoved Mover](#), which will immediately ruin GR, and also prove Aristotle wrong: there will be no need for his First Cause,

<http://www.god-does-not-play-dice.net/#Aristotle>

<http://www.god-does-not-play-dice.net/#Recami>

> The expansion can be only seen if there is something which **don't expand** (or scale).

You need some meta-observer equipped with a measuring tape and a clock, who can "see" the whole universe en bloc, even "before" the so-called inflation, to verify the dynamics of the "scale factor" parameterized by a variable called 'time'. Then this meta-observer must communicate her measurements to you and any other finite sub-system of the universe, Bob and Bill included (the latter suggested a "nondynamical" time in Phys. Rev. D 40 (1989) 2598-2614).

> Baryonic matter has (conjecturally) this property.

Please don't forget the non-baryonic ["dark matter"](#) which is app. six times more than the observable one. It is like an [elephant in a china pottery shop](#), only the elephant itself is 6 times larger than the shop.

> In another paper (arXiv:1006.2230) we describe matter as hyperbolic 3-manifolds  
> (knot complements). Hyperbolic 3-manifolds don't scale, i.e. every diffeomorphism  
> (including a conformal transformation) is an isometry (volume is a topological invariant).  
> So if matter is an hyperbolic 3-manifold then one can see the expansion

You and Helge Rose posed the question of how matter may emerge from space and considered "the smoothness structure of spacetime as underlying structure for a geometrical model of matter" ([arXiv:1006.2230v4 \[gr-qc\]](#)), and wrote:

"Thus exotic smoothness is able to represent a source of a gravitational field which cannot be distinguished from a usual source by an external observer. Furthermore, these sources are localized in the 4-manifold, i.e. one can construct a non-diffeomorphic smoothness structure from a given one by a modification of a 4-dimensional submanifold.

"As far as we know, sources of a gravitational field are any kind of matter (baryonic, radiation or dark)."

We know nothing about the "dark" sources (if any) of a gravitational field.

"From all this it seems natural (sorry, it isn't "natural" - D.) to relate matter with exotic smoothness. We will support this conjecture by showing that a 4-manifold admitting a Ricci-flat metric (in standard smoothness structure) changes to a 4-manifold with non-Ricci-flat metric in all exotic smoothness structures (see the discussion in subsection 4.1). Thus if one starts with a vacuum solution of Einsteins equation then exotic smoothness modifies this solution to a non-vacuum solution, i.e. the sources are determined by the exotic smoothness structure."

Carl is [a bit touchy](#) about his '[exotic smoothness conjecture](#)', so all I can suggest is to resolve the old cosmological "constant" problem known since 1930s (and the worst calculation in theoretical physics), to explain exactly what in the quantum vacuum "gravitates", and how. Then please use your theory to suggest the correct vacuum solution of Einstein's equation.

If you fail, check out my proposals at the links [above](#).

Besser eine Laus im Kraut als gar kein Fleisch.

All the best,

Dimi

=====

Subject: Re: arXiv:1206.4796v1 [gr-qc], Main Hypothesis  
Date: Mon, 25 Jun 2012 14:19:08 +0300  
Message-ID:  
<CAM7EkxkfdvCC2JHt3O6ammLObEiX2G-LXMxdqq0+DyuBboMmsA@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: "Asselmeyer-Maluga, Torsten" <Torsten.Asselmeyer-Maluga@dlr.de>  
Cc: [\[snip\]](#)

P.S. If you or some of your colleagues can construct some [non-Archimedean](#) meta-observer which doesn't physically "expand", please explain its "differential topology" ([Carl Brans](#)), and drop me a line. Then we could switch to math and (hopefully) sort out this whole mess.

Best - D.

On Mon, Jun 25, 2012 at 1:50 PM, Dimi Chakalov <dchakalov@gmail.com> wrote:  
[snip]

=====

Subject: Re: Cosmological Inflation and the Quantum Measurement Problem, [arXiv:1207.2086v2](#)  
[\[hep-th\]](#)  
Date: Tue, 17 Jul 2012 12:22:59 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Jerome Martin <jmartin@iap.fr>, vennin@iap.fr, peter@iap.fr

Cc: Daniel Sudarsky <sudarsky@nucleares.unam.mx>,  
Steve Adler <adler@ias.edu>,  
Thomas Thiemann <thiemann@theorie3.physik.uni-erlangen.de>,  
Catherine Meusburger <catherine.meusburger@gmail.com>

P.S. Please recall another puzzle, from Thomas Thiemann, [arXiv:astro-ph/0607380v1](http://arxiv.org/abs/astro-ph/0607380v1):

"Why is it that the FRW equations describe the physical time evolution which is actually observed for instance through red shift experiments, of physical, that is observable, quantities such as the scale parameter?"

"The puzzle here is that these observed quantities are mathematically described by functions on the phase space which do not Poisson commute with the constraints! Hence they are not gauge invariant and therefore should not be observable in obvious contradiction to reality."

So, the "scale parameter" shouldn't be observable either. The solution from Aristotle is posted at

<http://www.god-does-not-play-dice.net/#Aristotle>

[http://www.god-does-not-play-dice.net/#first\\_principles](http://www.god-does-not-play-dice.net/#first_principles)

Any comments ?

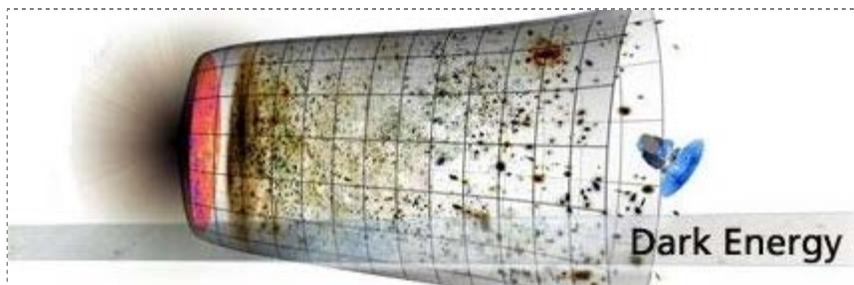
D.C.

On Tue, 17 Jul 2012 04:12:31 +0300, Dimi Chakalov <dchakalov@gmail.com> wrote:

>  
> Dear colleagues,  
>  
> You wrote: "Indeed, it remains to understand how a single outcome can  
> be produced. This point is particularly important given that we only  
> have one CMB map, that is to say only one measurement of the  
> corresponding observable. In other words, even if the cosmological  
> fluctuations can be viewed as a classical stochastic problem, this  
> does not explain how a given realization of this process becomes an  
> actual perception.  
>  
> "This "macro-objectivation" problem is already present in a  
> conventional situation but, as already mentioned before, it becomes  
> particularly embarrassing in the context of inflation where the  
> collapse of the wavefunction cannot be due to the presence of a  
> conscious observer."  
>  
> I think if we bear in mind the problems with "quantum clocks" (A.  
> Peres, Measurement of time by quantum clocks, Am. J. Phys. 48 (1980)  
> 552-557), and start from the case examined by Mott in 1929,  
>  
> [http://www.god-does-not-play-dice.net/#energy\\_exchange](http://www.god-does-not-play-dice.net/#energy_exchange)  
>  
> and then add the [Kochen-Specker Theorem](#), there could be only one  
> possible solution to the macro-objectification problem,  
>  
> <http://www.god-does-not-play-dice.net/#Singh>  
>  
> All the best,

>  
> Dimi Chakalov

**Note:** Look again at the *highly misleading* picture below:



Any time you look at your wristwatch, you record the dynamics of the "scale factor" parameterized by a variable with [unknown topology](#), called 'cosmological time'. It is "[nondynamical](#) and explicit" (Bill Unruh) yet **unobservable** with the machinery of the Hamiltonian formulation of GR. Hence its effects will be inevitably "**dark**".

It is not some "background Newtonian time" in the "time-dependent Schrödinger equation" ([Chris Isham](#)) either. As Asher Peres stressed in 1980, "the Schrödinger wave function  $\Psi(t)$ , with its continuous time evolution given by [XXX], is an idealization rooted in classical theory. It is operationally ill defined (except in the limiting case of stationary states) and should probably give way to a more complicated dynamical formalism, perhaps one **nonlocal** in time. Thus, in retrospect, the Hamiltonian approach to quantum physics carries the seeds of its own demise."

Instead of "nonlocal", the evolution of quantum-gravitational objects can be [quasi-local](#): if you consider the [Arrow of Space](#), the global nonlocal cosmological time, which cannot and **must not** be '[observable](#)' (cf. Tom Thiemann [above](#)), is fixed by the so-called '[sufficient conditions for spacetime](#)'. The latter will inevitably look "**dark**" with the Hamiltonian formulation of GR. If you believe such "dark" effects of gravity were produced by some stuff with *positive* energy density, you'll have to live with the [dark dancing elephant](#) for the rest of your life.

D. Chakalov  
July 17, 2012

=====  
Subject: [arXiv:1206.0927v2 \[gr-qc\]](#)  
Date: Tue, 24 Jul 2012 19:09:35 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Simen Braeck <simen.brack@hioa.no>, Oystein Elgaroy@astro.uio.no  
Cc: Valerio Faraoni <vfaraoni@ubishops.ca>, Michal Chodorowski <michal@camk.edu.pl>, Torsten Asselmeyer-Maluga <torsten.asselmeyer-maluga@dlr.de>, William G Unruh <unruh@physics.ubc.ca>

Dear Simen,

I read with great interest your latest paper, co-authored by Dr. Elgaroy. May I ask questions about

'the elephant in the room' (a.k.a. the "dark" energy from space).

Please correct me if I'm wrong. I extend this request to all your colleagues.

We agree that the redshift is not a Doppler effect, but the result of some "stretching effect" ([arXiv:1206.0927v2 \[gr-qc\]](http://arxiv.org/abs/1206.0927v2), p. 1), but what is the 'reference substance' that isn't "stretching" ?

You claim that, in the comoving coordinates of the FLRW line element, we can talk about (i) cosmological redshift, (ii) increase of  $a(t)$  with cosmic time, and (iii) expansion of space ("the redshift observed by comoving observers may in general be attributed to the effect of an expanding space"): with respect to what? Some 'reference substance' that isn't "stretching" ?

When you say "with respect to cosmic time  $t$ ", do you imply that the "cosmic time  $t$ " is gauge invariant observable? Please see Tom Thiemann at

<http://www.god-does-not-play-dice.net/#Martin>

Were "the cosmic time  $t$ " a bona fide GR observable, we could immediately trace back the very source of that 'dark energy from space', and it won't be "dark" anymore. Same applies to the source of the "non-baryonic dark matter",

<http://www.god-does-not-play-dice.net/#elephant>

Last question: Can your "static observer" detect the "stretching effect" ? If yes, she should detect the "dark elephant" as well. Do you agree?

If you can shed some light on these issues, I believe you could also explain those "[travelling disturbances in distances](#)", p. 6 from Bill Unruh at

<http://www.theory.physics.ubc.ca/407-09/linear.pdf>

All the best,

Dimi

=====

Subject: The fourth group of the Ishamian taxonomy, [arXiv:1207.1489v1 \[physics.hist-ph\]](http://arxiv.org/abs/1207.1489v1), pp. 3-4

Date: Mon, 9 Jul 2012 11:51:03 +0300

Message-ID:

<CAM7Ekxky8tgLLZE3We2P8xfr4dmGZkr67qc7w2EgtJj7wgbieQ@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Christian Wüthrich <wuthrich@ucsd.edu>

Cc: Nick Huggett <huggett@uic.edu> ,

Andreas <andreas.doering@comlab.ox.ac.uk> ,

Chris Isham <c.isham@imperial.ac.uk> ,

Claus Kiefer <kiefer@thp.uni-koeln.de> ,

Alejandro Perez <perez@cpt.univ-mrs.fr> ,

Carlo <rovelli.carlo@gmail.com> ,

Lee Smolin <lsmolin@perimeterinstitute.ca> ,

Abhay Ashtekar <ashtekar@gravity.psu.edu> ,

Karel V Kuchar <kuchar@physics.utah.edu>

Hi Christian,

It is really amazing how you managed to avoid everything you've learned from the references at my web site. For example, your claim in footnote 1 sharply contradicts the type-IV scheme of Chris Isham. The latter is the only possible approach.

Everything else, [LOG included](#), requires a miracle,

[http://www.god-does-not-play-dice.net/#first\\_principles](http://www.god-does-not-play-dice.net/#first_principles)

<http://www.god-does-not-play-dice.net/#Munchhausen>

I suppose you won't reply, as usual. But if you do, I will elaborate in details. Notice that those Ashtekar variables do not offer some "simplification" which "depends on a number of contentious and yet unresolved technical issues" (footnote 11), but totally obscure the fundamental unresolved issue of "what happens to tangent vectors to a manifold that are transported from one point of the manifold to another along a curve" (p. 7) -- you need a Biblical miracle do "define" those "[points](#)" and their ([affine](#)) connection. Which is why the type-IV scheme of Chris Isham is the only possible approach.

Forget about [LQG](#).

All the best,

Dimi

=====

Subject: Re: The fourth group of the Ishamian taxonomy, arXiv:1207.1489v1 [physics.hist-ph], pp. 3-4  
From: Dimi Chakalov <dchakalov@gmail.com>  
Date: Wed, 11 Jul 2012 22:53:53 +0300  
To: Christian <wuthrich@ucsd.edu>  
Cc: Tim <twm3@nyu.edu>, John <jearman@pitt.edu>, John <john.stachel@gmail.com>

Christian,

My email from Mon, 9 Jul 2012 11:51:03 +0300 is posted at

<http://www.god-does-not-play-dice.net/#Christian>

Forget about LQG and the Hamiltonian formulation of GR. First of all, your brain would not work,

<http://www.god-does-not-play-dice.net/#Seung>

Shall I elaborate?

Dimi

-----

**Note:** Again, if you can read these lines, the Hamiltonian formulation of GR **must be wrong**. Recall also that diffeomorphism invariance (cf. [Tim Maudlin, 2002](#)) **requires** the absence of local observables (cf. Charles G. Torre, [arXiv:gr-qc/9306030](#) and Steven B. Giddings *et al.*, [arXiv:hep-th/0512200](#)), so you don't have *precise* 'classical limit' even with textbook GR, nor can you recover the *dimensionality* of space ([M. Bojowald](#)). Forget it.

D. Chakalov  
July 12, 2012

=====

Subject: Re: Einstein's Genie  
Date: Wed, 11 Jul 2012 12:53:14 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Graham Nerlich <graham.nerlich@adelaide.edu.xx>  
Cc: heather.dyke@stonebow.otago.ac.nz

Dear Graham,

Thank you very much for the first six chapters from your latest book.

> Any comments would be welcome.

Regarding Ch. 6.5, 'A naïve model of naïve time', I support a dynamical version of 'present chauvinism' with the so-called [Arrow of Space](#) (all my email sent to you since [June 2008](#) deal with this issue); please see the latest arguments at

<http://www.god-does-not-play-dice.net/#Munchhausen>

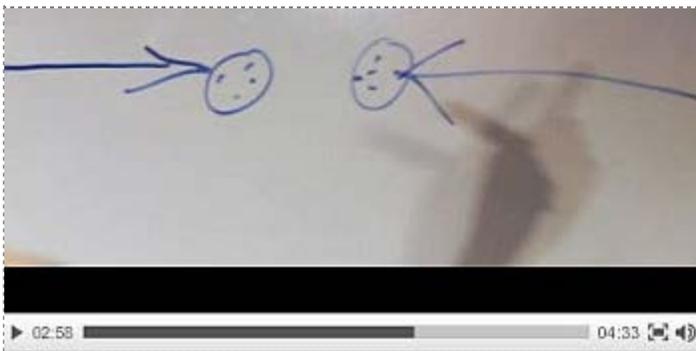
<http://www.god-does-not-play-dice.net/#Angelo>

Anyway, I suppose you have examined, in the rest chapters of your book, the [non-linear](#) coupling of matter to **itself** due to gravity. Think of a fish from a large [school of fish](#), which follows its \*quasi-local\* geodesic determined dynamically -- at each and every point -- jointly by its local state and the non-local influence from 'the whole school' (here we enter Machian gravity): I think this is a very good metaphor for '[quasi-local](#)' in GR, and the solutions to the notorious problems in MTW, [p. 467](#).

Best regards,

Dimi

=====



Subject: Tom Kibble, The Sunday Times, 01.07.12, p. 7  
Date: Sun, 1 Jul 2012 16:21:23 +0100

Message-ID:

<CAM7Ekx=5+vJARgqL0=VHrn47Qdu\_QA8hA+mYzL=7xb3LtSGc3w@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Tom Kibble <t.kibble@imperial.ac.uk>

Cc: GERALDINE.SERVANT@cern.ch,

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GRAEME.WATT@cern.ch,

GEORGE.ZOUPANOS@cern.ch,

John.Ellis@cern.ch,

James.Gillies@cern.ch

Dear Dr. Kibble,

Regarding the recent "[discovery](#)" of some "god particle" and the invitation from [CERN](#) to attend their gathering next week, you've reportedly declined, but said: "My guess is that it must be a pretty positive result for them to be asking us out there."

I don't know how anyone from CERN can claim "pretty positive result" with "99.99% confidence". As John von Neumann put it, "There's no sense in being precise when you don't even know what you're talking about."

These people from CERN are ignorant of the (old) cosmological problem from 1930s: they cannot explain how the vacuum gravitates, cannot include the electron in their "standard model", nor can explain the miraculous precision with which the proton mass is being fixed by the "quantum chromodynamics binding energy",

[http://en.wikipedia.org/wiki/Proton#Quarks\\_and\\_the\\_mass\\_of\\_the\\_proton](http://en.wikipedia.org/wiki/Proton#Quarks_and_the_mass_of_the_proton)

<http://www.god-does-not-play-dice.net/#Dolgov>

But they have money. A humongous amount of money. **Billions and billions of Euro.**

Anyway, I think the explanation of CERN's "[god particle](#)" is only possible in the framework of quantum gravity,

<http://www.god-does-not-play-dice.net/#ESI>

<http://www.god-does-not-play-dice.net/#CERN>

As Lord Rutherford noticed in his 1962 Brunel Lecture (14 February 1962), "[We haven't the money, so we've got to think!](#)"

Yours sincerely,

Dimi Chakalov

35 Sutherland St  
SW1V 4JU

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**Note:** [CERN](#) didn't of course detect any "[god particle](#)" directly, but [smashed protons](#) to seek *those particular* debris from the crash, which could have been interpreted with *their* "theory" as originating from the collision of protons in which a "god particle", or rather "[the heaviest boson ever found](#)", or maybe some [spin-2 particle](#), *might have been* present.

The first obvious problem is that [CERN](#) used something they do **not** understand: the very *generation* of proton mass, fixed by the quantum vacuum with an [error margin](#) of **one** part in  $10^{45}$ . Since they don't have any theory to explain such astonishing precision by which the quantum vacuum produces their source particles (nor can incorporate the electron in their "standard model"), CERN has in fact employed a *miracle* in their "theory" -- see John von Neumann [above](#).

The second problem is that these people at [CERN](#) have not made any efforts to explain the main puzzle known since 1929: [the tracks from individual quantum particles](#). They can't use "decoherence" nor "collapse of the wave function", and can't use [Hilbert space](#) either.

But again, [CERN](#) has an *enormous* amount of money -- **billions and billions of Euro**. Which is why they live in a **total socialism** and just don't care. The next monster may be a linear electron-positron collider tens of kilometers long with a [price tag of over €10bn](#).

As [Johann Makowsky](#) noted (*The Jerusalem Post*, 19.04.1985), "Overfunded research is like heroin: It makes one addicted, weakens the mind and furthers prostitution."

D. Chakalov

July 4, 2012

Last updated: July 9, 2012

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Subject: [arXiv:1203.5552v2 \[gr-qc\]](#)

Date: Fri, 27 Jul 2012 11:46:27 +0300

Message-ID:

<CAM7EkxnPC2hqc=zUmtk-dC-tY3cPB-8nUJgCRozK\_huOZz-tSA@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Kameshwar Wali <wali@phy.syr.edu>, shankark@bu.edu,

Cc: marc777@bu.edu, MarcWHoward777@gmail.com,

hehl@thp.uni-koeln.de,

luca.fabbri@bo.infn.it

Dear Dr. Wali,

You and your colleagues introduced a special "axis of foliation" and "non-vanishing torsion components along that dimension".

In my opinion, **the only way** to make the torsion and your "fifth dimension" hidden is explored at

<http://www.god-does-not-play-dice.net/#Recami>

All you need is to model the Universe as a brain,

<http://www.god-does-not-play-dice.net/#Seung>

All the best,

Dimi Chakalov

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**Note:** The phenomenon which *induces* rotation of celestial bodies in the local (physical) mode of spacetime comes from '[the sufficient conditions for spacetime](#)': check out the '[ideal waywiser](#)' and the [purely affine connection](#). It is manifestly wrong to seek some cold [non-baryonic dark matter](#) with positive energy density in the [axis of galaxy rotation](#), the [cosmic equator](#) included. The quantum presentation of [torsion](#) also *induces* "spin", but nobody would seek some 'axis of electron rotation' in the quantum world.

But in the current version of GR, people are prone to all sorts of cheap and primitive ideas, such as "[supermassive black holes](#)". Surely the effect is "dark", simply because it comes from '[the whole universe](#)'. Ignore it at [your peril](#).

D. Chakalov

July 30, 2012

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Subject: "Universal semiclassical asymptotic structure for large spatial volumes", [arXiv:1207.6653v1](#)  
[\[hep-th\]](#)

Date: Tue, 31 Jul 2012 13:24:09 +0300

From: Dimi Chakalov <dchakalov@gmail.com>

To: Thomas Hertog <thomas.hertog@fys.kuleuven.be> ,

IGUS Jim <hartle@physics.ucsb.edu>

Cc: [\[snip\]](#)

Dear Tom,

You, Stephen Hawking, and Jim Hartle speculated about some "universal semiclassical asymptotic structure for large spatial volumes." You compared "a tennis ball in flight" with "the evolving universe as a whole", and introduced the notions of "a quantum state of a closed universe" and "closed spacelike surface".

I'm afraid your ideas are sheer poetry, because you cannot define '[spacelike infinity](#)' :

<http://www.god-does-not-play-dice.net/#asymptotics>

Thus, you cannot talk about 'spacetime'. It is like a coin with two faces, and if you cannot describe one of its presentations, the whole "coin" is sheer poetry.

Shall I elaborate? Check out

<http://www.god-does-not-play-dice.net/#Angelo>

All the best,

Dimi

=====

Subject: [arXiv:1208.1463v1 \[gr-qc\]](#)  
Date: Thu, 9 Aug 2012 02:05:20 +0300  
Message-ID:  
<CAM7Ekx=kG3pvGMD4xSpeNr2DFJZ9ER+VJnCaMpBEFrVd+RFsTg@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Martin Bojowald <bojowald@gravity.psu.edu>  
Cc: [Abhay Ashtekar](#) <ashtekar@gravity.psu.edu> ,  
[Alejandro Perez](#) <perez@cpt.univ-mrs.fr> ,  
Carlo <rovelli.carlo@gmail.com> ,  
Karel V Kuchar <kuchar@physics.utah.edu>

Martin Bojowald: "Long-standing conceptual issues, such as the problem of time, can partially be solved at least in semiclassical regimes..."

No, Martin, there isn't any "partial" solution to the problem of time. You either solve it, or not.

You cannot, not even in principle, solve the problem of time, because you adopted the splitting of spacetime.

As Abby Ashtekar acknowledged in [arXiv:gr-qc/0410054v2](#), p. 32, "A common criticism of the canonical quantization program pioneered by Dirac and Bergmann is that in the very first step it requires a splitting of space-time into space and time, thereby doing grave injustice to space-time covariance that underlies general relativity. (...) Loop quantum gravity program accepts this price... "

### **Loop quantum gravity is for the birds.**

If you wish to have a professional discussion, I can send you the references, most of which are quoted at my web site.

If you prefer to waste your professional life with "[loop quantum gravity](#)", don't bother to respond. You will be publishing "effective" papers and exercise conference tourism for the rest of your life, like [Abby Ashtekar](#).

The choice is yours.

All the best,

Dimi

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**Note:** John S. Bell stressed that "reality has been identified [only at a single time](#)," hence the fundamental phenomenon called 'time' refers to the **agent** which (i) keeps the genidentity (Genidentität, Kurt Lewin) of the physical world at these instants of 'single time', and (ii) transfers the changed-in-time physical states *via* the '[dark Zen gaps](#)' denoted with " / " [above](#). In simple words, some properties of the physical system remain invariant 'during time' ("everywhere and for all time", [Ciufolini and Wheeler, p. 270](#)), while other 'change in time'.

However, once you embrace the "splitting" of spacetime in GR, you end up with a notion of 'time' which is not, and cannot be fundamental, because it can "evolve" just as much as space can. It's a dead frozen block universe ([Robert Geroch](#)). It doesn't matter if that dead frozen 'block' is flat or curved -- it cannot evolve **in that same** 3-D space.

Thus, you need to make 'space' dynamical along the [Affine Connection](#), which is the crux of the [Arrow of Space](#). But if you try to introduce such [global Heraclitean time](#) into present-day GR, it **must** break the "Lorentz invariance defining a cosmic (global) time", as well as "break the Galilei invariance

defining observers which are **at rest** with respect to the cosmic background radiation" (Luca Lusanna *et al.*, [arXiv:1007.4071v1 \[gr-qc\]](https://arxiv.org/abs/1007.4071v1)). Hence the solution to the problem of time in "classical" GR (which isn't "classical" at all) requires an upgrade of Einstein's GR to Machian quantum gravity.

[Karel Kuchar](#) was supposed to deliver a talk at the [Einstein Conference in Prague](#), entitled 'Canonical quantum gravity: Einstein's posthumous anathema', but he didn't attend. Good for him. There is no sense to explain the problems of [time & energy conservation in GR](#) to people who aren't interested in such "[can of worms](#)".

Conference tourism with "[loop quantum gravity](#)" and "[GW astronomy](#)" is far more pleasant.

D. Chakalov  
August 9, 2012

=====

Subject: Re: [arXiv:1206.6224v1 \[quant-ph\]](https://arxiv.org/abs/1206.6224v1)  
Date: Fri, 10 Aug 2012 10:32:02 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Avshalom Elitzur <Avshalom.Elitzur@weizmann.ac.il>  
Cc: "elياهو@post.tau.ac.il" <elياهو@post.tau.ac.il>, "yakir@post.tau.ac.il" <yakir@post.tau.ac.il>, Charles H Bennett <bennetc@us.ibm.com>, Lev Vaidman <vaidman@post.tau.ac.il>

On Fri, 10 Aug 2012 04:52:29 +0000,  
Message-ID: <BD81F37CEFF22C4FBE5B99D38920F0BC5A22DABE@ibwmbx03>,  
Avshalom Elitzur <Avshalom.Elitzur@weizmann.ac.il> wrote:

>  
> Dear colleagues  
> This guy is a pathetic spammer who keeps harassing Shahar and me for  
> many years begging us to read his rubbish.

The "rubbish" in question has nothing to do with your speculations, but with the facts posted at

<http://tinyurl.com/steel-evaporation>

As to your arXiv:1206.6224v1 [quant-ph], I recall a paper by Lev Vaidman and Yakir Aharonov, in which they confessed that haven't been able to reach a consensus on the proper interpretation of QM.

In your case, I intended to ask you to declare the conditions under which you will acknowledge that your ideas are wrong. But you can't do that, Avshalom. Your brain isn't working properly. Read [Asher Peres](#).

All the best,

Dimi

>> -----Original Message-----  
>> From: Dimi Chakalov [mailto:dchakalov@gmail.com]

>> Sent: Friday, August 10, 2012 3:17 AM  
>> To: Avshalom Elitzur; eliahuco@post.tau.ac.il; yakir@post.tau.ac.il  
>> Cc: Charles H Bennett  
>> Subject: arXiv:1206.6224v1 [quant-ph]  
>>  
>> Dear colleagues,  
>>  
>> I endorse the opinion of [Charles Bennett](#) on your "encrypted anticipation".  
>> The late Asher Peres would have said much more, I suppose.  
>>  
>> Check out Erwin Schrödinger,  
>> <http://www.god-does-not-play-dice.net/#Joel>  
>>  
>> Shall I elaborate, or would you prefer to keep quiet, as usual?  
>>  
>> All the best,  
>>  
>> Dimi Chakalov

**Note:** The reason to remind the opinion of Erwin Schrödinger [above](#) is the following quote (emphasis added) from Yakir Aharonov and Lev Vaidman (2001), The Two-State Vector Formalism of Quantum Mechanics, [arXiv:quant-ph/0105101v1](#):

"One of us (YA) is not ready to adopt the far reaching consequences of the MWI. He proposes another solution. It takes the TSVF even more seriously than it was presented in this paper. Even at present, before the "future" measurements, the backward evolving quantum state (or its complex conjugate evolving forward in time) exists! It exists **in the same way** (Sic! - D.C.) as the quantum state evolving from the past exists. This state corresponds to particular outcomes of **all measurements** in the future."

The set of "particular outcomes of **all measurements** in the future" includes the non-commuting observables interpreted with Bell-like "counterfactuals" (Tim Palmer, [p. 7](#)), so it is utterly unclear what kind of 'time' could be associated with such set of *ontic* states -- certainly **not** the one recorded with your wristwatch, because in the spacetime of STR one cannot have two or more *ontic* quantum states living simultaneously at one spacetime point/event.

Yet people try to interpret all quantum "mysteries" (Tim Palmer, [Fig. 1](#)) in the context of STR, despite the fact that the quantum realm is "connected" to the macroscopic world only with, and *nothing but*, the "probabilities" in the Born rule ('[shut up and calculate](#)'). They try to *sieve* the quantum world through the distorting "filter" of the spacetime of STR, only to find comfort in the famous claim by [Richard Feynman](#) that nobody *understands* QM.

Regarding the EPR [Gedankenexperiment](#), for example, people are prone to speculate about some "nonlocal Gespensterfelder" (a ghost field devoid of momentum and energy) which *might* have fixed "instantaneously" the spin of the entangled particle(s), *had we been able* (notice again the counterfactual "reasoning") to *observe* these quantum correlations in the spacetime of STR. But in fact, we can't. There is nothing more deceptive in QM textbooks than "the time parameter in the Schrödinger equation". All you can claim, **retrospectively**, is that some sort of nonlocal, faster-than-light correlations *might* have happened -- *had you been able* to *observe* these quantum correlations in the spacetime of STR -- but you simply cannot employ them to perform **work** "online", because they do **not** "unfold" along the time recorded with your wristwatch, and in the reference frame of your lab.

Ditto to the temporal "effects". Neither spatial nor temporal "quantum mysteries" can be employed to perform **work** at the length scale of tables and chairs. You cannot manipulate quantum entanglement **locally** either, and neither Yakir Aharonov nor Charles Bennett and his "quantum computing" colleagues can reconcile QM with STR by mapping the *ontic* quantum states (recall the [KS Theorem](#)) to the spacetime of STR.

To be specific, Yakir Aharonov *et al.* wrote ([p. 14](#)): "The choice anticipated by the weak outcomes *can become known only after* (Sic! - D.C.) *that choice is actually made*. This inaccessibility, which

prevents all causal paradoxes like "killing one's grandfather," secures human choice full freedom from both past and future constraints." But this particular "inaccessibility" has been explained with the Conway-Kochen [Free Will Theorem](#), so why invent the wheel? We know **nothing** about the relativistic status of these *ontic* states endowed with free will, except that we can't fit them into *any* Hilbert space: recall Erwin Schrödinger [above](#). And that's the crucial lesson from Quantum Theory: no Hilbert space can accommodate the [UNdecidable, UNSpeakable, pre-quantum Kochen-Specker state](#) (never in plural), called here 'John'. A Hilbert space can only deal with John's "[jackets](#)" -- **not** the *ontic* quantum state called 'John'. Such *ontic* quantum state must be **both** "epistemological" **and** "objective and real", which means that it must have a brand new **structure** made of two components: the *real ontic* 'John' and his fleeting "[jackets](#)". The latter are being explicated one-at-a-time along the [Arrow of Space](#), with **unit probability** (see the lottery drawing [above](#)). It is "just that simple" [[Ref. 1](#)]. Otherwise you cannot resolve the measurement and macro-objectification problems, and reconcile [QM with STR](#).

In the context of the [empty set axiom](#), the conjecture here is that there exists an ontic quantum-gravitational object, called 'John', such that no **set** made from his "[jackets](#)" belongs to. Physically, 'John' is interpreted as '[empty set](#)'; details [above](#).

Carl Friedrich von Weizsäcker dubbed such *ontic* state '**ur** objects', and speculated that they "can be seen as indivisible objects in a rigorous but abstract and thus non spatial sense" (Martrin Kober, [p. 2](#)). I called these **ur** objects 'John' and offered the metaphor of [John's jackets](#), to reconcile [QM with STR and GR](#). Back in 1953, Wolfgang Pauli suggested that the concept of [final cause](#) ("the end (*telos*), that for which a thing is done", Aristotle, *Physics* 194b33) should be considered as a complement to relativistic causality, and that there is a *third kind of natural laws*, apart from deterministic and statistical laws, which consists in "correcting the fluctuations of chance by meaningful or functional coincidences of causally non-connected events" (*Die Vorlesung an die fremden Leute*, in *Der Pauli-Jung-Dialog und seine Bedeutung für die moderne Wissenschaft*, ed. by Harald Atmanspacher *et al.*, Berlin: Springer, 1994, [pp. 317-330](#)).

Here, this *third kind of natural laws* is modeled by a new form of retarded causality implemented by 'the [sufficient conditions](#) for spacetime', called *biocausality*.



It is always **retarded** along the [Arrow of Space](#), and requires [fundamental flexibility](#) (not "uncertainty") in the quantum-gravitational realm, in line with the Conway-Kochen [Free Will Theorem](#). Namely, the future is 'open' up to the **unknown** unknown (non-unitary dynamics), which makes the universe to some extent *acausal*: the biocausality **always** includes an additional input from the Aristotelian *final cause* as well, but the latter is unknowable, hence what happens in the future cannot be derived exclusively from the past. In brief, we live in an [open free will universe](#), which can best be illustrated with the statement by Henry Ford: "Whether you believe you can do a thing or believe you can't, [you are right](#)".

Not surprisingly, the biocausality works in the [living matter](#) as well: Dead matter makes quantum jumps; the living-and-quantum matter is smarter.

If some day Yakir Aharonov and his younger colleagues can do better, I suppose we all will hear about it on *CNN Breaking News*.

Meanwhile, read Asher Peres, "[Unperformed experiments have no results](#)", *Am. J. Phys.* 46, 745-747 (1978). You cannot **chain** such unperformed results and manipulate entanglement **locally**, to build a scalable "[quantum computer](#)", nor employ the "[encrypted anticipation](#)" to perform any **work** at the length scale of tables and chairs. You can *only* ignore Erwin Schrödinger and the [Kochen-Specker Theorem](#), publish your papers, and keep dead quiet.

"just another crank"

August 10, 2012

Last updated: October 19, 2012

[Ref. 1] Edwin T. Jaynes, [Probability in Quantum Theory](#), in: *Complexity, Entropy, and the Physics of Information*, edited by W. H. Zurek, Addison-Wesley, 1990.

"But our present QM formalism is not purely epistemological; it is a peculiar mixture describing in part realities of Nature, in part incomplete human information about Nature – all scrambled up by Heisenberg and Bohr into an omelette that nobody has seen how to unscramble. Yet we think that the unscrambling is a prerequisite for any further advance in basic physical theory. For, if we cannot separate the subjective and objective aspects of the formalism, we cannot know what we are talking about; it is just that simple. So we want to speculate on the proper tools to do this.

.....

"In other words, we cannot say merely that the atom **is** "in" state  $u_1$  or "in" state  $u_2$  as if they were mutually exclusive possibilities and it is only we who are ignorant of which is the true one; in some sense it must be in both simultaneously, or as Pauli would say, the atom itself **does not know** (cf. Schrödinger [above](#) - D.C.) what energy state it **is** in. This is the conceptually disturbing, but experimentally required, function of the superposition principle.

"We conjecture that this is the circumstance that also deterred Niels Bohr from making ontological statements, and forced him to use such cautious language. He would never say (as some of his unperceptive disciples did) that  $|a_n|^2$  is the probability that an atom **is** "in" the  $n$ 'th state, which would be an unjustified ontological statement; rather, he would say that  $|a_n|^2$  is the probability that, **if** we measure its energy, we shall find the value corresponding to the  $n$ 'th state.

.....

"If this seems at first to be an obstacle to our purpose, it is also our real opportunity, because it shows that the probabilities we seek, which are to express the incompleteness of the information in a pure state in terms of a set of mutually exclusive possibilities (call it an "ensemble" if you like), **cannot** be the usual things called "probability" in the QM textbooks."

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Subject: The passage of time, [arXiv:1208.2611v1 \[gr-qc\]](#)

Date: Tue, 14 Aug 2012 04:45:24 +0300

Message-ID:

<CAM7EkxkBzhQW-4FRI5QLp2wsaCezfXfgk31\_9PvwQ4yiSRUPoA@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Rituparno Goswami <Rituparno.Goswami@uct.ac.za>

Cc: niall@ucc.ie, cpsoo@mail.ncku.edu.tw,

hlyu@phys.sinica.edu.tw, gerlach@math.ohio-state.edu,

seancarroll@gmail.com, George.Ellis@uct.ac.za

Dear Dr. Goswami,

You and George claim that the "passing of time marks the change from indefinite (not yet existing) to definite (having come into being); the present marks the instant at which we can act and change reality."

Since we are relativists, the special dynamical status of 'the present' poses the question: with respect to [what](#) ?

The only possible answer is offered with [the reference fluid in GR](#) and the Arrow of Space,

[http://www.god-does-not-play-dice.net/#OM\\_GR](http://www.god-does-not-play-dice.net/#OM_GR)

<http://www.god-does-not-play-dice.net/#Recami>

As to the blog of [S. Carroll](#), check out

<http://www.god-does-not-play-dice.net/#Seung>

All the best,

Dimi Chakalov

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**Note:** Regarding the *flow* of time, there are three options: (i) it does not exist, (ii) it *does* exist (e.g., [George F R Ellis](#)), and (iii) YAIN. The last option is explored at this web site, with the [Arrow of Space](#) explained with the Photoshop metaphor [above](#). At the instant 'now' from the local (physical) mode of spacetime, the flow of time is nonexistent (i), as the Unmoved Mover ([Karel Kuchar](#)) must not exist there in any way, shape, or form whatsoever, or else the "[aether](#)" will show up and destroy GR; in the context of current GR textbooks, this is the case of the so-called 'free fall' (Harvey S. Real, [p. 3](#); MTW, [p. 467](#)), the "conservation" of energy ([Hans Ohanian](#) and [Erik Curiel](#)), and [linearized gravity](#) (in Quantum Theory, we have *there only one* "[jacket](#)" cast from 'John', with [unit probability](#) -- one-at-a-time along the [Arrow of Space](#)). All "[normal](#)" and "dark" effects of gravity ([Chris Fewster](#)), and 'the [necessary conditions](#) for spacetime' in general, get smuggled along the Arrow of Space at **the next** instant 'now', but from the [global mode of spacetime](#). There is no way to preserve the "probability current" along the [non-unitary transitions](#) in the Arrow of Space, that is, [between](#) the instants 'now': every ([dead frozen](#)) universe (Photoshop [layer](#)) is newly created. The accumulated, along the Arrow of Space, universes blend into a *physically* observable (local mode) single universe cast on a [perfect continuum](#): the "[dark Zen gaps](#)" are totally eliminated there. *Voila*.

The conceptual error of George Ellis is encoded in his claim that the [Weyl Principle](#) can outline some *flow* of time [[Ref. 1](#)] in the *current version* of GR. No way. Surely we can *imagine* some 'explicit but unobservable', non-dynamical time ([W.G. Unruh & R.M. Wald](#)), but it **cannot** be 'GR observable' -- see the bewildered Tom Thiemann [above](#).

My last effort to contact George Ellis was in December 2008, regarding his essay 'On The Flow of Time' posted on the [FOXi Forum](#). He claimed ([Dec. 29, 2008 @ 17:53 GMT](#)) that "... the surfaces  $S: \{s = \text{const}\}$  are the globally preferred surfaces of time ("constant proper time since creation of the universe") on which coming into being **will** take place".

Well, I suggested 'the proof of the pudding': try to resolve the big old "[can of worms](#)" in GR by calculating the "localization" of GW energy (MTW, [p. 467](#)) along that "proper time". To be specific, I wrote ([Jan. 2, 2009 @ 14:30 GMT](#)):

"Perhaps it will be a good idea if George Ellis proves that EBU hypothesis could be "a preferable model to the BU" by calculating the localization of GW energy along the proper time of the [wristwatch of LIGO's operator](#)."

Not surprisingly, George Ellis didn't like the idea. As he elaborated previously (emphasis mine) on [Dec. 12, 2008 @ 04:24 GMT](#):

"Time in GR is represented as integrals along particle world lines, related to measurement and physics by ideal clocks (which of course being physical objects move along timelike world lines). The underlying assumption is different such clocks (atomic, electromagnetic, mechanical, etc) will all concur on **one universal concept of time** ('proper time') along the world line. A key issue here is how quantum based clocks measure time relative to classically based clocks; and of course also clocks are sensitive to gravitational potential energy, ..."

But how can **all** clocks, both classical and quantum, concur on **one universal concept of time** ('proper time'), on which coming into being **will** take place? As George Ellis acknowledged ([Dec. 10, 2008 @ 21:41 GMT](#)), "the outcome of quantum events is unknown and indeed undetermined until they happen." You need a new [Quantum Theory](#) [[Ref. 1](#)].

There is no preferred location in 3-D space of *the* point/event at which 'coming into being **will** take place', so we have to endow **all** spacetime "points" with the global **unique** 'coming-into-being' status, which will in turn define an absolute now-at-a-distance (pseudo-Cauchy) slice, resembling perhaps a transcendental tachyon which "travels" everywhere for zero time. This would be *the* absolute global "instant at which we can act and change reality" ([arXiv:1208.2611v1 \[gr-qc\]](#)).

Forget it, [George](#). You need the absolute reference frame of the "aether" ([Ta-Pei Cheng](#)) and the [reference fluid of GR](#) to define the *flow* of time [[Ref. 2](#)], otherwise it will be a meaningless self-referential jabberwocky. Then you need the [Arrow of Space](#), as 'change **of** space', plus a new [Quantum Theory](#) and a better proposal for your [Finite Infinity](#), to tackle the [asymptotic behavior](#) of spacetime and its [time-orientability](#).

D. Chakalov

August 14, 2012

Last updated: August 29, 2012, 15:36 GMT

[[Ref. 1](#)] George F R Ellis, The arrow of time, the nature of spacetime, and quantum measurement, October 7, 2011, pp. 33-34  
[http://www.mth.uct.ac.za/~ellis/Quantum\\_arrowoftime\\_gfre.pdf](http://www.mth.uct.ac.za/~ellis/Quantum_arrowoftime_gfre.pdf)

#### "7.1.2 Proposal

"The evolving nature of space time: the proposal is a Evolving Block Universe picture of spacetime, where the essential difference between the past (it exists) and future (it does not **yet** exist) generates a time asymmetry in all local physical processes. Spacetime starts at the beginning of the universe and then grows steadily until the end of time.

"At **any** instant the ontological nature of the past, present and future is fundamentally different.

"The way this asymmetry "reaches down" to the quantum measurement process and the state preparation process is **still to be clarified**."

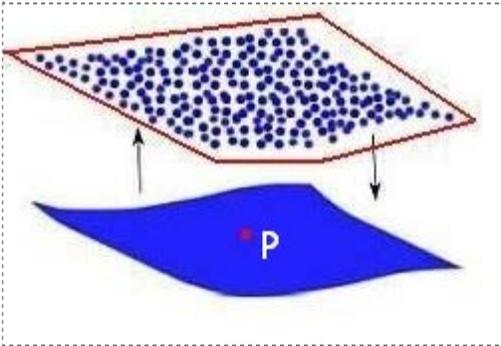
[[Ref. 2](#)] [That Mysterious Flow](#), by Paul Davies, *Scientific American*, September 2002, pp. 42-43, 'How Time Doesn't Fly':

"SEVERAL PHILOSOPHERS have arrived at the same conclusion by examining what we normally mean by the passage of time. They argue that the notion is internally inconsistent. The concept of flux, after all, refers to motion. It makes sense to talk about the movement of a physical object, such as an arrow through space, by gauging how its location varies with time. But what meaning can be attached to the movement of time itself? Relative to what does it move? Whereas other types of motion relate one physical process to another, the putative flow of time relates time to **itself**. Posing the simple question "How fast does time pass?" exposes the absurdity of the very idea. The trivial answer "One second per second" tells us nothing at all.

.....

"By convention, the arrow of time points toward the future. This does not imply, however, that the arrow is moving toward the future, any more than a [compass needle](#) pointing north indicates that the compass is traveling north. Both arrows symbolize an asymmetry, not a movement. The arrow of time denotes an asymmetry of the world in time, **not** an asymmetry or flux of time. The labels "past" and "future" may legitimately be applied to temporal directions, just as "up" and "down" may be applied to spatial directions, but talk of the past or the future is as meaningless as referring to the up or the down."

=====



Subject: The imaginary part of the gravitational action, [arXiv:1305.2207v1 \[gr-qc\]](https://arxiv.org/abs/1305.2207v1)  
Date: Mon, 13 May 2013 11:32:48 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Yasha Neiman <yashula@gmail.com>  
Cc: rmyers@perimeterinstitute.ca,  
norbert.bodendorfer@googlemail.com,  
ebianchi@perimeterinstitute.ca,  
ashtekar@gravity.psu.edu,  
lbszab@rmki.kfki.hu,  
helfera@missouri.edu

Yasha,

You believe that "the GR action is the result of a quantum-gravitational path integral" bounded with "flip surfaces" and "hidden" topological corners, and acknowledged that "the general physical meaning of the action's imaginary part is unclear."

It is certainly unclear to you and your colleagues, for you all didn't even try to understand the facts from 1912,

<http://www.god-does-not-play-dice.net/#balkanization>

More at

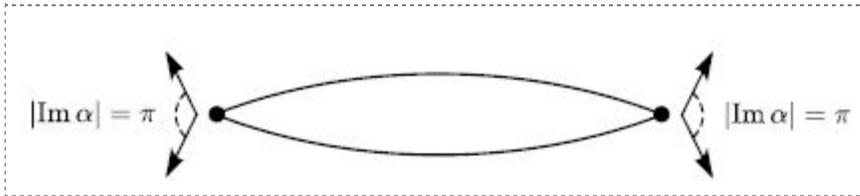
[http://www.god-does-not-play-dice.net/#RS\\_gravity](http://www.god-does-not-play-dice.net/#RS_gravity)

If you're interested, I can try to explain the error on p. 22.

D. Chakalov

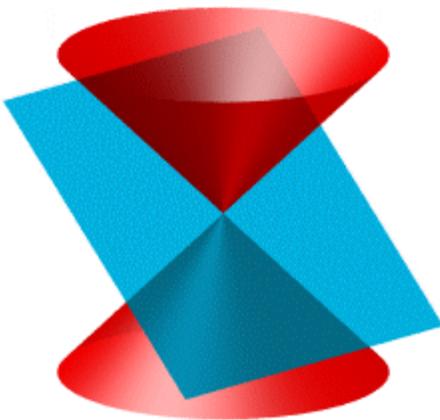
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**Note:** Here's Y. Neiman's drawing on p. 22, with "flip surfaces" and "hidden" topological corners:



It shows "a purely spacelike closed boundary, composed of two intersecting hypersurfaces. The full circles denote the intersection surface," but only some absolute or meta-observer like [Chuck Norris](#) could perhaps "see" it *en bloc*. Recall that we are confined *inside* spacetime, and if we try to suggest some special "end-points" that belong to a finite spacetime domain confined *inside* spacetime as well, the "boundary" (and also "trapped surface", [Adam Helfer](#)) will be **ill-defined** at these "end points". Why? Because they must **not** belong to the initial finite spacetime domain. These "end points" belong to the *global mode* of spacetime, and are physically *nullified*, as in the case of "[singularity](#)". This is *the only way* to introduce [boundaries on spacetime](#). Unless, of course, Yasha Neiman prefers [cat food](#).

Let me repeat the main ideas of the so-called [Arrow of Space](#), with which the phenomenon of transience ([Abner Shimony](#)) from the 'flow of time' is brought into [General Relativity](#): the Arrow of Space evolves along a **null-surface**, and at any instant 'now' the "time vector" from the [binding-of-points phenomenon](#) is completely and totally **zero**, as recorded with your physical ([unanimated](#)) clock. Thus, the new **w-axis** of the Arrow of Space, along which the *emergence* of spacetime ([Isham and Butterfield](#)) takes place, is **always** zero in the local (physical) mode of spacetime. Namely, the "[direction](#)" of the *emergence* of spacetime must **not** be *physically* detectable, because it "points" to a **luxonic world** (cf. Max Tegmark below) at which the whole universe has **already** reached its asymptotic [null-and-spatial infinity](#), and is 'stand still' -- **it** has become ONE.



Only [living creatures](#), such as the [human brain](#), can "read" this global *flow of time*, as 'change of space', while an [unanimated physical clock](#) can only read 'change *inside* space', which is a fictitious fake [coordinate "time"](#), as explained in 1967 by [Bryce DeWitt](#). And since everything happens '*inside* space' by means of 'time', we have particular **component** from the **global** flow of time, which is accessible *only* to living-and-quantum-gravitational systems and *only during* the Arrow of Space. This elusive **component** is projected at a point **x** (see the two drawings below) and is completely **fused** (Sic! - D.C.) at the same point **x** with the fake [coordinate "time"](#) from 'change *inside* space', which is why it completely **disappears** upon *physical* observations, leaving the [impression](#) that it doesn't exist.

This *component* from the *global* flow of time carries **pure energy** only, and only to the right-hand side of the [field equations](#), in terms of "*intangible* energy of the gravitational field" ([Hermann Bondi](#)) which is destined to be **already**-converted at *the same* point **x** into an **already**-linearized tangible

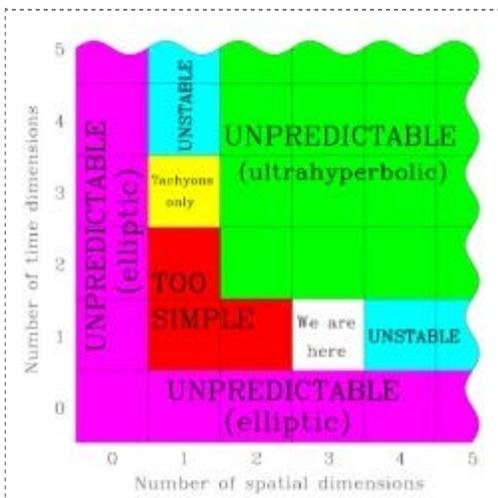
energy -- see the explanation of 'already' by clicking the animated picture below.



Stated differently, the *intangible* energy of the gravitational field **inevitably** leads to non-conservation of energy ([Hans Ohanian](#)) of *the whole universe*, but we can never see it as 'gravitational energy *per se*' that was somehow "added" to the *tangible* forms of energy in the right-hand side of the [field equations](#), like butter spread on a toast. **No**. We can *only* notice the perpetual flow of *tangible* energy, and [post factum only](#). Briefly, the true **dynamics** of General Relativity (forget about [ADM](#)) is manifested with the *flow of time* based on the *flow of tangible energy*, produced by **already**-converted, **pure** and *intangible* energy of the gravitational field. And since we need to define 'time' as bundled with energy conservation, [the only available option](#) we have is to include 'the invisible cat Macavity' ([Adam Helfer](#)), as suggested with Eq. 1, p. 35, in [ExplanatoryNote.pdf](#) from September 26, 2010. Not surprisingly, nobody showed any interest whatsoever, [as expected](#). Instead, people choose to stick to their GR textbooks and present this *intangible pure* gravitational energy as coming from some mundane stuff with **positive** energy density, only to confirm "[the worst theoretical prediction](#) in the history of physics" -- the cosmological "constant" problem known since [1930s](#).

Notice also that this [post factum](#) conversion can be **reversible**: under [specific conditions](#), matter can **dissolve** back to the quantum vacuum, namely, back to the quantum "[cloud](#)".

All this is highly important: *physically*, the invisible cat Macavity ([Adam Helfer](#)) might look like an "inverted" or "mirror" world ([Max Tegmark](#)), as speculated also by [Yakov Terletsii](#).



Max Tegmark, [arXiv:gr-qc/9702052v2](#): "The only remaining possibility is the rather contrived case where data is specified on a **null hypersurface**. To measure such data, an observer would need to "live on the light cone", *i.e.*, travel with the speed of light ... (its proper time would [stand still](#))."

**NB:** Again, all we can observe in right-hand side of the [field equations](#) fits in the range between " $6 \times 10^{-10}$  joules per cubic meter" ([John Baez](#)) to an equivalent in energy to **five** solar masses emitted in under 60 seconds in the form of [X-rays and gamma rays](#): "Within the jet, matter was expelled at over 99.9999 % of the speed of light." Thus, if matter can **dissolve** back to the [quantum-gravitational vacuum](#), it may not keep quiet at all.

Recall also that the [pure dark energy](#) of 'the universe as ONE' (global mode of spacetime) is mathematically "hidden", as explained below.

Strangely enough, if you show [the "set" errors](#) in the ["the worst theoretical prediction in the history of physics"](#), these people wouldn't care. Or will stubbornly claim that cannot understand this crucial issue from [1935](#). Or both.

Now, the specific question raised [above](#) is whether 3D null hyperplanes can \*hide\* the flow of time from direct physical observations, because the elementary **step** into the potential future in the Arrow of Space requires "discrete" or *nonsmooth topology changes*. Again, these [nonsmooth topology transformations](#) take place exclusively in 'the whole universe as ONE' (global mode of spacetime), and will be rendered **zero** in the *local* mode (see [below](#)), thanks to which the latter is a [perfect physical continuum](#) of 'world points' ([Bergmann and Komar](#)) at which "the metrical character (curvature) of the four-dimensional spacetime continuum is determined at every point by the matter **there**, together with its state" (Albert Einstein, *Kosmologische Betrachtungen zur allgemeinen Relativitätstheorie*, 1917).

According to [Tipler's theorem](#) from 1977, the *positiveness* of the energy-momentum [tensor](#) would ensure that there can be no changes in the [topology of spacetime](#), hence the causal structure of spacetime is "secured", meaning the spacetime is **dead frozen**. Our proposal is spelled out with option YAIN (iii) [above](#), and requires to **insert** topology changes in the *global* mode of spacetime at the "two" edges of the *local* mode of spacetime, namely, both at "asymptotic infinity" and [between](#) the **quasi-local** points (the [empty set R](#)). Keep in mind, however, that in the *global* mode of spacetime these "two" edges actually belong to **ONE** entity (see above).

Stated differently, the [Arrow of Space](#) *requires topology changes*: check out the puzzle of continuum from Georg Cantor [[Ref. 1](#)] and find out how "dimensions" are build up by the [Arrow of Space](#), one-point-at-a-time ([time dimension](#)), step-by-step "separated" by [null hypersurfaces \(causal boundaries\)](#), leading to the *emergence* of spacetime. If you talk about the cardinality of the "set" of points, recall the phenomenon which *produces* these [uncountably infinite](#) points: the *emergence* of spacetime along the [Arrow of Space](#).

The crux of the task is depicted with the idea of Quantum Geometry in the drawing [above](#): the quantum-geometrical 'world point' ([Bergmann and Komar](#)) must be produced by the [quantum-gravitational properties of matter](#), after which we may "shrink" the structure and dynamics of this quantum-geometrical world point into a classical "point" used by "[bartenders](#)". We cannot take the opposite route and try to *derive* [Quantum Geometry](#) from the classical 'open sets' ([James Dungundji](#)). The fundamental questions of associating numbers with a given **quasi-local** point and its **re-coordination** [[Ref. 2](#)] require brand new mathematical insights introduced from [Quantum Theory](#).

For example, "the heart of the principle of **general relativity**" [[ibid.](#)] is based on the presumption that the 'world point' ([Bergmann and Komar](#)) **P** is uniquely defined as a *geometrical* point, in order to attach later a [tangent vector](#) at it. However, this metaphysical presumption may be valid iff we were working with some fixed background spacetime providing such fictitious "points" of *perfectly localized* matter from the outset. Then we could simply ignore gravitation and present such **non-gravitating** matter as 'objective reality *out there*', such as showing particular object on a map, say, the main building of the University of Milan in Italy.



If we consider the 'world point' **P** above, we say that the **properties** (Eigenschaften) of matter and fields at **P** are invariant under coordinate transformations, since **P** exists as 'objective reality *out there*', and these properties will **not** change if we choose a new map with different coordinates of **P**. Such *invariance* of properties under coordinate transformations from different maps **always** requires a *perfect localization* at **P** to define these properties, but in [General Relativity](#) **P** cannot be a **preexisting** fixed geometrical point. We do have the crucial *perfect localization*, but at a **quasi-local** point (forget about "closed spacelike 2-surface"), because we *cannot* define the gravitational energy density at a **classical** point (MTW, [p. 467](#)). Again, the localization of matter is again *perfect*, but does **not** correspond to 'objective reality *out there*' from classical physics, because such localization at a **quasi-local** points is [quantum phenomenon](#) from [Quantum Geometry](#). In simple words, a **quasi-local** point has a [quantum structure](#) depicted in the drawing [above](#).

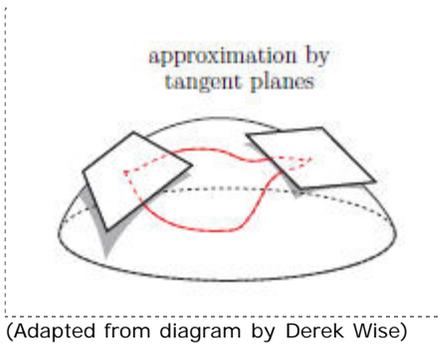
These unsolved questions of General Relativity require proper [Quantum Theory](#), but are not taken into account by mathematical physicists. [Carl Brans](#), for example, was not interested (private communication, 2012) and bluntly ignored these challenges. Anyway. The first off unresolved problem of the continuum is the *emergence* of 'finite distances' -- hence '3-D space' and 'time' -- in the classical world, as explained [above](#) with a simple equation presenting the fundamental puzzle stressed some 2070 years ago by [Lucretius](#):

$$1/\infty \rightarrow 0$$

We denote with **1** every finite **interval** defined with respect to the [fixed point of The Beginning](#), such as 'one meter' and '[one second](#)', which obeys the [Archimedean axiom](#), hence is 'physical reality' and has been *dynamically* produced in the *local* mode of spacetime. We cannot explain, by using *exclusively* the [Archimedean axiom](#), how the product of 'infinity' and '[zero](#)' can produce such 'finite entity'. We need also the **non**-Archimedean global mode of spacetime and the phenomenon producing a finite "[speed](#)" of light, since **only** the [phenomenon of light](#) can take into account the "different number" of points in the continuum of Georg Cantor [[Ref. 1](#)], and -- notice the Big Puzzle -- "[read](#)" them in [such way](#) that some 'finite entities' with '[distance function](#)' can *emerge* in the *local* mode of spacetime with the [relation of intermediacy](#) [A (**zero**) B], interpreted as '**zero** is *the whole universe as ONE*, residing in the *global* mode of spacetime, [between](#) every two neighboring points A and B'.

But if you believe that we don't need topology changes and insist on working with a "frozen" spacetime with Lorentzian metric, check out (i) the Hilbert space problem (e.g., Claus Kiefer, arXiv:0812.0295v1 [gr-qc], [p. 9](#)) and (ii) the *measurable* effects associated with vacuum fluctuations (Emil Mottola, [arXiv:1006.3567v1 \[gr-qc\]](#)).

For a general outlook, read a brief explanatory note [here](#). You will need new degrees of freedom in your models of spacetime, which requires new mathematical ideas from [Quantum Theory](#) regarding "smooth manifolds" [[Ref. 3](#)] in Einstein's [Allgemeine Relativitätstheorie](#):



In my opinion, the drawing above is *the* most deceitful and misleading approximation in current GR textbooks (e.g., [Robert Wald](#)). It offers to our euclidean eyes some sort of "curvature", which "fits nicely in 3-dimensional flat Euclidean space" ([Baez and Bunn](#)), and is made **by** matter and fields with some initial "flat" surface. Sorry, only [Chuck Norris](#) and his distinguished colleagues at the [Perimeter Institute](#) can "understand" such textbooks. Here's why.

On the one end, "the flat spacetime should be a completely empty space without **any** kind of energy" (Hyun Seok Yang, [arXiv:1111.0015v3](#)), so we cannot promote it to some initial **elastic** body with initial, albeit vanishing small, global "dark" tension. On the other end, we cannot picture such non-existing "flat" jabberwocky as 'the flat limit of GR', and switch off gravity 'at a point' to obtain "geodesics" ([Alan Rendall](#)), because we can only make local observations 'at a point', but these "points" cannot be defined with the gravitational energy density (Erik Curiel, [pp. 1-4](#); MTW, [p. 467](#)) in the first place. Moreover, it has been noted by [Bernhard Riemann](#) that "the flat limit of a curved manifold is ambiguous in the sense that there are infinitely many manifolds with zero Riemannian curvature, but with different **shapes**" [[Ref. 4](#)]. Thus, we cannot reach GR from Minkowski spacetime, nor derive/recover the latter from the former as some "flat limit".

We can only look at one single point at which the intrinsic geometry of spacetime, defined with the curvature & torsion, is **not** present. But what could be the degrees of freedom of gravitational "field", to understand what "happens" due to gravity at this '*one point*' ?

Well, we know for sure that the *propagation* of gravitation cannot be confined *exclusively* to 4-D spacetime [[Ref. 5](#)] -- it will definitely **leak out**, which means that its *observable* effects can be detected **only** in *particular pattern* produced with test particles ("fish"), endowed with the faculty of **self-acting** (school of fish). The crux of the matter is about the *flow of time* -- not about 'time read with a dead clock'.

For the record: this fundamental issue was raised on [26 November 1999](#) in the context of "loop quantum gravity", and again on [19 February 2003](#) regarding LIGO, but hasn't been discussed so far (12 January 2013). I won't comment on the reason why people avoided it, but will briefly explain it with a simple drawing.

Recall that the gravitational field couples to **itself** ([Sean Carroll](#)), which produces wave-like pattern in the *holomovement* (swathe) of the bootstrapped, already-correlated and *quasi-local* test particles, which share their **pure dark energy**; a bit like a delocalized holistic "cloud" (here we need [Quantum Theory](#)) spread "**over**" [[Ref. 5](#)] the "school of fish" *en bloc*.

Let's say we have test particles (recall the Coca Cola bottles [above](#)), which can be influenced by their common delocalized holistic 'potential reality' during the *flow of time* from the Arrow of Space. They will swing back and forth in a **cycle** produced from gravitational waves (GWs). I will lower the dimensions to 1+1-D world, and show two cyclical patterns in 1-D space, evolving in 1-D *flow of time*, shown here with two instants, **t<sub>1</sub>** and **t<sub>2</sub>** (the "dark" red / "gaps" from the last drawing will have to be omitted).

xx\_x\_x\_x\_x\_x\_x\_x\_x\_x\_x\_x\_x  
 x\_x\_x\_x\_xx\_x\_x\_x\_x\_x

Perhaps people would be prone to suggest some "extra" space-like dimension [[Ref. 5](#)] to accommodate the (dimensionless, [Kip Thorne](#)) **amplitude** of the gravitational "wave", but there's no need for such multidimensional superstitions (one can also mention here the complications from quantum physics added to the question of geodesics, [MTW](#), p. 480).

But (i) *where* does gravitation propagate, and (ii) *how* does it interact **non-linearly** (cf. the 'drawing hands' by [Maurits Escher](#)) with the mundane stuff placed in the right-hand side of the [Einstein's field equations](#), in order to produce three orthogonal spatial directions along which we can see "as far as we like" ([Lee Smolin](#))?

Many great people have offered various guessing to question (i), ever since [Gunnar Nordström](#) tried in 1914, but have bumped into question (ii). Suppose, for example, that "gravitation may propagate along extra dimensions in excess of four, but it also propagate in a space-time subspace of some higher-dimensional space" ([Marcos Maia](#)): how would you construct **nonlinear** propagation of gravitational energy in "dimensions in excess of four" *and* propagation of its **source** in 4-D "subspace", in such way that we could see 'as far as we like'?

Forget it. We need quantum gravity. The first step (not final solution) is to avoid blatant errors: no multidimensional superstitions. Look at the drawing below (source [here](#)):

[x/x/x/x/x/x/x/x/x/x/x](#)

Every **x** state denotes a *physical* 3-D space with an *already*-linearized gravitational bootstrapping of *self-interacting* matter (local mode of spacetime). But where's da time? Well, these *uncountably* infinite **x**-universes are **re**-created in the '[dark Zen gaps](#)' denoted with **/**. Hence a '[time dimension](#)' is *accumulated* by the [Arrow of Space](#), one-**x**-at-a-time.

The result is gravitational *holomovement* of matter, which propagates *en bloc* (forget about [LIGO and Virgo](#)). But if you ask an expert about how does this "happen", you'll most likely hear some jabberwocky, because "after all, general relativity does seem to work well as a theory, and yet I can certainly read the time on my wrist watch!" ([Chris Isham](#)).

Yes, we all can read the time on our "wrist watch!", which is why we need to explain the [Arrow of Space](#) within some new, still uncovered, nontrivial mathematical framework.

D. Chakalov  
December 14, 2012  
Last update: May 14, 2013, 12:04 GMT

[Ref. 1] Tony Crilly with Dale Johnson, The Emergence of Topological Dimension Theory, in: *History of Topology*, ed. by Ioan M. James, North Holland, 1999, [pp. 1-24](#).

### 3. Cantor's "paradox" of dimension

While Bolzano could be regarded as a precursor, there is little doubt that Georg Cantor is the true father of dimension theory. In 1877 Cantor discovered to his own amazement that the points of a unit line segment could be put into one-to-one correspondence with the points of a unit square or even more generally with the points of a  $q$ -dimensional cube. Cantor's probing led him to exclaim to his friend Richard Dedekind (1831–1916): "As much as you will not agree with me, I can only say: I see it but I do not believe it" [3, p. 44]. The strange result immediately called into question the very concept of dimension. Was it well-defined or even meaningful?

As his correspondence with Dedekind shows, Cantor discovered these results in 1873. Cantor had met Dedekind by chance in Gersau during a trip to Switzerland in 1872 and their famous exchange of letters ensued [7, 8, 10, 23]. From his discoveries about linear sets of points it was perfectly natural for Cantor to wonder whether there were different types of infinite sets in the plane or in higher-dimensional spaces. In a letter to Dedekind dated 5 January 1874 he posed a tantalising new research question, a question which is basic to the growth of dimension theory:

Can a surface (perhaps a square including its boundary) be put into one-to-one correspondence with a line (perhaps a straight line segment including its endpoints) so that to each point of the surface there corresponds a point of the line and conversely to each point of the line there corresponds a point of the surface? [17, p. 132]

Subsequent to the Gauss Jubilee Cantor switched his line of attack. Instead of trying to prove that a one-to-one mapping could not exist he tried to construct one. This proved the key and in a letter to Dedekind of 20 June 1877 he presented a startling geometrical conclusion:

that surfaces, solids, even continuous figures of  $\rho$  dimensions can be put into one-to-one correspondence with continuous lines, thus figures of only one dimension; therefore, that surfaces, solids, even figures of  $\rho$  dimensions have the same power as curves [17, p. 133].

Immediately Cantor saw his result on the equal power or cardinality of sets of various dimensions as a criticism of the assumptions about dimension commonly held by the geometers of the time. Dimension was not a problem for them, and many were used to basing their investigations on intuition. They casually spoke of simply infinite, twofold, threefold, . . . ,  $\rho$ -fold infinite figures; they even regarded the infinity of points of a surface as the square of the infinity of points of a line or the infinity of points of a solid as the cube of the infinite set of points of the line. Cantor's result amounted to an attack on these "foundations" of geometry, on the very concept of dimension they were using uncritically.

[Ref. 2] Carl H. Brans, Exotic smoothness and spacetime models, Albert Einstein Institute, Golm, 2007, [ex-talk-aei-2007.pdf](#)

## Differential Topology = Global Calculus

In defining any point set,  $X$ , there may not be a priori any *preferred* way to associate numbers with a given point,  $\mathbf{p} \in X$ . For spacetime models,  $\mathbf{p}$  is an **event**. The process of assigning numbers is determined by the physical procedure associated with a **reference frame**, mathematically by a **coordinate patch**.

It is easy to get lazy and falsely secure about this matter since most spaces,  $X$ , considered in both physics and mathematics are modeled by subsets of  $\mathbb{R}^n$ , so each  $\mathbf{p}$  is “naturally” associated with an ordered set of real numbers. However, it is well known that

**Remark 1** The definition of coordinates is not unique.

From this arises the following question at the heart of the principle of general relativity:

**Question 1** Does re-coordination have any physical (or mathematical) consequences?

Process of assigning numbers to points in  $X$  is accomplished by an atlas of charts,  $(U, \phi_U : U \rightarrow \mathbb{R}^n)$ . To do calculus, need differential consistency in overlap,  $\phi_U \cdot \phi_V^{-1} \in C^\infty$ . A **differentiable structure** on  $X$  is defined by a maximal atlas, and makes  $X$  into a **differentiable**, or **smooth manifold**. The atlas enables the consistent definition of calculus over  $X$ , obviously indispensable for any physical theory.

The atlas contains coordinate transitions *within* a given  $X$ , but also allows the definition of a natural *equivalence* established by a **diffeomorphism**. This is a homeomorphism of one smooth manifold to another (or itself),  $f : X \rightarrow Y$ , which together with its inverse is smooth when expressed in the atlases on  $X$  and  $Y$  respectively.

[Ref. 3] Richard W. Sharpe, [\*Differential Geometry: Cartan's Generalization of Klein's Erlangen Program\*](#), Springer, 1997

## §1. Smooth Manifolds

The definitive modern definition of a smooth manifold seems to have been given by Hassler Whitney ([H. Whitney, 1936]), in which a smooth manifold is presented as floppy pieces of Euclidean space glued together with a sort of differentiable glue. But in order to gain perspective, we start our more detailed discussion with *topological* manifolds.

## Smooth Manifolds

The following definition comes into sharper focus if the meanings of the maritime terminology of “charts” and “atlas” are given due consideration.

**Definition 1.4.** If  $M^m$  is a topological manifold, then a (*smooth*) *atlas* on  $M$  is a collection  $\mathcal{A} = \{(U_i, \varphi_i)\}$  of charts such that

- (i) the  $U_i$ s form an open covering of  $M$ , and
- (ii) for each pair of charts  $(U, \varphi)$  and  $(V, \psi)$  in  $\mathcal{A}$ , the map

$$\Phi = \psi\varphi^{-1} |_{\varphi(U \cap V)}: \varphi(U \cap V) \rightarrow \psi(U \cap V)$$

is a smooth<sup>5</sup> (i.e.,  $C^\infty$ ) map between open sets in Euclidean space (*change of coordinates*; see Figure 1.5). For brevity, we may speak of the *chart*  $\varphi$ , leaving  $U = \text{domain}(\varphi)$  nameless. ☼

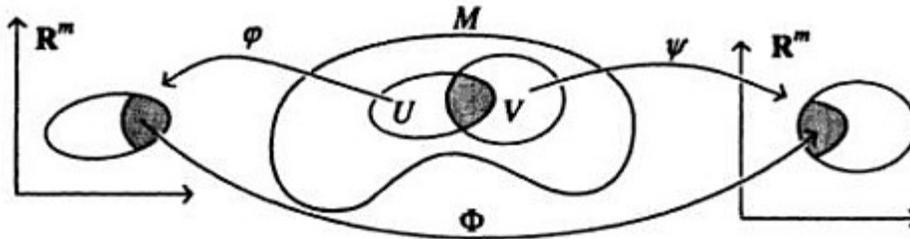


FIGURE 1.6. Change of coordinate system.

[Ref. 4] [Marcos Maia](#), private communication, January 11, 2013, 00:38:57 -0800 (PST).

[Ref. 5] Naresh Dadhich, On the derivation of the gravitational dynamics, [arXiv:0802.3034v1 \[gr-qc\]](#).

Gravity is an inherently self interactive force and the self interaction could only be evaluated by successive iterations. The Einstein gravity is self interactive but it contains only the first iteration through the square of first derivative in Riemann curvature. The question is how do we stop at the first iteration? The second iteration would ask for a quadratic polynomial in Riemann curvature which should give the corresponding term in the equation of motion. Thus the quadratic tensor,  $T_{abcd}$  as given in Eqn. (4) with specific coefficients, will alone meet the requirement for inclusion of the second iteration. However its effect in the equation of motion can be felt only for dimension,  $n > 4$ , and hence we have to go to higher dimension for physical realization of the second iteration of self interaction [4, 5]. It is remarkable that even classical dynamics of gravity asks for dimension  $> 4$ . As two and three dimensions were not big enough for free propagation of gravity, similarly four dimension is not big enough to fully accommodate self interaction dynamics of gravity. Then the most pertinent question is where does this chain end?

=====

Subject: No sign of axion at present  
Date: Fri, 18 Jan 2013 05:19:46 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Muhammad Asghar Hashmi <prof\_asghar@iub.edu.pk>, asghar\_hashmi@yahoo.com, mhashmi@iub.edu.pk

M. Asghar Jan 17, 2013 6:08 PM  
<http://physicsworld.com/cws/article/news/2013/jan/17/physicists-seek-cosmic-domain-walls>

No sign of axion at present

The project of the cosmic walls hinges on the existence of the particle called axion. The existence of this particle was proposed in the late 1970s, to neutralise the experimentally unfounded (via the very low lower limit on the neutron electric dipole moment of  $< 2.9 \cdot 10^{-26}$  e.cm) tendency of the strong interaction in the SM for the existence of CP violation. All the experimental work over the years has not shown any sign of existence of this particle.

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Dear Professor Asghar,

Thank you for your recent note. I believe the reason why people introduced "axion" is explained at

<http://www.god-does-not-play-dice.net/#Klauder>  
<http://www.god-does-not-play-dice.net/Klauder.pdf>

All the best,

Dimi Chakalov

=====

Subject: Gravitational waves and pulse-time red herrings, in [quadrupole approximation](#)  
Date: Fri, 14 Dec 2012 07:38:11 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Adam D Helfer <helfera@missouri.edu>  
Cc: [[snip](#)]

Dear Adam,

By reading your arXiv:1212.2926v1 [gr-qc], Sec. 1.2, '[A more general setting](#)', it seems you like red herrings,

[http://www.god-does-not-play-dice.net/#red\\_herring](http://www.god-does-not-play-dice.net/#red_herring)

But if you are good in math, try the task at

<http://www.god-does-not-play-dice.net/#Neiman>

All the best,

Dimi

-----

**Note:** The present [GW detectors](#) are designed on the basis of the [linearized approximation](#), contrary to the mathematical facts known from [Hermann Weyl](#) and [Hermann Bondi](#). Despite the PR efforts by [Bernie Schutz](#), [LIGO and the like](#) are manifestly blind and deaf to (i) the [nonlinear phenomenon](#) acknowledged in [GR textbooks](#) and (ii) the very [displacement](#) of spacetime caused by [gravitational waves](#). With respect to *what?* We can detect, at least in principle, such "displacement" of spacetime only *with respect to* the underlying [reference fluid of GR](#), and only by the physical, or rather *physicalized* effects of the spacetime metric, detected on matter. Thus, the proper GW detectors must be endowed with the faculty of *self-acting* from the Arrow of Space (cf. [above](#)), with the perpetual "displacement" of 3-D space along the [w-axis](#) that builds '[time direction](#)' as *perfectly continuous* (local mode of spacetime) instants 'now', one-at-a-time (cf. option YAIN (iii) [above](#)). And because the [gravitational waves](#) are *emerging* with the flow of time, they are truly fundamental phenomena which must **not** be [diffeomorphism-invariant](#) observables, and some people say that both GWs and the [flow of time](#) cannot "exist". Likewise, we cannot physically detect the human mind either, but only the nonlinear *self-interactions* of the [brain](#). Simple, no?

Just don't forget that, unlike [electromagnetism](#), any kind of energy is a source of gravity, and "every *dynamical* degree of freedom introduced to the system" ([Alex Schenkel](#)) will interact with the geometry through fundamentally **nonlinear** gravitational interactions at each and every instant 'now' from the [Arrow of Space](#). Unlike [electromagnetism](#), these nonlinear and **self-acting** interactions cannot be screened off and are *always* present (forget about [LIGO](#)). In the right-hand side of the

Einstein field equations, these nonlinear, quasi-instantaneous and **self-coupling** interactions are *omnipresent*, the gauge symmetry principle used in present GR textbooks requires that all parameter coordinates are "unphysical", and "strictly speaking, general relativity is not a parametrized field theory" ([Charles Torre](#)).

D. Chakalov

December 14, 2012

Last updated: December 17, 2012, [08:01:15 GMT](#)

=====  
Subject: Re: Gravitational waves and pulse-time red herrings, in [quadrupole approximation](#)  
Date: Sun, 16 Dec 2012 12:48:50 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: "Helfer, Adam D." <helfera@missouri.edu>  
Cc: [[snip](#)]

On Sat, 15 Dec 2012 22:47:48 +0000, Helfer, Adam D. <helfera@missouri.edu> wrote:

>  
> Dear Dimi,  
>  
> I'm afraid I don't quite follow the thread on the links you gave me.

The thread is from articles by theoretical physicists, published in peer reviewed journals. I've been sending these references to you for many years. Ignore them at your peril.

> As nearly as I can tell, it sounds as if you don't think gravitational waves are real,  
> or are observable, but (if that is the case) I am not understanding your objection.

It sounds as if you haven't even glanced at these articles, starting from the one by Hermann Weyl. Of course gravitational waves are real, but cannot be detected \*in principle\* with LIGO, Virgo, etc., for reasons explained by [Hermann Bondi](#). Ignore them at your peril.

If some day you or any of your colleagues wish to respond professionally, read the articles in question, and use math (not some verbal statements like yours above) to explain your belief in LIGO, Virgo, or any other GW "detector" based on the \*linearized approximation\* of GR.

I will immediately prove you wrong. **Promise.**

And once I prove you wrong, I will add some very simple facts (not opinions) from my web site, which I'm sure you know since March 2009.

Just recall that in October 2009 (Tue, 27 Oct 2009 12:10:26 +0200), I asked you and 74 physicists to endorse the submission of my manuscript "Taxpayer's perspective on GW astronomy" to ArXiv.org server: two people refused (Jonathan Thornburg and Stanley Deser), while the rest -- you included -- didn't even bother to respond to my email.

Please get professional. The sooner, the better.

Sincerely,

Dimi Chakalov

P.S. You can read my initial email from December 14th at

[http://www.god-does-not-play-dice.net/#Neiman\\_Helfer](http://www.god-does-not-play-dice.net/#Neiman_Helfer)

Soon on [DVD](#).

D.C.

On Fri, 14 Dec 2012 07:38:11 +0200, Dimi Chakalov <dchakalov@gmail.com> wrote:  
[snip]

=====



Subject: Re: Gravitational waves and pulse-time red herrings, in [quadrupole approximation](#)  
Date: Mon, 17 Dec 2012 21:09:59 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: "Helfer, Adam D." <helfera@missouri.edu>  
Cc: [\[snip\]](#)

On Mon, 17 Dec 2012 14:55:19 +0000,  
Message-ID:  
<D1150F0ACBC46649A9D8D3036374A7E103FB0F5B@UM-MBX-T01.um.umssystem.edu> ,  
Helfer, Adam D. <helfera@missouri.edu> wrote:  
>  
> Dear Dimi,  
>  
> There is more than one thing one might mean by "linearized gravity."

There is only one thing we must care about "linearized gravity", in the case of LIGO, Virgo and the rest of GW "detectors" based on such "linearized" approximation: the inherent [non-conservation of energy](#) in the full nonlinear GR.

This unsolved task is known since the first days of GR, after David Hilbert. Let me quote from Sir Hermann Bondi:

"The vanishing of its [the energy-momentum tensor - D.C.] covariant divergence is often called a conservation law, but in fact it is a [law of non-conservation](#), because the extra terms (not includable in a Green's type function) precisely describe the transfer between the \*intangible\* energy of the gravitational field (as it will be called here), which is not described by the energy-momentum tensor, and the tangible forms which are so described. (...) In relativity a non-localizable form of energy is inadmissible, because any form of energy contributes to gravitation and so its location can in principle be found." (Sir Hermann Bondi, Conservation and non-conservation in general relativity, Proc. R. Soc. Lond. A 427 (1990) 249-258)

In standard GR textbooks, the unsolved problem of "localization" of gravitational energy density 'at a point' (MTW, [p. 467](#)) refers to the case explained by Sir Hermann Bondi above.

Now, it is manifestly wrong to [\\*cheat and deliberately waste\\*](#) hundreds of million USD and Euro for "enhancing the sensitivity" of what has been a [dead turkey](#) from the outset -- the current GW "detectors" based on some "linearized" approximation of the initial unsolved problems explained

above. No "linearized" approximation can solve these problems, and "it would be **hopeless** to look for exact solutions for the gravitational waves emitted by realistic gravitational sources" (Michele Maggiore, *Gravitational Waves: Theory and Experiments*, Oxford University Press, 2007, [p. 32](#)).

Briefly, [it is wrong to cheat](#).

Do you and your colleagues agree?

If you agree, get real. Do your job. Professionally.

Details from December 17, 2012, 08:01:15 GMT, at

[http://www.god-does-not-play-dice.net/#Neiman\\_Helfer](http://www.god-does-not-play-dice.net/#Neiman_Helfer)

Sincerely,

Dimi Chakalov

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"The representation of matter by a tensor was only a fill-in to make it possible to do something [temporarily](#), a wooden nose in a snowman."

Albert Einstein's Last Lecture, Relativity Seminar, Room 307, Palmer Physical Laboratory, Princeton University, April 14, 1954

"In general relativity the identity of a world point is not preserved under the theory's widest invariance group. This assertion forms the basis for the conjecture that some physical theory of the future may teach us how to dispense with [world points](#) as the ultimate constituents of space-time altogether."

P. G. Bergmann and A. Komar, The Coordinate Group Symmetries of General Relativity, *Int. J. Theor. Phys.* 5 (1972) 15-28

**Note:** In my previous email printed [above](#), I asked [Adam Helfer](#) to "read the articles in question, and use math (not some verbal statements like yours above) to explain your belief in LIGO, Virgo, or any other GW "detector" based on the \*linearized approximation\* of GR."

As in the case of [Bernie Schutz and collaborators](#), Adam Helfer has to choose from two alternatives: either claim that he is a square dilettante and knows nothing about GR, or cheat like [Bernie Schutz and collaborators](#).

For those who are not familiar with the subject, recall that the first "motivation" to use "linearized approximation" is based solely on a **wild uneducated guess** -- see again the analogy with a [weather thermometer](#). Of course, this wild uneducated guess runs **against** GR, as stressed by Michele Maggiore ([p. 32](#)) above.

As to the second "motivation" from [PSR1913+16](#), see what we know about the *inferred* "loss of kinetic energy" [here](#).

It's all wishful thinking and cheating. If you don't understand GR, you may indulge in some dreams of "GW astronomy" and try to suggest some new mathematical presentation of these "waves", which could miraculously solve the initial problems. For example, you know that certain tasks cannot be solved unless we change the type of coordinates, so by the same token you jump on some "linearized approximation": [change the math](#), problem solved.

But if [you know GR](#), you *must* cheat to [get the money](#), because [you know bloody well](#) that the

**transfer** of 'tangible' (Hermann Bondi) forms of energy by gravitational waves **cannot** be described *in principle* in [textbook GR](#): "... the extra terms (not includable in a Green's type function) precisely describe the **transfer** between the \*intangible\* energy of the gravitational field (as it will be called here), which is not described by the energy-momentum tensor, and the tangible forms which are so described."

In fact, this **transfer** is a "[bi-directional](#)" -- as we can describe it *only* with the linearized notion of time read with a physical clock -- **negotiation** between geometry and matter placed in the two sides of Einstein field equations, which (i) has been **already** settled, due to the "[speed](#)" of light, at *each and every* instant we look at our clock, and (ii) covers the whole universe *quasi-instantaneously*, like in a [school of fish](#).



The end result is that the whole universe is being [bootstrapped](#) by its "thoughts", called [gravitational waves](#): one-at-a-time during the *emergence* of '[time direction](#)' and its 3-D space. It is one object, called 'spacetime', and if we can **ignore** gravitation, we can safely approximate it with some fictitious fixed "background" spacetime comprising of "points" with fixed physical content and non-dynamical spacetime metric -- it will be a *bona fide* classical theory in which things exist 'out there'. But the non-linear [General Relativity](#) **cannot** be developed on such limiting case of 'objective reality *out there at a point*', because of the [emergence](#) of '[time direction](#)' & 3-D space' and subsequently the [non-linear](#) dynamics of the metric "field" (forget about [LIGO](#)). We need [quantum gravity](#).

In simple words, there are things in Nature, which [do exist](#) but **cannot** be converted into gauge-invariant observable, and therefore the current GR textbooks **cannot** offer any recipe whatsoever for their detection. [None](#). There is no such animal as 'gravitational stress-energy **tensor**' defined at individual spacetime points, which can evoke '[geodesic deviation](#)' and determine the value of the Riemann tensor at that same spacetime point (Erik Curiel, [pp. 1-4](#)). Surely it exists, but is a [generic quantum phenomenon](#), not "[tensor](#)". All this leads to a [Machian](#) quantum theory of gravitation based on an infinity of gauge-related *quasi-local* realizations (called here '[jackets](#)'), in which the gauge group<sup>1</sup> is defined with the [Arrow of Space](#).

So, if [you know GR](#) but wish to cheat, you may claim that some "approximation" might solve the LIGO problem [on paper](#), then [get the money](#), have fun, [avoid criticism](#), publish papers, and after you ultimately fail, put the blame on Einstein: "*Any such failure of GR should point the way to new physics.*" (B. F. Schutz *et al.*, [arXiv:0903.0100v1 \[gr-qc\]](#))

On 19 February 2013, I will update these notes, to commemorate ten years since I wrote to *Nature* ([Wed, 19 Feb 2003 23:40:26 +0200](#)) about this widely known problem with LIGO "collaboration", but nobody responded professionally. Nobody will, [for sure](#). These people are [not at all stupid](#), they just live in a [total socialism](#).

Shame on LIGO and Virgo "collaborations". They are **total disgrace** to the GR community.

D. Chakalov  
December 17, 2012  
Last updated: December 21, 2012, 12:37 GMT

<sup>1</sup> Marc Henneaux and Claudio Teitelboim, *Quantization of Gauge Systems*, Princeton, 1992, p. xxiii.

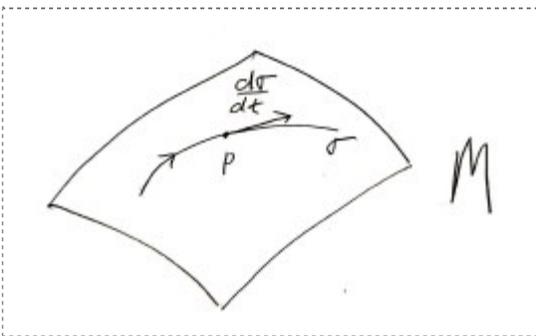
Physical theories of fundamental significance tend to be gauge theories. These are theories in which the physical system being dealt with is described by more variables than there are physically independent degrees of freedom. The physically meaningful degrees of freedom then reemerge as being those invariant under a transformation connecting the variables (gauge transformation). Thus, one introduces extra variables to make the description more transparent and brings in at the same time a gauge symmetry to extract the physically relevant content.

=====

One cannot pinpoint the "expansion" of spacetime in the "smooth neighborhood" (the latter is [sheer poetry](#), of course) of the [quasi-local](#) "point" **P** from the drawing below; check out Ned Wright's [balloon metaphor](#). This is [Quantum Geometry](#) in action. My proposal is to start from a [Borel set](#) and endow all [points](#) with the *dual structure* of option YAIN (iii) [above](#). More in [December 2012](#) at ESI Vienna; [details](#) available upon request.

D. Chakalov  
August 29, 2012, [12:32:06 GMT](#)

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Subject: Re: arXiv:1208.5399v1 [gr-qc], [Sec. 5.3](#)  
Date: Wed, 29 Aug 2012 00:23:57 +0300  
Message-ID:  
<CAM7Ekx=T+r2zSbWfFopT89fGb4D14deAmBdw5AwoyniXNm4DpA@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Chris Fewster <chris.fewster@york.ac.uk>  
Cc: galloway@math.miami.edu, ford@cosmos.phy.tufts.edu

P.S. Please see a drawing attached, from Greg's 'Spacetime Geometry' (October 30, 2008, [p. 3](#)): in what "**direction**" the "expansion" of spacetime happen, in the smooth neighborhood of the "point" P, so that you can talk about "[scale factor](#)" and hence the parameter **t** in Greg's drawing ?

Best - D.

On Tue, Aug 28, 2012 at 11:22 PM, Dimi Chakalov <dchakalov@gmail.com> wrote:

>  
> Dear Chris,  
>  
>> As to dark energy, it depends a bit on the model concerned. For the dark  
>> energy associated with a cosmological constant, the dominant, weak, and null  
>> energy conditions hold, but the strong energy condition fails.  
>  
> But if SEC fails -- and it must fail -- how can you "save" the rest of  
> those energy conditions?  
>  
> Just check out the requirements needed to somehow "isolate" SEC from  
> the other energy conditions, and if you find any reasonable solution,  
> please do write me back. Or better post your brand new paper on  
> [gr-qc]. I trust Larry and Greg can offer detailed insights. Then all  
> those "singularity theorems" must be reconsidered,  
>  
> [http://god-does-not-play-dice.net/#John\\_Alice](http://god-does-not-play-dice.net/#John_Alice)  
>  
> Good luck.  
>  
> All the best,  
>  
> Dimi

>> On 28 August 2012 05:11, Dimi Chakalov <dchakalov@gmail.com> wrote:  
>>>  
>>> Dear Chris,  
>>>  
>>> It is, and has always been, a pleasure to read your papers.  
>>>  
>>> Regarding the mess with the "singularity theorems", I wonder which  
>>> energy conditions will be violated by the "dark energy". Or rather,  
>>> which energy condition might survive?  
>>>  
>>> The opinion of your colleagues will be greatly appreciated, too.  
>>>  
>>> My thoughts are posted at  
>>> <http://www.god-does-not-play-dice.net/#asymptotics>  
>>>  
>>> All the best,  
>>>  
>>> Dimi  
-----

**Note:** I stated [above](#) that the notion of "smooth neighborhood" is [sheer poetry](#) -- not only because it brings terrible mathematical difficulties ([I. Raptis](#)), but also because the very notion of 'smooth' ([P. Tod](#)) is **not** well-defined mathematically. Consider, for example, some variable like the ratio of black/white hair on my skull -- one can define the notion of '*practically* white hair' by setting the

above ratio to, say, 0.1%. Some people may argue that the notion of 'effective white hair' begins to emerge "around", say, 1%. But the rigorous notion of 'white hair' corresponds to **zero** black hair. Then we don't talk about the ratio above, but instead claim that the black hair is an 'empty set' -- zero. This is the mundane notion of 'zero something', because we have compared two observables and have instructed one of them to disappear into "zero".

In our case, however, we aren't talking about 'hair' with two different and comparable colors, but about two **ontologically** different objects placed at the two sides of the Einstein field equation (EFE): in the l.h.s. we place **pure geometry**, like 'the grin of the Cheshire cat without the cat', as observed by Alice.



Then we make two metaphysical claims. Firstly, we say that there is no 'grin' (geometry) without the 'cat', in the sense that if we could somehow remove the cat in the r.h.s., there would be no 'grin' left in the l.h.s. ("space is not a thing"), and secondly -- once we have the two objects in EFE, there will be a holistic input from 'the universe as ONE', which is smuggled via the l.h.s. into the r.h.s. of EFE, and is physically observed **only** there.

This holistic effect, called 'the sufficient conditions for spacetime', is **not** accounted for in the unfinished *Allgemeine Relativitätstheorie*, which is "merely a makeshift in order to give the general principle of relativity a preliminary closed-form expression. For it was essentially no more than a theory of the gravitational field, which was isolated somewhat artificially from a total field of as yet **unknown** structure" (A. Einstein). We just *assume* that one can parallel-transport (Bob Wald) "tangent vectors" to define "curvature" (see Greg Galloway's drawing above), because the underlying manifold is 'perfectly smooth', but in order to define **rigorously**, without any poetry, the mathematical meaning of 'smooth', we need the non-Archimedean world of 'the grin of the cat without the cat', presented here with the so-called global mode of spacetime. To understand the latter, recall that we model the universe as a brain endowed with 'potential reality' from the Arrow of Space: all quantum-gravitational correlations "in the air" take place in this 'potential reality' -- look at D. N. Mermin's talk [Ref. 1] and replace 'consciousness' with 'potential reality'. Just don't mix 'potential reality' with its possible, but scientifically unverifiable, global mental presentation (qualia) known as [John 1:1]. The famous dictum *Mens agitat molem* (Vergil, The Aeneid, Ch. 6, 727), or *Der Geist bewegt die Materie* by the Unmoved Mover (Karel Kuchar), applies *strictly* to 'potential reality' known since Aristotle.

Going back to the initial question: "in what "**direction**" the "expansion" of spacetime happen, in the smooth neighborhood of the "point" P, so that you can talk about "scale factor" and hence the parameter **t** in Greg's drawing ?"

If you, my dear reader, cannot answer this question, check out the *dual structure* of geometrical "points", option YAIN (**iii**) above.

D. Chakalov

August 31, 2012

Last updated: September 1, 2012, 18:55:31 GMT

[Ref. 1] N. David Mermin (June 8, 2005), What I'd Like to Know about 2105  
<http://people.ccmr.cornell.edu/~mermin/homepage/talk1.pdf>

pp. 11-12: "The notion of *now* -- the present moment -- is immediately evident to an individual consciousness as a special moment of time, or a brief interval, of order perhaps a few tenths of a second. It seems highly plausible to me that your now overlaps with my now or, if you are very far

away from me, with a region space-like separated from my now. On the other hand, I can conceive of it not working this way: that your now is two weeks behind or fifteen minutes ahead of my now.

"Physics has nothing to do with such notions. It knows nothing of now and deals only with correlations between one time and another. The point on my world-line corresponding to now, obvious as it is to me, cannot be identified in any terms known to today's physics. Consciousness has a particularity that seems absent from the physical description of the world, which deals only with relations. Consciousness can go beyond time differences and position itself absolutely along the world-line of the being that possesses it.

.....

"... the only statements quantum mechanics makes about the world are relational. If I view myself as a system describable by [quantum mechanics](#), then my state becomes entangled (and his **brain would not function** - D.C.) with anything in the physical world I interact with. My conscious perceptions, on the other hand, have a particularity that goes beyond the correlation between those perceptions and what they are perceiving."

## Addendum

May I offer my not-so-humble, and strongly biased ([Luke 17:21](#)), answer to the question [above](#), "in what **"direction"** the "expansion" of spacetime happen..."

The question doesn't have an answer in present-day GR: the '[reference fluid](#)' is excluded from the outset, and because an answer to the question [above](#) will inevitably reveal the preferred *flow* of time definable *only* with respect to the '[reference fluid](#)', the question doesn't have an answer -- see option (i) [above](#), "it does not exist."

To be specific: the "**direction**" along which the "expansion" of spacetime "happen" is compactified **on** the dimensionless point **P** from the drawing [above](#), and because you treat this point **P** as a [bartender](#), you cannot separate its **two** components: check out option YAIN (iii) [above](#). Again, the *very* point **P** is **quasi-local** -- it is **both** extremely "non-local" in the global mode of spacetime, being spanned to the size of '[the whole universe](#)', **and** extremely "local", being compactified to a dimensionless *geometrical* "point" ('the grin of the Cheshire cat without the cat') in the local mode of spacetime. This proposal requires a new, to the best of my knowledge, geometry and topology of *the* spacetime in GR, which models 'the whole universe as ONE', and can also be compatible with [Quantum Theory](#).

Otherwise you simply cannot define the point **P** [above](#), because your current GR textbooks (e.g., MTW, [p. 467](#)) explicitly forbid localization of gravitational energy density at **P**. This "localization" is a [quantum phenomenon](#).

Metaphorically speaking, the "localization" acts as a robust "[linearized](#)" surface that is being inserted "[sequentially](#)", at every instant 'now' from the [Arrow of Space](#), under the '[freely falling elevator](#)', due to which we find out, [retrospectively](#), that the universe has obviously been explicated at this *local mode* of spacetime with [one "charge" only](#), called 'matter endowed with inertia'.

Why is this [difficult to understand](#), I wonder.

The crux of GR is the bold presence (see Tom Thiemann [above](#)) of the gauge-dependant **absolute structures** (James L. Anderson, [Principles of Relativity Physics](#), Academic Press, New York, 1967, p. 73). They do not obey the 'generalized principle of action and reaction' (*ibid.*, p. 339), and can be revealed in Quantum Theory *only* as '[potential reality](#)'. The resulting "input" from these absolute structures is manifested as [self-acting faculty](#) of matter fields bootstrapped by their [gravitational waves](#): matter can 'act on itself'. We have the same phenomenon of [purely geometrical nature](#) right above our neck: we think *about* our brain, **by** our brain, hence our brain is 'self-acting'. Physically, we cannot observe our "[mind](#)" in the brain -- just a *self-acting* brain. Replace "mind" with 'the [sufficient conditions for spacetime](#)', and you're done.

In my not-so-humble and [strongly biased](#) opinion, the only way to embed these absolute structures and the rest of 'the [sufficient conditions for spacetime](#)' in Einstein's unfinished *Allgemeine*

*Relativitätstheorie* (cf. Richard Feynman below) is by revealing the "total field of [as yet unknown structure](#)" manifested by the Arrow of Space along a [null-surface](#). Perhaps we will end up with the Machian quantum gravity suggested here. I don't know. More in December 2012 at [ESI Vienna](#).

D. Chakalov

September 2, 2012

Last updated: September 5, 2012, [17:19:38 GMT](#)

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The next question was - what makes planets go around the sun? At the time of Kepler some people answered this problem by saying that there were angels behind them beating their wings and pushing the planets around an orbit. As you will see, the answer is not very far from the truth. The only difference is that the angels sit in a different direction and their wings push inward.

Richard Feynman, *Character Of Physical Law*, 1967, [p. 8](#)

=====

Subject: Re: arXiv:1208.5399v1 [gr-qc], [Sec. 5.3](#)

Date: Wed, 12 Dec 2012 07:21:55 +0200

From: Dimi Chakalov <dchakalov@gmail.com>

To: Chris Fewster <chris.fewster@york.ac.uk>

Cc: eleni-alexandra.kontou@tufts.edu,

galloway@math.miami.edu,

ford@cosmos.phy.tufts.edu,

kdo@cosmos.phy.tufts.edu,

matt.visser@msor.vuw.ac.nz,

carlos@iaa.es,

psj@tifr.res.in,

Rituparno.Goswami@uct.ac.za,

George.Ellis@uct.ac.za,

rouse@maths.ox.ac.uk

Dear Chris,

I haven't received your reply to the question from my email (Tue, Aug 28, 2012 at 11:22 PM, cf. below).

Since SEC must fail due to "dark energy" (Carlos Barcelo and Matt Visser, [arXiv:gr-qc/0205066v1](#)), can you save NEC and all those "celebrated" [singularity theorems](#)?

Or perhaps you or some of your colleagues can somehow separate SEC from the rest of energy conditions?

Please use math. It helps.

My opinion can be read at

[http://www.god-does-not-play-dice.net/#red\\_herring](http://www.god-does-not-play-dice.net/#red_herring)

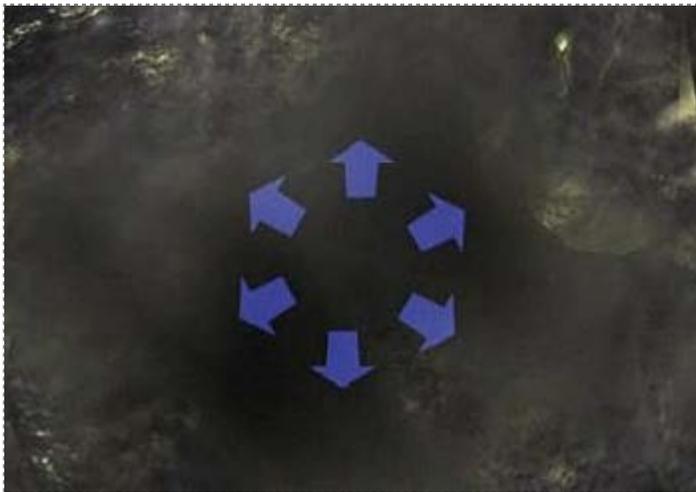
All the best,

Dimi

On Tue, Aug 28, 2012 at 11:22 PM, Dimi Chakalov <dchakalov@gmail.com> wrote:

>  
> Dear Chris,  
>  
>> As to dark energy, it depends a bit on the model concerned. For the dark  
>> energy associated with a cosmological constant, the dominant, weak, and null  
>> energy conditions hold, but the strong energy condition fails.  
>  
> But if SEC fails -- and it must fail -- how can you "save" the rest of  
> those energy conditions?  
[snip]

=====



Subject: The clock field from the "dark energy" of [you-name-it]

Date: Mon, 17 Sep 2012 17:40:24 +0300

Message-ID:

<CAM7Ekx=K0GkJNfJ0r5R3d44qmFf2gZByUZtDJw0=mbUVaAjj9g@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Romualdo Tresguerres <romualdotresguerres@yahoo.es>

Cc: Friedrich W Hehl <hehl@thp.uni-koeln.de> ,

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Dear Dr. Tresguerres,

First, please accept my delayed condolences for the physical loss of your father. I know it hurts, especially if you take life too seriously.

I have an immodest request. I am trying to understand (i) the bundle background (Motion in gauge theories of gravity, arXiv:1202.2569v2 [gr-qc], Figs 1, 5, and 6, [p. 18](#)), and (ii) the clock field from the "dark energy" of [you-name-it], introduced to massive free point particles, such that the resulting "time" be one-dimensional, metrical, and "temporally global, i.e. such that every event goes through any value of the time variable once and only once" (Time Evolution in Dynamical Spacetimes, arXiv:gr-qc/9607066v1, [p. 2](#)).

At the end of the day, I suppose you should obtain unique solution to the puzzle of "time from scale factor" (with respect to what?) at

<http://www.god-does-not-play-dice.net/#Fewster>

It goes without saying that I cannot agree with your "clock field to be identical with a dynamical time-like field provided by the nonlinear approach to PGT" (Time evolution in the presence of gravity, arXiv:gr-qc/0009029v1, [p. 3](#)), for reasons explained at the link above.

I noticed that [Fred Hehl](#) doesn't talk on this fundamental problem (forget about [C. Rovelli](#)), and hope that you or some of your colleagues can help.

All the best,

Dimi Chakalov

-----

**Note:** We must **not** be able to *physically* detect the 'flow of time' ([G F R Ellis](#)), produced by the phenomenon of transience [[Ref. 1](#)], as '[observable in GR](#)' -- it must be *physically* unobservable yet drastically evident, despite its gauge origin ([Tom Thiemann](#)). Much like the [Heisenberg-Born omelette](#), we must fulfill two opposite requirements -- see option YAIN (iii) [above](#). In the framework of the *physically* unobservable input from the newly introduced '[sufficient conditions](#) for spacetime', we face the worst calculation in theoretical physics known since [1930s](#), the so-called old cosmological "constant" problem ([Niayesh Afshordi](#)) based on our ignorance of the gravitational contribution of [the vacuum](#).

Thus, we cannot -- and must **not** -- physically pinpoint the "**direction**" of the "expansion" of spacetime [[Ref. 2](#)], in the smooth neighborhood of the "point" **P** [above](#), so that we could talk about "[scale factor](#)" and hence the parameter **t** in Greg Galloway's drawing [above](#), although the *very same* parameter **t** is read by [every physical watch](#). I was hoping to elucidate this fundamental problem of present-day GR in November 2002, after Chris Isham's statement that such **linearized** time can be read by his "[wrist watch!](#)", because I totally reject "miracles" disguised with advanced math.

Let me be specific, regarding the clock field from the "dark energy" of [\[you-name-it\]](#).

When you were still young and susceptible, you were taught what we nowadays accept as true metaphysics: only matter can [interact](#) with matter. Fine, but then you detect the *physical* presence of "dark energy" and get a [Nobel Prize](#), and automatically assume that this "anomalous dark energy" must have originated from physical stuff with *positive* energy density, because 'only matter can [interact](#) with matter'. Then you seek the very **source** of that "anomalous dark energy", because only parapsychologists would talk about 'energy' without explaining 'energy of *what?*' And finally you have to face up to 96% of "[dark stuff](#)".

Then of course you're ready to retire, or rather publish your papers with [EoS of dark energy](#) (e.g., by "extra pumping", [Saul Perlmutter](#)) until you fully and irreversibly retire. When and how did you go wrong?

You missed 'the [sufficient conditions](#) for spacetime' (the poetic explanation is offered by Lee Smolin on [p. 206 above](#)). You **misused** 'physical stuff with *positive* energy density' just as people speculated about some [Homunculus](#) or "[psychon field](#)" or "[Higgs field](#)". Namely, the [sufficient conditions](#) for

spacetime originate from 'the whole universe as ONE', in line with our model of 'the universe as a brain'. These [sufficient conditions](#) are indeed hidden (or "dark", to follow your twisted terminology), to produce "zero" ( [the empty set R](#) ) -- not some finite Killing "vector" -- **on** the point **P** in Greg Galloway's drawing [above](#). If it weren't **zero** in the local (physical) mode of spacetime, the Transience [[Ref. 1](#)] will show up as *physical* phenomenon, along with '[the flow of time](#)', and the *physical* "[aether](#)" will ruin the whole Theory of Relativity. Which, of course, [will not and must not happen](#).

Notice that I specifically do **not** say what is meant by "zero" ( [the empty set R](#) ) above. This "zero" [[Ref. 2](#)] is not pertinent to the mundane case of 'zero *something*', as explained [previously](#). It cannot be any finite "vector" that we set to zero, and it cannot point to any particular direction in 3-D space either, because in the latter case we would have an exclusive preferred *physical orientation* of the Transience [[Ref. 1](#)] with respect to the [CMB aether](#).

This "zero" is just a **remnant** from the 'change of space' from the [Arrow of Space](#), which is being **nullified** into a geometrical "point" (Bianchi identity "[enforces](#)" zero divergence for the Einstein tensor, [Niayesh Afshordi](#)), and then **fused** *within this same* physical "point" to produce the [necessary & sufficient rules](#) for spacetime. Then the *necessary* rules in the *right hand side* of [EFE](#) become 'alive' due to this point-like input -- one-at-a-time along the Arrow of Space -- due the holistic [global sufficient rules](#). We can **only** observe the physical stuff in the r.h.s. of EFE, and then realize that this stuff has **already** become [influenced](#) by the geometry ('the grin of the Cheshire cat without the cat') and has become 'self-acting', that is, **alive** -- just like in the case of the smaller [human brain](#). If we were looking for some [Homunculus](#), we would have come up with similar "dark stuff" like [Saul Perlmutter](#) and [his colleagues](#). But we don't make such stupid mistakes. No. We cannot *physically* catch the [sufficient conditions](#) for spacetime. Yet they are spread [everywhere](#), and make the "point" **P** [above](#) *quasi-local*.

To understand the specific input of the [sufficient conditions](#) for spacetime, look at the geodesic hypothesis ([Alan Rendall](#)) "when the Christoffel symbols vanish", from Sean Carroll, Eq. 4.9 on p. 104 [[Ref. 3](#)]: yes, the Christoffel symbols **must** vanish one-at-a-time, at each and every instant 'now' from the Arrow of Space, to produce **different** [Photoshop layers](#), but if you ignore '[the dark Zen gaps](#)' from the global mode of spacetime and **only** *fuse* those canonical data to produce your 3+1-D spacetime from GR textbooks, you will end up with a dead "geodesic" recipe made of **zero** Christoffel symbols: "if the Riemann tensor vanishes in the neighborhood of a point, then there will exist a chart at **that point** in which the Christoffel symbols vanish" (Adam Helfer, [private communication](#)). And you will be haunted by "dark stuff" [forever](#).

To those who still claim that "cannot understand" (e.g., [Saul Perlmutter](#) boldly declared, with wide opened eyes, that he has tried all theories, but failed to mention my email in the past seven years), see what you get with your "[negative pressure](#)": "If the vacuum is trying to pull the piston back into the cylinder, it must have a negative pressure, since a positive pressure would tend to push the piston out," says [Ned Wright](#).

But for *any* kind of smooth omnipresent "pressure", you need [boundaries of spacetime](#).

Also, you cannot explain the "expansion" of spacetime [with respect to itself](#). Thus, you are talking parapsychology, albeit it can bring you a juicy [Nobel Prize](#).

No, you cannot *physically* detect the "**direction**" of the "expansion" of spacetime, and hence the parameter **t** in Greg Galloway's drawing [above](#), because currently you have missed 'the [sufficient conditions](#) for spacetime' and can only muse, like a Flatlander, on the two opposite spacelike "directions" along the **radius** of [Ned Wright's balloon](#). With the [global mode of spacetime](#), however, you have an entirely different, *en bloc* perspective of those "two opposite [spacelike directions](#)".

Physically, you cannot, and must **not** be able to detect "time" [[Ref. 1](#)] from the "[scale factor](#)", and hence the parameter **t** in the drawing [above](#), because no physical stuff can "move" along the null-surface of the [Arrow of Space](#). Just get serious about Einstein's *Kosmologische Betrachtungen zur allgemeinen Relativitätstheorie* (1917): we postulate that "the metrical character (curvature) of the four-dimensional spacetime continuum is determined at **every point** by the matter there, together with its state", but this ongoing, one-at-a-time along the [Arrow of Space](#) **determination** captures the true dynamics of Einstein's unfinished Allgemeine Relativitätstheorie, with its [necessary & sufficient rules](#).

Which is why I don't believe in the "clock field" suggested by Romualdo Tresguerres [above](#). There is no "[timelike unit vector](#)" either. It's an illusion -- see option [YAIN \(iii\)](#). The dynamics of the expansion of spacetime -- with respect to [what?](#) -- cannot be "simplified when considering mass distribution with special symmetry properties provided by the metric" (Danylo Yerokhin *et al.*, arXiv:1108.0203v4 [astro-ph.CO], [Sec. III](#)). Nothing can change *with respect to itself*. Only [Baron Munchhausen](#) can perform such miracle.

In summary, recall that 'time' always refers to 'change *in* space' (local mode of spacetime), which [requires three "points"](#): a finite interval in 3-D space (A, B) and a [sliding cutoff](#) interpreted as "[singularity](#)". The latter, however, does **not** belong to the local mode of spacetime. The [finite interval \(A, B\)](#) represents [both the necessary and sufficient rules](#) for spacetime. The **reason** why physical things exhibit 'change' (hence 'time') is [both](#) because of their 'necessary' physical nature (e.g., [thermodynamics](#)) [and](#) because of their 'sufficient' holistic nature determined by 'the whole universe as ONE'. The latter refers to 'change **of** space' along the [Arrow of Time](#), compactified onto the [quasi-local](#) point **P** in the drawing [above](#). And because you use differential geometry as a [bartender](#), you can *only* observe a [perfectly continual](#) sequence of such "points" **P** in the local (physical) mode of spacetime, in which [the sufficient rules](#) for spacetime and '[the dark Zen gaps](#)' are being **nullified** by the so-called '[speed of light](#)' -- one-at-a-time along the [Arrow of Space](#).

I hope this explains the primordial [Affine Connection](#) along the [w-axis](#), constituted by *two space-inverted, [atemporal](#)* connections in '[the dark Zen gaps](#)'.

Dimi Chakalov

September 18, 2012

Last update: October 19, 2012, 08:30 GMT

[Ref. 1] Abner Shimony, Implications of Transience for Spacetime Structure, in: *The Geometric Universe*, ed. by S.A. Huggett, L.J. Mason, K.P. Tod, S.T. Tsou, and N.M.J. Woodhouse, Oxford University Press, 1998, [pp. 161-172](#).

"Even more problematic is the role of transience in physical theory. Classical mechanics, special relativity, and [general relativity](#) differ profoundly in their assumptions about spacetime structure, but in all three the structure is characterized without any reference to the slipping away of [the present moment](#) into the past."



[Ref. 2] Bryce de Witt, The Quantum Theory of Gravity. [I. The Canonical Theory](#), *Phys. Rev.* **160**, 1113-1148 (25 August 1967), p. 1119.

"Since the statistical results of any set of observations are ultimately expressible in terms of [expectation values](#), one therefore comes to the conclusion that nothing ever takes place in quantum gravitydynamics, that the quantum theory can never yield anything but a [static picture](#) of the world.[18]"

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[18] Cf. [A. Komar, Phys. Rev. 153, 1385 \(1967\)](#).

[Ref. 3] Sean M. Carroll, Lecture Notes on General Relativity, [arXiv:gr-qc/9712019v1](#).

All of this should constitute more than enough motivation for our claim that, in the presence of gravity, spacetime should be thought of as a curved manifold. Let us now take this to be true and begin to set up how physics works in a curved spacetime. The principle of equivalence tells us that the laws of physics, in small enough regions of spacetime, look like those of special relativity. We interpret this in the language of manifolds as the statement that these laws, when written in Riemannian normal coordinates  $x^\mu$  based at some point  $p$ , are described by equations which take the same form as they would in flat space. The simplest example is that of freely-falling (unaccelerated) particles. In flat space such particles move in straight lines; in equations, this is expressed as the vanishing of the second derivative of the parameterized path  $x^\mu(\lambda)$ :

$$\frac{d^2 x^\mu}{d\lambda^2} = 0 . \quad (4.8)$$

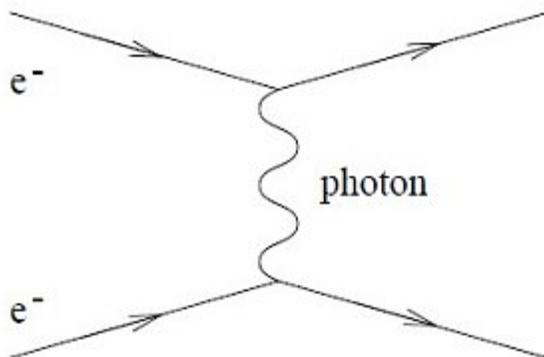
According to the EEP, exactly this equation should hold in curved space, as long as the coordinates  $x^\mu$  are RNC's. What about some other coordinate system? As it stands, (4.8) is not an equation between tensors. However, there is a unique tensorial equation which reduces to (4.8) when the Christoffel symbols vanish; it is

$$\frac{d^2 x^\mu}{d\lambda^2} + \Gamma^\mu_{\rho\sigma} \frac{dx^\rho}{d\lambda} \frac{dx^\sigma}{d\lambda} = 0 . \quad (4.9)$$

Of course, this is simply the geodesic equation. In general relativity, therefore, free particles move along geodesics; we have mentioned this before, but now you know why it is true.

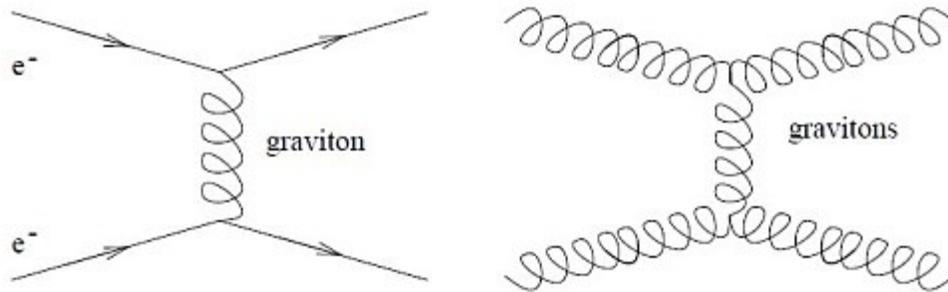
pp. 112-113: "The nonlinearity of general relativity is worth remarking on. In Newtonian gravity the potential due to two point masses is simply the sum of the potentials for each mass, but clearly this does not carry over to general relativity (outside the weak-field limit). There is a physical reason for this, namely that in GR **the gravitational field couples to itself.**

"This can be thought of as a consequence of the equivalence principle — if gravitation did not couple to itself, a "gravitational atom" (two particles bound by their mutual gravitational attraction) would have a different inertial mass (due to the negative binding energy) than gravitational mass. From a particle physics point of view this can be expressed in terms of Feynman diagrams. The electromagnetic interaction between two electrons can be thought of as due to exchange of a virtual photon:



"But there is no diagram in which two photons exchange another photon between themselves; electromagnetism is linear. The gravitational interaction, meanwhile, can be thought of as due to exchange of a virtual graviton (a quantized perturbation of the metric).

"The nonlinearity manifests itself as the fact that both electrons and gravitons (and anything else) can exchange virtual gravitons, and **therefore** exert a gravitational force:



"There is nothing profound about this feature of gravity; it is shared by most gauge theories, such as [quantum chromodynamics](#), the theory of the strong interactions. (Electromagnetism is actually **the exception**; the linearity can be traced to the fact that the relevant gauge group,  $U(1)$ , is abelian.) But it does represent a departure from the Newtonian theory.

p. 123: "The situation is precisely analogous to that in electromagnetism, where we know that no amount of initial data can suffice to determine the evolution uniquely since there will always be the freedom to perform a gauge transformation [XXX]. In general relativity, then, coordinate transformations play a role reminiscent of gauge transformations in electromagnetism, in that they introduce ambiguity into the time evolution.

p. 127: "A final example is provided by the existence of singularities, points which are **not** in the manifold even though they can be reached by travelling along a geodesic for a finite distance.

"Typically these occur when the curvature becomes infinite at some point; if this happens, the point can no longer be said to be **part of the spacetime**. Such an occurrence can lead to the emergence of a Cauchy horizon — a point  $p$  which is in the future of a singularity cannot be in the domain of dependence of a hypersurface to the past of the singularity, because there will be curves from  $p$  which simply end at the singularity."

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Subject: LSST

Date: Sat, 22 Sep 2012 14:47:51 +0300

From: Dimi Chakalov <dchakalov@gmail.com>

To: David Wittman <wittman@physics.ucdavis.edu>, dmwittman@ucdavis.edu

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Dear Dr. Wittman,

It was a great pleasure to watch your videos. Thank you.

Please notice my interpretation of that ["dark" stuff](#) and [LSST](#) at

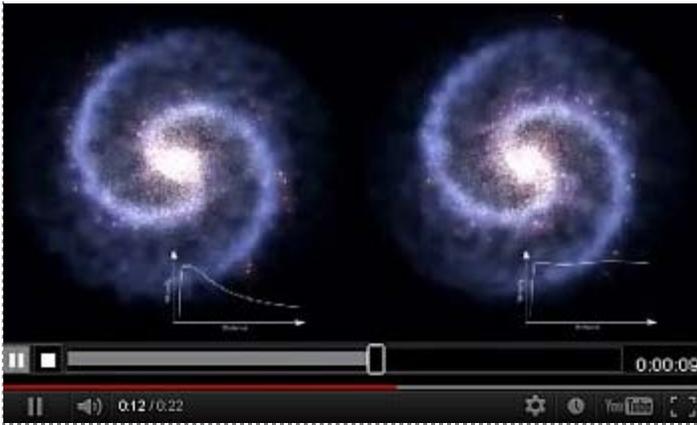
<http://www.god-does-not-play-dice.net/#Romualdo>

All the best,

Dimi Chakalov

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**Note:** Look at the animation of the galaxy rotation below:



This "anomalous" fact is a fact. What we call [non-baryonic dark stuff](#) complements the "dark energy", as two sides of **one tug-of-war** "coin". These [bootstrapping](#) effects of gravity begin to emerge at the galaxy length scale and up, toward the Large, yet [Vera Rubin](#) was not awarded the Nobel Prize. Totally ridiculous.

Notice that the current textbook version of GR is valid only for our solar system, which means that there are two major unsolved tasks ahead: the modified Machian gravity starting at galaxy length scale, and then the last layer of the physical world in which the extreme [tug-of-war](#) effect produces asymptotically flat spacetime at cosmological scale ([Dynamic Equilibrium Conjecture](#)).

The important issue here is that the kinematics of 3-D space is 'classical' (Minkowski spacetime) *only* at the length scale of tables and chairs. It is the **beginning** of the quantum-gravitational realm in two "directions" along the [w-axis](#), toward the Small and toward the Large. In the local (physical) mode of spacetime, there is no '[flow of time](#)' along the *entire* **w**-axis. What we can observe at the [Archimedean](#) local mode of spacetime are "two" 3-D blueprints from the Arrow of Space -- just like a Flatlander would be confined to "see" two opposite and **T-invariant** directions in 2-D space, while we can have a brand new, holistic, *en bloc* view on the whole Flatland with our new 'global mode'. Likewise, we can only see "two" opposite directions of the inflating balloon ([Ned Wright](#)), toward the Small and toward the Large, but in the global mode of spacetime we would have a brand new, holistic, *en bloc* view on [the whole spacetime](#). Hence for a local observer confined at the macroscopic world, there are indeed 'Small and Large', but for a co-moving observer the "size" of an electron will be **indistinguishable** from the "size" of a galaxy (the so-called *relative scale principle* or [RSP](#)). Hence the really interesting predictions, such as [REIM](#), come from elevating the quantum-gravitational effects straight at the macroscopic level.

If you aren't interesting, you will face the insoluble problem of 'after' in the phrase "one hundredth of a second **after** the big bang" ([Markus Pössel](#)): although your wristwatch does read this "time", no *physical* stuff can reach the *dual sliding cutoff above*, currently known as [The Beginning](#) and the [Planck scale](#).

See again 'The Two Rules of Success' [below](#).

D. Chakalov  
 September 24, 2012  
 Last updated: September 27, 2012

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"LOTS OF THINGS ARE INVISIBLE, BUT WE DON'T KNOW HOW MANY BECAUSE WE CAN'T SEE THEM."

Subject: Re: Curvature energy vs torsion energy, arXiv:1006.2154v1 [gr-qc], p. 4

Date: Fri, 28 Sep 2012 15:58:48 +0300

From: Dimi Chakalov <dchakalov@gmail.com>

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Dear Professor Wanas,

Regarding my email from [Mon\\_14\\_Jun\\_2010\\_12:29:02\\_+0300](mailto:Mon_14_Jun_2010_12:29:02_+0300), may I ask you to help me pinpoint the \*geometrical\* presentation of "more than one affine connection" (arXiv:gr-qc/0010099v1, Sec. 3) in Greg Galloway's drawing at

<http://www.god-does-not-play-dice.net/#Fewster>

Please notice that we are talking about **both** torsion ('the interaction principle', arXiv:0809.5040v1 [gr-qc]) **and** [the flow of time](#). The latter is considered the source of all "dark" stuff ([CDM & DDE](#)), and because I agree with you that "space with simultaneously non-vanishing curvature and torsion gives a complete representation of the physical world including space and time", I need a \*geometrical\* presentation of '[the flow of time](#)' (cf. the link above).

If you or some of your colleagues can solve the puzzle at the link above with the Absolute

Parallelism (AP) geometry, please write me back.

The opinion of your colleagues will be greatly appreciated, too.

Kind regards,

Dimi Chakalov

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**Note:** In [arXiv:1006.2154v1 \[gr-qc\]](https://arxiv.org/abs/1006.2154v1), Mamdouh Wanas wrote: "Any geometric structure, characterized by a **linear** connection, has two important geometric entities: "Curvature" and "Torsion"."

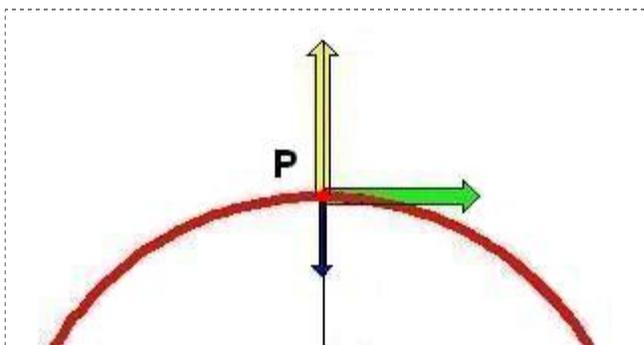
But the **topology** of the [Affine Connection](#) in '[the dark Zen gaps](#)' enforces gravitation to become "**linear**" in the local (physical) mode of spacetime, which is why [you won't see](#) any **nonlinear** "dark" gravitational effects. There *are* affine connections (M. Wanas), but only in the **global mode** of spacetime ([the dark Zen gaps](#)), because the two *space-inverted*, along the **w-axis**, [atemporal](#) connections, constituting the [Affine Connection](#), are *physically nullified* in the local (physical) mode of spacetime. Thus, the 'flow of time' from the [Affine Connection](#) does **not** exist in the local (physical) mode of spacetime, and we need the [sufficient conditions](#) for spacetime -- [Der Geist bewegt die Materie](#). Which inevitably leads to option YAIN (iii) [above](#).

Stated differently, the **w-axis** of the '[flow of time](#)' does **not** exist as 'physical dimensions' in any way, shape, or form whatsoever. The dimensions of the physical bodies along the '[flow of time](#)' are **exactly zero**. The [Killing vector field](#) is produced by the [sufficient conditions](#) for spacetime, while the twice-contracted [Bianchi identities](#) are valid *only* for an isolated, completed, already-negotiated *physical* universe at **one** instant 'now' from the Arrow of Space. Hence in the local (physical) mode of spacetime we see a generated or "[emerged](#)" [perfect continuum](#) of such universes, fused into a perfect **physical** continuum by the '[speed of light](#)', with no "[time parameter](#)" nor "[torsion](#)" -- they both have to be **nullified** in the physical world. The *emerging* Lorentzian geometry -- "the existence of one axis of time of a **different nature** to the space axes" ([José Senovilla](#)) -- inevitably requires the option YAIN (iii) [above](#).

To sum up, Mamdouh Wanas' statement [above](#) -- "any geometric structure, characterized by [**snip** - D.C.] connection, has two important geometric entities: "Curvature" and "Torsion" -- must be understood as referring to the [quasi-local](#) point **P** in the initial drawing [above](#), presented, however, in the [global mode](#) of spacetime ([the dark Zen gaps](#)), pictured with **red** in the **torsion** drawing below (source [here](#)).

**NB:** To understand the [Arrow of Space](#), notice the interpretation of the instant 'now' as a **dual** object pertaining to both the *global* and *local* modes of spacetime. In the former case, it is an [emerging](#) object presenting the new [biocausality](#), while in the latter (physical) case it is an [infinitesimal](#) object building the physical continuum ([the global dark Zen gaps](#) are nullified there) at **all length scales**.

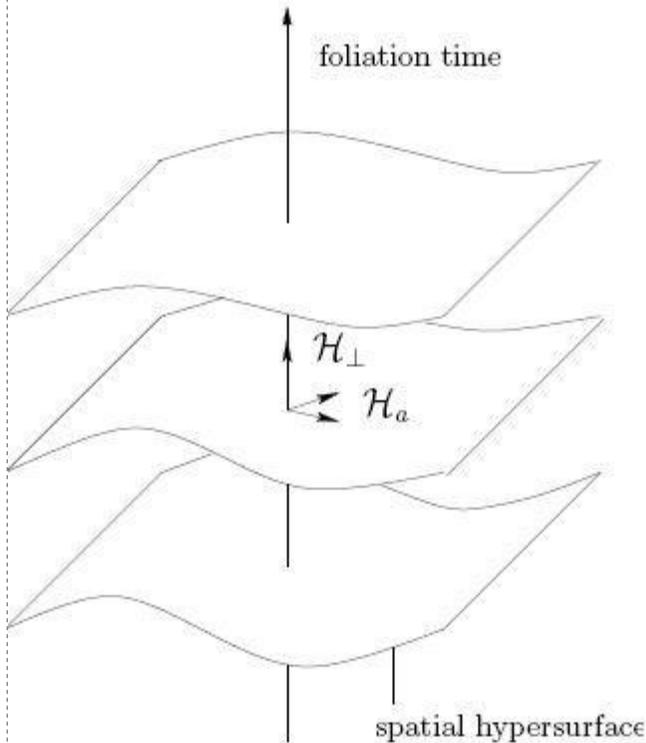
I deliberately omitted the phrase "a **linear**" in M. Wanas' statement, because we could **wrongly** imagine such [linear connection](#) only for the local (physical) mode of spacetime, made of accumulated and [already-linearized frozen](#) universes 'now' by the [Arrow of Space](#).



### Fig. 1

The green "tangent" vector at the *quasi-local* point **P** shows the alleged "[curvature](#)", while the two **opposite** torsion vectors at the same point **P**, with dark blue and yellow, run along the **radius** of the "inflating balloon" ([Ned Wright](#)), that is, along the new **w-axis**.

For comparison, look at the drawing from Claus Kiefer and Barbara Sandhöfer below, and notice that the "foliation time" does **not** exist in the local (physical) mode of spacetime, because it is produced by 'the flow of time' ([the sufficient conditions](#) for spacetime) from the [Arrow of Space](#), in line with option YAIN (iii) [above](#). Also, the alleged "Hamiltonian" (Domenico Giulini and Claus Kiefer, [arXiv:gr-qc/061141v1](#)) is **fake**, because it cannot in principle accommodate for the geometrical and topological degrees of freedom producing [the "dark" effects of gravity](#).



**Fig. 1.** The above plot shows the (3 + 1)-decomposition of a four-dimensional spacetime. Spatial hypersurfaces are stacked together along a foliation parameter. The components of the Hamiltonian tangential and perpendicular to the hypersurfaces are shown (but note that there are actually three components tangential to the hypersurfaces).

Notice that we can draw **three** spatial axes ( $x, y, z$ ) at the point  $\mathbf{P}$  in our Fig. 1 above (none is shown), then can set our **three** vectors depicting the "curvature" and "torsion" in Fig. 1 to **zero**, to obtain the limiting case of Minkowski spacetime, and finally imagine the point  $\mathbf{P}$  as the mass center of [our Frisbee](#): the metric will be dead fixed, and we can claim that the [gravitational energy density](#) at point  $\mathbf{P}$  might be zero, as in some fictitious flat background spacetime with zero gravity, zero torsion, and zero "dark" effects.

Then -- and *only* then -- we can imagine some fourth axis, denoted with  $\mathbf{t}$  in the *emerging* Lorentzian geometry, and draw the trajectory of [our Frisbee](#), because we have eliminated the hidden, due to the [Equivalence Principle](#), *dynamical* degrees of freedom of the [quasi-local](#) point  $\mathbf{P}$  in the unfinished Allgemeine Relativitätstheorie undertaken by [Albert Einstein](#), with crucial help from [Tullio Levi-Civita](#) and [David Hilbert](#).

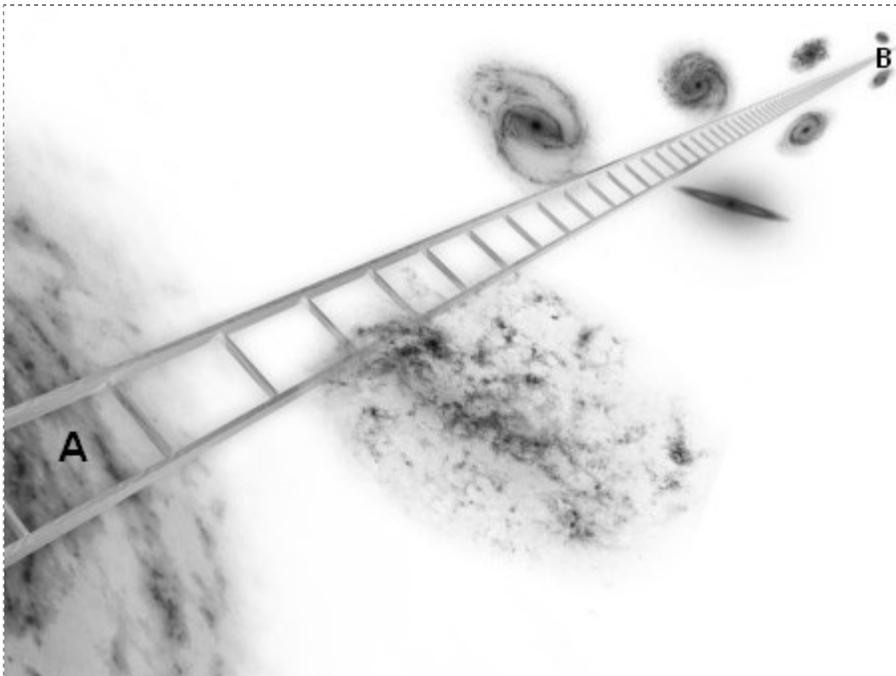
As expected, [people disagree](#). They may never understand their [GR textbooks](#) and will keep dreaming about "[warp field mechanics](#)" forever, like [NASA Eagleworks](#). But they enjoy unlimited amount of cash, no supervision, and don't care. In plain English: [total socialism](#).

D.C.

September 28, 2012

Last updated: October 5, 2012, [06:08:02 GMT](#)

=====



Subject: [Gauge theories of gravitation](#) ?

Date: Tue, 16 Oct 2012 15:20:16 +0300

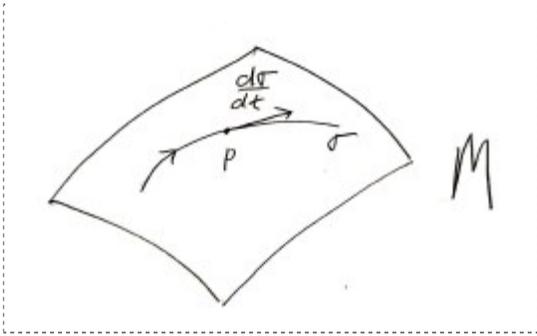
From: Dimi Chakalov <dchakalov@gmail.com>

To: mb@ipb.ac.rs, hehl@thp.uni-koeln.de, itin@math.huji.ac.il,  
t.kibble@imperial.ac.uk, tod@maths.ox.ac.uk, galloway@math.miami.edu,  
chris.fewster@york.ac.uk, ford@cosmos.phy.tufts.edu

Dear colleagues,

Here's a simple question for your efforts.

Q: In what "direction" the "expansion" of spacetime happen, in the smooth neighborhood of the "point" P, so that you can talk about "[time from scale factor](#)", namely, the parameter t in the drawing attached, from Greg Galloway:



<http://www.god-does-not-play-dice.net/#Fewster>

Please study the text and reply professionally, and I will reply accordingly, with utmost pleasure.

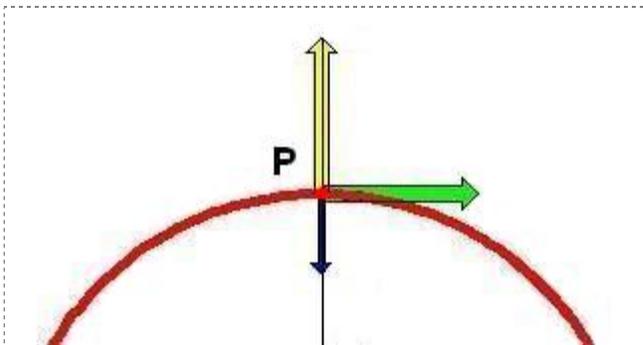
Fred Hehl: Please don't try to say that cannot understand the problem -- it is from 1930s.

All the best,

Dimi Chakalov

**Note:** The "direction" of the "expansion" of spacetime cannot *physically* exist, because first of all it will require some *finite* time interval -- not a "point" **P** -- for the flow of time, but the latter must **not** be physically present in any way, shape, or form whatsoever. Hence time and space are emergent phenomena produced by the 'necessary & sufficient conditions'. In order to talk about "direction", you need (i) finite interval (**A**, **B**) defined with three points, and (ii) background spacetime to define these *fluent* geometrical points. But in our case you cannot find (ii) in your GR textbooks, because you are a 3-D Flatlander who can talk only about the T-invariant "direction" along the radius of the "inflating balloon" from Ned Wright, and you have only **one** "point" **P** there. The flow of time requires an **accumulation** of infinite number (uncountably infinite) of *emergent* and *quasi-local* points 'now' which are, thanks to the necessary & sufficient conditions and the Arrow of Space, fused in a *perfect* continuum, while your GR textbook (not your brain) is confined in the "radius" of the expanding balloon below, and of course your "spacetime" is dead frozen (Robert Geroch).

The T-invariant "direction" of the "expansion" of spacetime (Ned Wright) does **not** exist in the local (physical) mode of spacetime. It is inevitably compactified into the "point" **P** -- recall option YAIN (iii) above and the axiom about the flow of time (neither 'time parameter in GR' nor any 'normalized time-like Killing vector' can be derived from the "dark energy" of you-name-it). The two torsion components, marked in the drawing below with yellow and dark blue, are necessarily "dark" due to the sufficient conditions for spacetime; currently, the latter are "statements that cannot be made within the theory" [Ref. 1].



(compare it with the "inflating balloon" from Ned Wright)

In the **local** mode of spacetime, the [remnant](#) at **P** from [DDE](#) points to the timeless future (yellow vector), while the T-invariant [remnant](#) at the same **P** from [CDM](#) points to the timeless past (dark blue); the green "tangent" vector [by itself](#) cannot produce any "time" either ([Karel Kuchar](#)). But combined with the [sufficient conditions](#) for spacetime, these *topological* phenomena induce "spin", from [galaxies](#) to the [observable universe](#). We [cannot explain](#) the dynamics of objects **larger** than the solar system [[Ref. 2](#)] with *only* the green "tangent" vector at **P**. In present-day GR, the time phenomenon is introduced '[by hand](#)' (another "miracle" is the metric grounded on [Planck scale](#)), because the "dark energy" of [you-name-it](#) is indeed *physically* invisible. We cannot and must **not** display the *binding phenomenon* of the [Arrow of Space](#), but only the kinematics of spacetime from which a composite physical *remnant* at point **P** is shown with the three vectors above. This composite *remnant* resides in the local (physical) mode of spacetime, and is effectively zero in Minkowski spacetime: the [energy-momentum](#) is firmly associated with effectively local points, and we can talk about some dead background Minkowski spacetime, because the [self-action](#) of spacetime along the Arrow of Space can be safely ignored.

Now, [people believe](#) that "if you double the distance to 2 megaparsecs, a galaxy would be [moving away](#) at twice that speed, or 148.6 km/sec", so the natural question is, how large is the *relativistically observable* volume of spacetime fixed by the event horizon? The incoming (to Earth) light would have to be **infinitely** Doppler-shifted toward red, yet if GR were indeed 'classical theory', these "dark" object (albeit still technically unobservable) will have to exist 'out there'. To be specific, how large is the radius (**A, B**), where **A** is fixed at Earth, while **B** sits at the event horizon at which its "receding speed", relative to **A**, tends *asymptotically* toward the "speed" of light? Once you calculate the relativistic radius (**A, B**) [above](#), you will know the **current** amount of "dynamical dark energy" ([DDE](#)) needed to perform such miracle, but **not** the **total** reservoir of "dark energy" available 'out there' ([where?](#)) for the *entire* cosmological time, from which a fleeting portion is being poured into the current spacetime ever since the "big bang" along the [Arrow of Space](#). Just don't forget that the *very same* "expansion" was faster-than-light "during" the inflation, say, for about  $10^{30}$  seconds, as it *would have been* recorded with your clock today:

The total duration of inflation in this model is about  $10^{-30}$  seconds.

**Nothing**, the "big bang" included, could possibly "erect a locally inertial coordinate system in which matter satisfies the laws of special relativity" (Steven Weinberg, [pp. 62-68](#)) and [Lorentzian metric](#) within  $10^{-30}$  seconds, and safely store it in some "[spacetime foam](#)" for [13.73 billion years](#). **No way**. You need the dynamics of spacetime *itself* to understand [the "ripples" of spacetime](#).

So, how much is the **total** "dark energy" right now, as we speak? **Infinite** and **invisible**.

Which means that the current [textbook GR](#) is not a 'classical theory' in which *everything*, the [gravitational energy](#) included, should stay available 'out there'. As in the [human brain](#), we can *only* consider 'matter' in the r.h.s. of the Einstein field equations, endowed with [self-action](#). We must not *directly* observe (option YAIN (iii) [above](#)) its [self-acting](#) due to the physically unobservable [sufficient conditions](#) for spacetime: *Der Geist bewegt die Materie*. In order to grasp the self-acting phenomenon of 'matter' in the [non-linear](#) GR (we cannot [directly observe the "speed" of light](#) and the luxonic, global mode of time of such non-linear self-acting), we need the [dynamics of spacetime](#) along the Arrow of Space -- if we employ only the local (physical) mode of spacetime, we will inevitably face the "frozen" paradox ([Bryce de Witt](#)). Hence the first off task is to explain the self-acting phenomenon of **quantum** matter producing "[quantum waves](#)" and include the later with the [non-linear gravitational waves](#) capable of transporting the '*tangible* forms of energy energy' ([Hermann Bondi](#)) on a **perfect** physical continuum. The latter is recovered first in [Quantum Theory](#), and then introduced as *dynamical continuum* in the non-linear GR, endowed with a new *gravitational entanglement* (example with CDM [above](#)) to replace the "instantaneous" action of gravity in Newton's theory: gravity does 'know' about *everything*. The end result is expected to be a Machian quantum

gravity free from any "quantum jump" artifacts: Dead matter makes quantum jumps; the living-and-quantum-gravitational matter is [smarter](#).

To understand the current cosmological essays, imagine that you are confined within a car (gravitationally closed system with asymptotic ["boundaries"](#)), which ["accelerates"](#) with respect to **itself** due to its "dark energy" (again, the physical "time" has been inevitably compactified into a **single point** only), but the only way to "see" your acceleration is to measure the fuel tank of your car: it perpetually *gains* petrol (in the r.h.s. of the Einstein field equations) *because* of your "acceleration" (Danylo Yerokhin *et al.*, arXiv:1108.0203v4 [astro-ph.CO], [p. 10, Eq. 33](#)). I mean, it is not even funny. It's ridiculous.

Notice also the mathematical term 'compact space' in [[Ref. 1](#)], footnote 8 on p. 7, which is a bit sophisticated expression of the paradox of 'infinite space' from [Achilles](#) (see [above](#)): suppose Achilles is throwing his famous spear in *any* direction in 3-D space toward **B**, which is the event horizon of the *relativistically observable* volume of spacetime. He starts from the "center" of the universe at Athens located at point **A** [above](#), and one can suggest that he will **not** be able to throw his spear further from the event horizon located at **B**, because he will be already **"arbitrarily close"** [[Ref. 1](#)] to the "final" point **B**, that is, the distance from Achilles to point **B** will be [infinitesimal](#) (recall '[the empty set R](#)'). Which means that he would reach some *asymptotic limit* of being 'too far away from Athens', which is [reciprocal](#) to the infinitesimal displacement **ds**, such that the *very distance* (**A, B**) would prevent him to move further. Another important assumption is that, in theory, the *relativistically observable* event horizon (**A, B**) matches the asymptotical [null-and-spatial infinity](#).

However, let me focus on two issues. One is the idea that the *very distance* in spacetime is a **parameter** that will [locally](#) affect the kinematics of the whole spacetime (like the influence of the [school of fish](#) on every infinitesimal local fish). Thanks to this T-invariant [nonlinear](#) bootstrapping phenomenon, we conjecture about the **interdependence** of Large and Small; for example, we extend local information to the whole spacetime, i.e., "globally throughout the space" [[Ref. 1](#)]. The crucial idea is that this nonlinear bootstrapping influence -- the *global* properties of spacetime ([the sufficient conditions](#) for spacetime) can *instantaneously* (global mode of spacetime) act "locally" on every [quasi-local](#) point of spacetime, and *vice versa* -- is a **parameter** of spacetime which **grows with distance**, starting from the length scale of tables and chairs, along the new, space-invariant [w-axis](#). Hence the *very distance* (**A, B**) will block Achilles, once he has reached the asymptotical [null-and-spatial infinity](#). Of course, this can never happen in the *local* mode of spacetime due to the [dual age cosmology](#).

Well, this is a metaphysical statement which may or may not be true. But the second issue, that Athens at point **A** would be some privileged "center" of the universe, is wrong, because we can replace Athens with some closer point (say, with a finite small interval *behind* the previous location of the spear), and Achilles can throw his spear further, *ad infinitum*. Why? Because [the universe](#) is like an *unbroken ring with no circumference*, for the "circumference" (global mode of spacetime) is *nowhere*, and the "center" (global mode of spacetime) is *everywhere*. This is [Quantum Geometry](#). It cannot be derived from dead matter alone. We need the physically unobservable [sufficient conditions](#) for spacetime **as well**.

Regarding the *relativistically observable* event horizon (**A, B**), similar considerations apply to the [reciprocal case](#) of "[infinitely small](#)", as in both cases these two (as well as ONE, in the global mode) edges do **not** belong to the physical spacetime: [the only way](#) to reach them *from within* spacetime would be to assume that the **final** 'nothingness' does exist *within* spacetime, as with the vacuum cleaner of Pink Panther [above](#), which is **absurd** -- we haven't seen things to disappear into the 'nothingness' of [timelike naked singularity](#) nor to show up helter-skelter from 'nothingness' (the latter is the case of some "white hole" inhabited by *advanced* Russian civilizations, as demonstrated, with impeccable math, by [Slava Dokuchaev](#)). Also, the [forty-year old idea](#) of quasi-local mass [[Ref. 3](#)] is wrong, firstly because ["asymptotic symmetry"](#) requires precise [asymptotic spacetime boundaries](#) which does not, and must **not** physically exist -- see again option YAIN (iii) [above](#).

The solution is to accept two seemingly alternative statements: the 3-D space is [dual](#), because it is both "infinite" and "finite" along (**A, B**), toward the Large and the Small, as presented (to a 3-D Flatlander) in the local (physical) mode of spacetime along the radius of the "inflating balloon" from [Ned Wright](#) and the radius of the three-vector drawing [above](#). In the [physically hidden](#) global mode of spacetime, we have a brand new viewpoint on the spacetime of 'the whole universe as ONE', and

all questions about its physical "size" yield the same answer: **YAIN**. There are indeed statements that currently "[cannot](#) be made within the theory" [[Ref. 1](#)], and such tasks cannot be resolved with abstract classical "[paracompact Hausdorff space](#)" either. We need [Quantum Geometry](#) of the [quasi-local](#) points defined by their physical (energy-momentum) content. The task is from the first days of General Relativity -- it cannot be a *bona fide* classical theory [[Ref. 4](#)]. No way.

Just look at the recent efforts of Junichi Iwasaki in [arXiv:1210.7466v1 \[gr-qc\]](#) to suggest some *reference observable* in GR, "with respect to which other observables evolve": if by 'other observables' we denote 'the whole universe driven by [DDE](#)', then the *reference observable* will be nothing but 'the whole universe', which **evolves** in its [scale-factor time](#), but with respect to itself. We must **not** be able to observe [physically](#) such final reference object, which is at *absolute rest* and can *act on itself* -- the Aristotelian First Cause. We just call it "[aether](#)". Anyway, sorry for repeating this old story again.

If you reject the new [Relative Scale Principle](#) and still believe in "expansion" of spacetime (with respect to [what?](#)) with  $74.2 \pm 3.6$  kilometers/second/megaparsec ([Adam Ries](#)), "black holes" ([Kevin Brown](#)), "[GW astronomy](#)", "spacetime [curvature](#)", "[quantum computers](#)", and [Higgs](#), you may find solace in the old saying from Xià-Shāng Dynasties (2070-1029 BC):

## 委託詢價 讓採購工作更輕鬆

將詢價信息委託給百卓專業的採購團隊  
我們為您推薦合適的供應商和報價信息

D. Chakalov  
October 16, 2012  
Last updated: November 4, 2012, 23:02 GMT

[Ref. 1] Gustavo E. Romero, Adversus singularitates: The ontology of space-time singularities, [arXiv:1210.2427v1 \[physics.gen-ph\]](#), p. 8.

See also footnote 8, p. 7:

"A space is said to be compact if whenever one takes an infinite number of "steps" in the space, eventually one must get **arbitrarily close** to some [other point of the space](#). Thus, whereas disks and spheres are compact, infinite lines and planes are **not**, nor is a disk or a sphere with a [missing point](#). In the case of an infinite line or plane, one can set off making equal steps in any direction [without approaching any point](#), so that neither space is compact. In the case of a disk or sphere with a missing point, one can move toward the missing point without approaching any point **within** the space. More formally, a topological space is compact if, whenever a collection of open sets covers the space, some sub-collection consisting only of finitely many open sets also covers the space. A topological space is called compact if each of its open covers has a finite sub-cover. Otherwise it is called noncompact. Compactness, when defined in this manner, often allows one to take information that is known **locally** – in a [neighborhood of each point of the space](#) – and to extend it to information that [holds globally throughout the space](#)."

[Ref. 2] Naresh Dadhich, Subtle is the Gravity, [arXiv:gr-qc/0102009v1](#), p. 10.

We have thus a curved Riemannian spacetime of 4-dimensions which imbibes in its curvature the universal interaction. How do we deduce the equation of motion for the interaction? It is the curvature of spacetime which should yield the equation. The Riemann curvature satisfies the Bianchi differential identity, which on contraction yields the divergence free second rank symmetric tensor, called the Einstein tensor  $G_{ab}$ . The natural equation that could thus follow is:

$$G_{ab} = -\kappa T_{ab} + \Lambda g_{ab} \quad (3)$$

where  $\kappa$  and  $\Lambda$  are constants and  $T_{ab}$  is a symmetric tensor with vanishing divergence. This requirement ensures conservation of what the symmetric tensor  $T_{ab}$  may represent. The natural choice for that is the energy-momentum tensor of a matter distribution. The second term on the right is a constant for the covariant derivative relative to the curved metric  $g_{ab}$ .

The question is, could we make any sense out of this equation? At the outset, it looks a good equation ensuring the conservation of energy and momentum represented by the tensor  $T_{ab}$ , and  $\Lambda$  could be identified with the well-known cosmological constant. Let us solve it for  $T_{ab} = \Lambda = 0$  for a radially symmetric metric. It is most remarkable that the solution includes in the first approximation gravitational field of a mass point in the Newtonian theory. This implies that the universal interaction is that of gravitation and the above equation is indeed Einstein's equation for gravitation in GR.

[Ref. 3] Mu-Tao Wang and Shing-Tung Yau, Quasilocal mass in general relativity, [arXiv:0804.1174v3](https://arxiv.org/abs/0804.1174v3) [gr-qc]; talk also at 'Connections in Geometry and Physics 2010', Perimeter Institute, Canada, May 7-9, 2010.

"As is well known, by the equivalence principle there is no well-defined concept of energy density in general relativity. On the other hand, when there is **asymptotic symmetry**, concepts of total energy and momentum can be defined. This is called the ADM energy-momentum and the Bondi energy-momentum when the system is **viewed from** spatial infinity and null infinity, respectively. These concepts are fundamental in general relativity and have been proven to be natural and to satisfy the important positivity condition in the work of Schoen-Yau [14], Witten [17], etc. However, there are limitations to such definitions if the physical system is not isolated and cannot quite be viewed from infinity where asymptotic symmetry exists. It was proposed more than 40 years ago to measure the energy of a system by enclosing it with a membrane, namely a closed spacelike 2-surface, and then attach to it an energy-momentum 4-vector."

[Ref. 4] C.W. Misner, K. S. Thorne and J. A. Wheeler, *Gravitation*, §20.4, W. H. Freeman and Company, 1973; excerpt from Paul McGrath, Richard Epp and Robert Mann, Quasilocal Conservation Laws: Why We Need Them, arXiv:1206.6512v1 [gr-qc], [p. 2](#).

"A bulk term in a [local conservation law](#) can be a symptom of the presence of fields that are not being accounted for in the stress-energy-momentum tensor. For example, in the standard Poynting theorem, the  $j \cdot E$  bulk term is present because  $T^{ab}$  **excludes** the charged matter field that is [the source](#) of the electromagnetic field, and represents an [energy transfer mechanism](#) between the electromagnetic field and the charged matter field. (...) A solution to this problem is to move from local to [quasilocal](#) conservation laws, which can properly account for the gravitational physics."

Note to [MTW, §20.4]: Paul McGrath *et al.* agree that "there is no such thing as a local gravitational energy density (energy per unit volume), that when integrated over a volume gives the total

gravitational energy in that volume". If 'unit volume' is replaced with the point **P** from Greg Galloway's drawing [above](#), we cannot integrate such "gravitational points" over a *finite* volume either. Yet other people claim that one can miraculously bypass this problem with some '[finite region](#)', which is nevertheless comprised from these 'unit volumes at **P**'. Total mess. See the "[linearization](#)" problem and the "feedback effect", explained by Ronald Adler, Maurice Bazin, and Menahem Schiffer in *Introduction to General Relativity*, 2nd ed., McGraw-Hill, New York, 1975, Ch. 9.1, [p. 301](#).

The solution is [very simple](#) but highly [non-trivial](#). I can't say more, because I do not offer math to people who don't care about General Relativity ([Matthew 7:6](#)).

D. Chakalov  
November 29, 2012, 07:44 GMT

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Subject: [arXiv:1210.5417v2 \[gr-qc\]](#): Quasi-local distribution and motion of matter?  
Date: Tue, 30 Oct 2012 14:43:28 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Janusz Garecki <garecki@wmf.univ.szczecin.xx>  
Cc: Adam Helfer <helfera@missouri.edu>,  
Laszlo Szabados <lbszab@rmki.kfki.hu>

Dear Professor Garecki,

It is a real pleasure to hear from you. Thank you very much for your kind reply.

May I take this opportunity to ask you to help me understand your latest [arXiv:1210.5417v2 \[gr-qc\]](#).

I wonder if my wristwatch can read the conformal time  $[\tau]$ , ref. [6] [therein](#).

If your answer is in the positive, please consider the problems with the matter energy-momentum tensor and the \*local\* ([Sic!](#)) distribution and motion of matter,  $T_{ik}(x)$ , under the conditions of "an ideal (or perfect) fluid" (footnote 2) in your "accelerated flat model" (footnote 6),

[http://www.god-does-not-play-dice.net/#Fred\\_Hehl](http://www.god-does-not-play-dice.net/#Fred_Hehl)

Please feel free to ask questions. Thank you for your time and considerations.

The opinions of your colleagues will be greatly appreciated, too.

Best regards,

Dimi Chakalov

=====  
Subject: Singularity theorems and torsion in General Relativity  
Date: Sun, 30 Sep 2012 02:15:45 +0300  
Message-ID:  
<CAM7Ekxmw\_zZyu68a-cG5KmT1o3jr2ABt\_mw6B\_d4h1jd77QZOw@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Jose M M Senovilla <josemm.senovilla@ehu.es>,  
Alan Rendall <rendall@aei.mpg.de>,  
Robert M Wald <rmwa@midway.uchicago.edu>,  
Helmut Friedrich <hef@aei.mpg.de>,  
Adam Helfer <helfera@missouri.edu>,  
Laszlo Szabados <lbszab@rmki.kfki.hu>,  
Jörg Frauendiener <joergf@maths.otago.ac.nz>,  
Luciano Rezzolla <rezzolla@aei.mpg.de>

Dear colleagues,

My understanding of "singularity" and "torsion" is posted at

<http://www.god-does-not-play-dice.net/#invisible>

Thank you very much for your professional articles. No need to reply, of course.

The reason why I do not publish papers is explained in the **Addendum** at

<http://www.god-does-not-play-dice.net/#Rezzolla>

All the best,

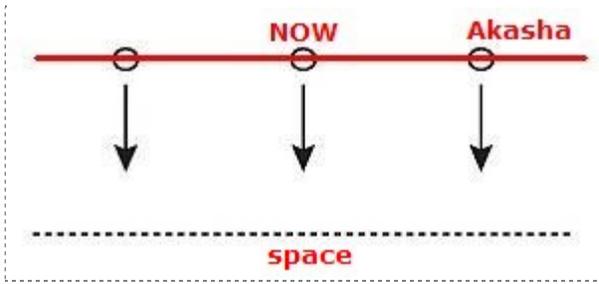
Dimi Chakalov

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**Note:** The task is very simple: if you throw a Frisbee in [Minkowski spacetime](#), you can talk about the **connection** (no gravity: see [Jose J. Pereira](#)) of the "points" from its trajectory, and hence the dynamics of such [isolated system](#) -- you will ignore all [sufficient conditions](#) for spacetime. But one you add gravity and torsion, you need a new, dynamical spacetime and the precise Affine Connection: see the three [tangent vectors](#) at Fig. 1 [above](#).

Think about 'causality' as presented only at a single point ([John Bell](#)), with its two features of (i) inheriting the physical influences from the neighboring past point and (ii) passing them to the **next** point in the future; more from [David Bohm](#). This is the phenomenon of '[transience](#)' from 'the flow of time', corresponding to option [YAIN \(iii\)](#). [Isn't this simple?](#)

Now, in your [idiotic textbooks](#) (pardon my French), you present 'causality' with a dead frozen "space" and an invisible "torch" that highlights the dead frozen "time", as well as some Akasha-like memory to keep the Genidentity ([Kurt Lewin](#)) and pass it from any given point to the neighboring one, much like some "[ideal waywiser](#)".



You don't have the phenomenon of '[transience](#)' from 'the flow of time'. Instead, the whole universe is dead frozen ([Robert Geroch](#)) and nobody can explain the [necessary & sufficient](#) conditions for spacetime from the [Arrow of Space](#), producing '**biocausality**'.



The latter is a perfectly *retarded* causality, because the [atemporal](#) bi-directional [bootstrapping](#) influences do **not** exist in the local (physical) mode of spacetime, thanks to [John's jackets](#) and the [Kochen-Specker Theorem](#).

Briefly, the phenomenon which "moves" the instant 'now' is 'the whole universe as ONE', known since [Aristotle](#) and denoted here as [the sufficient](#) conditions for spacetime. We cannot and **must not** be able to detect this [invisible phenomenon](#) at the point **P** from [Greg Galloway's drawing](#). But it *does* exist ([Luke 17:21](#)).

D.C.  
October 3, 2012, [12:19:28 GMT](#)

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Subject: Re: Energy exchange  
Date: Tue, 2 Oct 2012 17:01:41 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Ingemar Bengtsson <ibeng@fysik.su.se>  
Cc: Adan Cabello <adan@us.es>, fpallik@phys.uoa.gr,  
ppearle@hamilton.edu, kiefer@thp.uni-koeln.de,  
christian.schell@aei.mpg.de, andreas.doering@comlab.ox.ac.uk

P.S. Ingemar Bengtsson wrote ([arXiv:1210.0436v1 \[quant-ph\]](#), p. 2):

"[Ernst Specker's original motivation](#) concerned a problem in theology: can God know the outcome of all events, also those that could have happened but in fact did not? The answer from quantum mechanics is a clear no."

God knows the outcome of all events, also those that could have happened but in fact did not. The answer from Quantum Theory is a [clear YAIN](#).

See the initial link in my email below, and option YAIN (iii) at

<http://www.god-does-not-play-dice.net/#Goswami>

D.C.

On Tue, 2 Oct 2012 16:38:27 +0300, Dimi Chakalov <dchakalov@gmail.com> wrote:

- >
- > Dear colleagues,
- >
- > If you truly believe that "quantum theory seems to be a universal
- > framework for all interactions" ([Schell & Kiefer](#)), may I ask you to
- > explain the creation of path in the Wilson cloud chamber by energy
- > exchange b/w the quantum particle and its classical environment,
- >
- > <http://www.god-does-not-play-dice.net/#Renner>
- >
- > A penny for your thoughts.
- >
- > Sincerely,
- >
- > Dimi Chakalov

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<sup>1</sup> To clarify: we have not performed the demonstrably *impossible* feat of finding a tensor  $\tau_{ab}$ , quadratic in the gravitational field  $h_{ab}$  and second-order in derivatives, that is invariant under the linearized gauge transformation  $\delta h_{ab} = \check{\nabla}_{(a} \xi_{b)}$ . Rather, we rely on a gauge-fixing programme (motivated by key properties of  $\tau_{ab}$  and the energetics of an infinitesimal gravitational detector) to remove the freedom to perform such transformations, and hence arrive at a physically unambiguous description.

Subject: [arXiv:1210.0831v1 \[gr-qc\]](#), Footnote 1: "To clarify: we have not performed the demonstrably *impossible* feat..." "

Date: Wed, 3 Oct 2012 13:32:21 +0300

From: Dimi Chakalov <dchakalov@gmail.com>

To: Luke Butcher <l.butcher@mrao.cam.ac.uk> ,

Anthony Lasenby <a.n.lasenby@mrao.cam.ac.uk> ,

Mike Hobson <mph@mrao.cam.ac.uk>

Cc: Christof Wetterich <c.wetterich@thphys.uni-heidelberg.de> ,

Diego Marin <dmarin.math@gmail.com> ,

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Adam Helfer <helfera@missouri.edu> ,

Laszlo Szabados <lbszab@rmki.kfki.hu> ,

Erik Curiel <erik@strangebeautiful.com> ,

Carsten Gundlach <c.j.gundlach@soton.ac.uk> ,

Andersson N.A. <n.a.andersson@soton.ac.uk>,  
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Luke, Tony, and Mike:

It is indeed possible to solve your problem known from textbooks (MTW, [p. 467](#)), but you have to be very good in math: solve the task of "time from scale factor",

<http://www.god-does-not-play-dice.net/#Romualdo>

<http://www.god-does-not-play-dice.net/#invisible>

Unless you know the **exact** value of gravitational energy density in every ([quasi-local](#)) point in the full non-linear GR, you can't ever \*think\* of tangent vector at that same ([quasi-local](#)) point.

Why are you wasting your time with poetry?

Pity you won't reply and will continue to waste paper, which is a valuable commodity.

Any comments?

Dimi

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**Note:** In [arXiv:1008.4061v2 \[gr-qc\]](#), Luke, Tony, and Mike wrote: "We shall not attempt to extend our results beyond the linear theory at this time," because "localising gravitational energy-momentum in this regime (where the distinction between background and fluctuation is [virtually meaningless](#)) may be an **inherently flawed idea**." See their excerpt below (all emphasis mine).

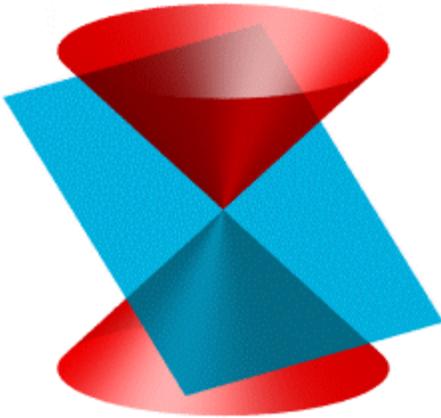
## B. Energy-Momentum Currents

Superficially, general relativity is a theory in which the energy and momentum of matter is always conserved:

$$\nabla^a T_{ab} = 0. \quad (7)$$

However, the sticky bead argument has already demonstrated that this is not the case; in reality, matter may gain (or lose) energy through interaction with the gravitational field. The reason for this apparent contradiction is as follows. In order to determine the energy of each part of the detector, one must first specify a timelike vector field  $e_0^a$  (the "time direction" conjugate to the energy) with which to form an energy current-density  $J^a \equiv T^a_b e_0^b$ . The incoming gravitational wave will then prevent  $e_0^b$  from satisfying  $\nabla_a e_0^b = 0$ , and we will find that  $\nabla_a J^a = T^a_b \nabla_a e_0^b \neq 0$ . This inequality indicates a

Notice that Eq. 7 above is wrong ([Hans Ohanian](#)): matter fields *always* gain-and-lose energy through interactions with the gravitational "field". We cannot use the linearized gravity to model this [non-linear interaction](#), because our wristwatch cannot read the global, non-linear time along the [null-surface](#) of the [Arrow of Time](#).



Just think about this: you have an insurmountable 'problem of time', but how come **there is no 'problem of space'** in canonical quantum gravity ([D. Giulini and C. Kiefer](#))?

Anyway, I tried to explain "canonical gravity" [[Ref. 1](#)] to my dog, but he didn't get it. Probably it's too difficult.

D. Chakalov  
October 3, 2012  
Last updated: October 4, 2012

[Ref. 1] Steffen Gielen, Derek K. Wise, Lifting General Relativity to Observer Space, [arXiv:1210.0019v1 \[gr-qc\]](#)

p. 1: "General relativity is about understanding that physics does not take place against the backdrop of a fixed geometry. Rather, geometry itself is a dynamical entity, bending and curving in response to matter, just as matter is subject to geometric rules of the space it inhabits. There are, however, different possible interpretations of such statements. In particular, do we mean the geometry of spacetime, the geometry of space, or [something else](#)?"

"This question is the root of tension between 'covariant' and 'canonical' approaches to gravity. The 'covariant' approach focuses on the geometry of spacetime, given 'all at once'. This is elegant, but unfortunately rather far removed from our actual experience of the world, in which space and time appear quite distinct. The so-called 'canonical' picture focuses instead on the geometry of space and how this geometry [evolves in time](#), and is thus more clearly related to our spatiotemporal intuition.

"On the other hand, the notion of 'time' is fixed arbitrarily from the outset, going [against](#) the spirit of relativity, even when the final result is independent of this choice. Worse yet, showing this independence in some formulations is decidedly nontrivial. The term 'canonical gravity', stemming from the 'canonically conjugate' variables in Hamiltonian mechanics, thus stands in ironic contrast with standard mathematical use of the word 'canonical', where it usually means involving no arbitrary choices. In brief, canonical gravity is **not** canonical."

=====

Subject: Scalar gravitational particle?  
Date: Wed, 5 Sep 2012 16:02:11 +0300  
Delivered-To: dchakalov@gmail.com  
Message-ID:  
<CAM7EkxkrdHp8Ktm5McyFb2R3GTBN4eGSW4=2xtjK99paNKqCjw@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Charles Wang <c.wang@abdn.ac.uk>  
Cc: Wang Yong-jiu <>wyj@hunnu.edu.cn>,  
Giuseppe Vitiello <vitiello@sa.infn.it>,  
Chris Fewster <chris.fewster@york.ac.uk>,  
Greg Galloway <galloway@math.miami.edu>,  
Larry Ford <ford@cosmos.phy.tufts.edu>,  
Luciano Rezzolla <luciano.rezzolla@aei.mpg.de>

Dear Professor Wang,

May I ask a question. You've been quoted at  
<http://www.ft.com/cms/s/0/8e616e6c-f6a1-11e1-827f-00144feabdc0.html#axzz25b1wwRCD>

"No existing theory can explain how so much energy is emitted in a supernova," said Prof Wang. "My theory is that a scalar particle – one of the most elementary types of particle in the universe and similar to the Higgs boson – is at work in these starbursts and responsible for the additional energy that causes the explosion to take place."

If possible, please let me learn more on the exact mechanism of energy release in a supernova, given your opinion on "the true dynamical degrees of gravity", Sec. 6 in 'New 'phase' of quantum gravity',

<http://rsta.royalsocietypublishing.org/content/364/1849/3375.full.pdf+html>

I would expect that some [boson-like mediator](#) of such anomalous energy release exists in Nature, but it is definitely not "[graviton](#)", for reasons hinted at

<http://www.god-does-not-play-dice.net/#Fewster>

The opinion of your colleagues on "the true dynamical degrees of gravity" will be greatly appreciated, too.

Kind regards,

Dimi Chakalov

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**Note:** To resolve 'the worst calculation in theoretical physics' (the old cosmological problem known since [1930s](#)), the quantum-gravitational vacuum should be treated as '[potential reality](#)', which in turns requires that the "creation", or rather explication of matter from the vacuum is *reversible*, i.e., under specific conditions matter will **dissolve** back to the vacuum, instead of "collapsing" to produce [supernovae](#). It would be really difficult to overestimate the importance of [this conjecture](#).

D. Chakalov  
September 5, 2012

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**Dark matter inevitable?**  
May be Law of gravity needs to be  
changed for distant cosmos?  
May be the assumption of BM+DM  
(two matter components) is incorrect?

Subject: "CMB acts as an aether." (Ta-Pei Cheng, Relativity, Gravitation and Cosmology, 2005, [p. 160](#))  
Date: Fri, 17 Aug 2012 04:44:48 +0300  
Message-ID:  
<CAM7Ekxk+PQYs5U8SG9g4nvw2aB28NNgTTyXY9rKKDjX4SwMing@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Ta-Pei Cheng <tpcheng@umsl.edu>  
Cc: [Anthony Zee](#) <zee@kitp.ucsb.edu>, [\[snip\]](#)

Dear Professor Cheng,

Regarding the last slide from your recent talk on Dark Matter and Dark Energy, [http://www.umsl.edu/~chengt/DarkU\\_nyc.pdf](http://www.umsl.edu/~chengt/DarkU_nyc.pdf)

may I quote from the first edition of your GR book (Relativity, Gravitation and Cosmology: A Basic Introduction, Oxford University Press, Oxford, [2005](#)), p. 10 (p. 9 in the 2nd ed.):

"In Mach's and Einstein's view, space and time are nothing but expressing relationships among physical processes in the world -- "**space is not a thing.**" Such considerations, together with the idea of the principle of equivalence between gravitation and inertial forces, led Einstein to the belief that the laws of physics should have the same form in all reference forms, thus abolishing the concept of space as a thing."

I think 'relationships among physical processes' constitute only 'the necessary conditions for spacetime', while 'the *sufficient* conditions for spacetime' may have a holistic Machian origin,

[http://www.god-does-not-play-dice.net/#John\\_Alice](http://www.god-does-not-play-dice.net/#John_Alice)

You also wrote ([ibid.](#), Sec. 8.5.4, p. 160):

"The peculiar motions mentioned above are measured with respect to the frame in which the CMB is isotropic. The existence of such a CMB rest frame does not contradict special relativity. SR only says that no internal physical measurements can detect absolute motion. Namely, physics laws do not single out an absolute rest frame. It does not say that we cannot compare motion relative to a cosmic structure such as the microwave background.

"The more relevant question is why constant velocity motion in this CMB rest frame coincides with the Galilean frames of Newton's first law. (**CMB acts as an aether.**) To the extent that the CMB frame represents the average mass distribution of the universe, this statement is called Mach's principle (cf. Box 1.1). While to a large extent Einstein's GR embodies Mach's principle, there is no definitive explanation of why the CMB rest frame defines the inertial frames for us."

The textbook "explanation" of inertia is not complete, to say the least (e.g., mass *there* governs spacetime geometry *here*, I. Ciufolini and J.A. Wheeler, [Gravitation and Inertia](#), 1995, p. 270), because it misses the bi-directional negotiations in the reference frame of the "aether", expressed with the *sufficient conditions* for spacetime [above](#).

As an analogy, think of a [school of fish](#), in which every fish is directed by 'the whole school', and is also --- at the very same instant -- affecting 'the school of fish': the geodesic of every fish will be determined by 'the whole school of fish' by such bi-directional negotiations in the reference frame of the "aether". A possible model is offered by Jim Woodward, *Gravitation: The Origin of Inertia*,

<http://physics.fullerton.edu/~jimw/general/inertia/index.htm>

"Inertial reaction forces are instantaneous; there's no doubt whatsoever about that. When you push on something, it pushes back on you immediately. If they're caused chiefly by the most distant matter in the universe, how can that be?

.....

"The act of pushing on something causes a disturbance in the gravitational field to go propagating off into the future. It makes stuff (the "absorber") out there wiggle. When the stuff wiggles it sends disturbances backward (and forward) in time. All the backward traveling disturbances converge on what we're pushing and generate the inertial reaction force we feel. No physical law is violated in any of this. And nothing moves faster than the speed of light. It only seems so because of the advanced waves traveling at the speed of light in the backward time direction."

So, we may have an [atemporal medium](#), as in Cramer's Transactional Interpretation of QM, which facilitates gravitation and inertia, dubbed "aether", which is in turn introduced as 'the sufficient conditions for spacetime' (cf. [above](#)).

Its physical effects will be inevitably "dark", which brings us to the [last slide](#) from your recent talk on Dark Matter and Dark Energy.

A penny for your thoughts.

All the best,

Dimi Chakalov

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**Note:** Ta-Pei Cheng should be fully aware that the assumption of '[two matter components](#)' is indeed [incorrect](#). He should also know the meaning of the old Chinese saying [above](#). Unfortunately, he will never respond professionally, firstly because he deeply believes in "[black holes](#)", which he described as "[the full power and glory of GR](#)".

But the textbook GR cannot *in principle* explain inertia. Ta-Pei Cheng can at best suggest some ideas about just **one** of the components of the mechanism of inertia: mass *there* governs spacetime geometry *here* (Ciufolini and Wheeler, p. 270), while the back-reaction of the spacetime geometry *here* to the mass *there* is impossible to describe with the linearized approximation of GR. He can only claim that at every [instant](#) the values of two "masses", the inertial and **active** gravitational mass (cf. [Wolfgang Rindler](#)), coincide with very high precision, but the **dynamics** of the mechanism fixing this apparent "equality" takes place literally *within* the instant 'now'. It is *quasi*-instantaneous, by analogy with the [quasi-local mass](#). The only way to describe the **bi-directional** negotiations (it is actually **one** event) between 'mass *there* <--> spacetime geometry *here*' was suggested by [Jim Woodward](#).

The latter requires two [atemporal](#) gravitational waves, as well as the [hidden](#) absolute reference frame of the "aether" provided by [CBM](#).

Thus, Ta-Pei Cheng can expect all sorts of "dark" gravitational effects, generated by 'the universe as ONE' (cf. the *sufficient* conditions for spacetime [above](#)), in line with the rules of Machian quantum gravity. And yes, the assumption of '[two matter components](#)' is indeed [incorrect](#). Which is why he will never reply professionally, or else will have to re-write his book 'Relativity, Gravitation and Cosmology' from the outset.

[D. Chakalov](#)

August 17, 2012

Last updated: August 18, 2012, [13:23:12 GMT](#)

=====



Subject: Re: GR17, Session D1

Date: Sat, 14 Jul 2012 12:09:05 +0300

Message-ID:

<CAM7EkxkTSjoX-JECM\_P=vOAiHbiyZgt6NZvy=7cQXZ+ah8xjag@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Thomas Thiemann <thiemann@theorie3.physik.uni-erlangen.de>

Cc: klaus.mecke@physik.uni-erlangen.de,  
catherine.meusburger@math.uni-erlangen.de,  
karl-hermann.neeb@math.uni-erlangen.de,  
ismolin@perimeterinstitute.ca

Dear Thomas,

Eight years ago, you decided to shut me up and left my email below unanswered, but granted Lee Smolin 3 (three) oral presentations. Yet neither you nor Lee have so far addressed the main unresolved problem with erecting Lorentzian metric from the hypothetical spacetime "foam",

[http://www.god-does-not-play-dice.net/#first\\_principles](http://www.god-does-not-play-dice.net/#first_principles)

Would you allow me to talk at your '[First Erlangen Fall School on Quantum Geometry](#)' (8-12 October 2012) ? If you agree, I promise to be *\*very\** polite about your efforts ([not frank](#)). Just give me a chance to hear your objections to my theory of quantum gravity.

Regards,

Dimi

-----  
 Subject: Re: GR17, Session D1  
 Message-ID: <40C37793.29100A59@chakalov.net>  
 Date: Sun, 06 Jun 2004 22:59:15 +0300  
 From: Dimi Chakalov <dimi@chakalov.net>  
 To: tthiemann <tthiemann@perimeterinstitute.ca>  
 CC: Curt.Cutler@aei.mpg.de, brien.nolan@dcu.ie  
 X-Priority: 1 (Highest)  
 References: 1 , 2 , 3

Dear Thomas,

Please inform me about possible upgrade of my poster presentation to talk. I'm encountering tremendous difficulties in transforming my GR17 paper to poster. Feel like having my mouth shut with duck tape.

Best - Dimi

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**Note:** Yesterday (August 22, 2012), I received an email signed by "the organizers.", which said that my application [wasn't approved](#) -- I am not allowed to attend the First Erlangen Fall School on Quantum Geometry even as a *listener*.

Well, Tom Thiemann is obviously playing hardball. Which is why I will be completely frank. The *First Erlangen Fall School on Quantum Geometry* will miss the target, and will be a total waist of time and resources. The reason is that the true Quantum Geometry encodes both the *necessary* and the *sufficient* conditions for spacetime, briefly explained [above](#).

To identify 'the *sufficient* conditions for spacetime', look closely at a [typical "3+1" mantra](#) (or rather [sheer poetry](#)):

Let  $(\mathcal{M}, g_{\alpha\beta})$  be a 4-dimensional spacetime, i.e. a 4-dimensional smooth manifold  $\mathcal{M}$  endowed with a pseudo-Riemannian metric  $g_{\alpha\beta}$ , of signature  $(-, +, +, +)$ . We denote by  $\nabla_{\alpha}$  the Levi-Civita connection associated with  $g_{\alpha\beta}$ . The 3+1 formalism of GR is based on the assumption that  $(\mathcal{M}, g_{\alpha\beta})$  is globally hyperbolic, so that it can be foliated by a one-parameter family of spacelike hypersurfaces  $(\Sigma_t)_{t \in \mathbb{R}}$ .

The recipe by which the [Levi-Civita connection](#) is "associated" with the pseudo-Riemannian metric, and the rules by which it defines "[parallel transport](#)", require a brand new metaphysical **binding phenomenon** for "points", which is exactly what the so-called [sufficient conditions](#) for spacetime stand for. The *binding* phenomenon in question is depicted with the **x**-lines [above](#). It doesn't point to any "direction" in the local (physical) mode of spacetime, because the [Arrow of Space](#) evolves along a null-surface, and at any instant 'now' the "time vector" from the [binding phenomenon](#) is completely and totally **zero**, as recorded with your physical clock. So, look at the drawing below, and answer the question, what **causes** the states of a physical system to get shifted from point **x** to the "next neighboring" point **x**, in line with the metaphysics of locality and causality?

[x/x/x/x/x/x/x/x/x/x/x](#)

Is this *because* of [thermodynamics](#)? Or *because* of any other "time arrow"? Of course **not**. You can't say that the binding phenomenon above is **caused** by thermodynamics, *because* if you open your window in a cold winter day, your room will [get colder](#). All "time arrows" are blueprints of an underlying 'master time arrow' presented here with the [Arrow of Space](#). The latter *must not* be directly observable [[Ref. 1](#)], or else the "[aether](#)" will show up as a real inertial reference frame.

When people like Tom Thiemann make the "assumption" that  $(M, g_{ab})$  is [time-orientable](#) and "globally hyperbolic" (cf. the compass needle metaphor [above](#)), they refer *tacitly* to the same [sufficient conditions](#) for spacetime -- a global holistic feature of 'the whole universe as ONE' (Lee Smolin, [p. 206](#)), which **complements** the buildup of its spacetime by 'the necessary conditions' supplied by [type I matter fields](#).

Nowadays nobody would claim, after Newton, that space is a "**thing**" (cf. [Ta-Pei Cheng](#)) which can exist **without** matter. Nobody is *that* stupid. Yet Tom Thiemann ignored the fact that one cannot build a spacetime from matter alone -- you need the [sufficient conditions](#) for spacetime **as well**, encoded in the famous saying '[Der Geist bewegt die Materie](#)'. Any time you talk about '[the universe as a whole](#)', to explain its cosmological time and "dark energy", you take the stand of some [non-Archimedean](#) meta-observer who takes a snapshot of 'the whole universe' to verify the [asymptotic behavior of its spacetime](#). Thus, you are tacitly using the [sufficient conditions](#) for spacetime, which endow the Quantum Geometry of every spacetime "point" with a [quasi-local topological structure](#). But what is the topological presentation of the [non-Archimedean geometry](#) of 'the universe as ONE' ?

The task is highly non-trivial, firstly because your [diff geometry textbooks](#) are written for [bartenders](#) who cannot solve **the first off task** in GR: on the one hand, we need geometrical "points" to attach "vectors" and then parallel-transport these "vectors" along a **line** (1-D Euclidean space), but on the other hand we cannot define the [gravitational energy density](#) at these "points" (cf. MTW, [p. 467](#) and [Erik Curiel](#)). The solution is simple but non-trivial, because it comes from [Quantum Theory](#) and requires a holistic phenomenon (Lee Smolin, [p. 206](#)): the [sufficient conditions](#) for spacetime.

In life sciences, this holistic phenomenon is known by the expression 'the whole is *more* than the sum of its parts'. For example, once a [school of fish](#) is formed, every individual "fish" will be involved in **bi-directional** negotiations (the crux of the non-linear coupling of [matter and gravity](#)) with 'the whole school as ONE', which determine their [quasi-local](#) "geodesic" **dynamically**, at each and every [quasi-local](#) "point" from their spacetime. But the latter is [perfectly smooth](#), so we have a brand new task for quantization of spacetime.

That's what Quantum Geometry is supposed to reveal. The alleged "[loop quantum gravity](#)", which will be again advertised at the *First Erlangen Fall School on Quantum Geometry* by Tom Thiemann's colleagues (e.g., [Jerzy Lewandowski](#)), is completely inadequate.

Of course, Tom Thiemann will disagree, so let me offer a very simple example: try to *reproduce*, as Gedankenexperiment, the *operational* definition of 'one second' [above](#) with 'the *necessary* conditions for spacetime' **alone**.

But there isn't such perfect clock in Nature. An answer to the question posed by Catherine Meusburger, "which time to consider in quantum theory?" [[Ref. 1](#)], requires a new [Quantum Theory](#) which can be reconciled with Einstein's unfinished *Allgemeine Relativitätstheorie* (not the current GR textbooks). The empirical fact that "measurements by observers generally involve time" ([ibid.](#)) cannot explain the cosmological time -- see the bewildered Tom Thiemann [above](#).

You need the [sufficient conditions](#) for spacetime **as well**, otherwise you'll have to ground the Quantum Geometry on a [Biblical miracle](#) left to be resolved by a bunch of curious [self-acting](#) elementary particles ([IGUSes](#)) survived after the CMB formation [[Ref. 2](#)], along with lots of "[dark stuff](#)".

It is *very* sad that people like T. Thiemann have occupied the famous [Erlangen University](#).

D. Chakalov

August 23, 2012

Last updated: August 27, 2012, 18:23 GMT

[Ref. 1] Peter G. Bergmann, Observables in General Relativity, in *Gravitational Measurements, Fundamental Metrology and Constants*, ed. by Venzo De Sabbata and Vitaly N. Melnikov, NATO ASI Series Volume 230, Kluwer, 1988, [pp. 15-18](#).

See also: [Catherine Meusburger \(April 2009\)](#), Cosmological measurements, time, and observables in (2+1)-gravity, [Slide 19](#)

## Role of time

### time in general relativity

- Hamiltonian is constraint  $\Rightarrow$  no time evolution on phase space
- physical (Dirac) observables time-independent
- but: measurements by observers generally involve time

### measurements (return time, angles, red shift)

- measurements depend on physical state and on eigentime of observer at emission of lightray
- eigentime of observer **not** function on physical phase space but external parameter
- time measurements as functions on the physical phase space: time elapsed between two physical events

**example:** eigentime elapsed between two measurements of return time that yield values  $\Delta t(v) = c_1, \Delta t(v) = c_2$

**question:** which time to consider in quantum theory?

[Ref. 2] Victor J. Stenger, The universe: the ultimate free lunch, *Eur. J. Phys.* 11(4), 236-243 (1990), p. 243

"Because the symmetry between matter and antimatter that initially existed was broken by one of the early phase transitions, the annihilation of particles and antiparticles into the photons, now part of the [microwave background](#), was **not** perfect, leaving a small residue of one part in a billion quarks and electrons that then stuck together in the clumps that we call galaxies, stars, planets, rocks, trees and [people](#)."



Subject: Energy exchange  
Date: Wed, 29 Aug 2012 16:25:46 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Renato Renner <renner@phys.ethz.ch>  
Cc: colbeck@phys.ethz.ch,  
thomas.wilson@cern.ch,  
teta@univaq.it,  
hartmann.roemer@physik.uni-freiburg.de,  
norbert.straumann@gmail.com,  
giulini@zarm.uni-bremen.de

Dear Renato,

Perhaps you and your colleagues are too busy to dwell on the [KS Theorem](#)<sup>1</sup>, so let me offer a simple puzzle from 1929 (no links to "[John's jackets](#)"): the creation of path in the Wilson cloud chamber by energy exchange b/w the quantum particle and its classical environment.

According to Heisenberg (1930), by "path we understand a series of points in space which the electron takes as 'positions' one after another," but notice that at each of these 'points in space', an \*energy exchange\* has occurred.

Try to explain the generation of (i) the observable path, like the trails left in the sky from a jet plane, and (ii) the underlying unobservable one, to explain both trajectories: on both "layers" we have \*energy exchange\*, correct?

Notice that we aren't talking about the direction of the observable path, as discussed by Sir Nevill Mott (cf. Alessandro Teta, [arXiv:0905.1467v1 \[math-ph\]](#)), but about \*continuous energy exchange\* between one single quantum particle (endowed with [imaginary phase](#)) and its "measuring" environment.

You can't use the "collapse" in QM textbooks nor some "[decoherence](#)", and you can't introduce some time operators in QM either, although you can measure the duration of the observable path (i) with [your wristwatch](#).

What would you do, then?

The only response I have so far is from Prof. Dr. Maurice de Gosson, an Austrian mathematician and mathematical physicist at the University of Vienna: "[Buzz off, idiot!](#)" (Mon, 21 May 2012 18:47:46 +0200).

Can you do better?

Best regards,

Dimi

On Tue, Aug 28, 2012 at 9:26 PM, Renato Renner <renner@phys.ethz.ch> wrote:  
[snip]

-----  
<sup>1</sup> Let me try to explain the gist of [Kochen-Specker Theorem](#), particularly the physical significance of the *uncolorable* set of observables and the quantum notion of contextuality ([Ernst Specker](#)). First, consider a kaleidoscope with many distinguishable, by their color, pieces of glass. You are interested only in the 'states' of these colored bits of glass 'on the table', *after* the kaleidoscope has been shaken 'in the air' (=the [dark Zen gaps](#)). You may use the machinery of classical mechanics, attach

some time-reversible 'trajectories' to all colored pieces in their phase space, with definite color 'on the table', etc. This exercise poses no problems. (However, if you were told, when you were young and susceptible, that GR were *the same* kind of '[classical theory](#)', you'll face a [huge insurmountable problem](#).)

But imagine that all colored pieces obtain their 'color' *contextually*, that is, every piece does **not** have any definite color *whatsoever*, because it is "*uncolored*" by default -- unless a **correlation** between all pieces, at particular instant, is established, such that every glass piece obtains its color at *this* instant (one-at-a-time along the [Arrow of Space](#) and with [unit probability](#)), and with respect to 'the rest of glass pieces' (=relationally). Here, we have a **determination** of the instantaneous 'color' of every glass piece by 'the rest of glass pieces from the whole ([Machian](#)) kaleidoscope', brought to every *context-dependant* **uncolored** piece -- it has become a 'contextual observable'.

Recall the question posed by [Erwin Schrödinger](#) (1935): "The rejection of realism has logical consequences. In general, a variable *has* no definite value before I measure it; then measuring it does *not* mean ascertaining the value that it *has*."

**NB:** We **cannot** apply the notion of probability (forget about [Cox and Kolmogorov](#)) to such "**uncolored**" *contextual ontic* state, as Erwin Schrödinger stressed in [November 1950](#); see also Karl Svozil, [arXiv:0904.1649v2 \[quant-ph\]](#), Sec. 3, 'Quantum state of the Thomson lamp'. Check out also the Gedankenexperiment with four dice [above](#).

Now, the famous KS Theorem demonstrates that, for Hilbert dimension 3 and higher, a fraction from the total number of *colorable* pieces will remain **uncolored**: before setting the experimental 'context', all quantum states had been **uncolored** by default, but once we try to impose *classical* 'color' to them, *some* of these **uncolored** quantum states will become *uncolorable in principle*.

**I**N 1954, J. F. Thomson proposed the following problem:

There are certain reading lamps that have a button in the base. If the lamp is off and you press the button the lamp goes on, and if the lamp is on and you press the button the lamp goes off. So if the lamp was originally off, and you pressed the button an odd number of times, the lamp is on, and if you pressed the button an even number of times the lamp is off. Suppose now that the lamp is off, and I succeed in pressing the button an infinite number of times, perhaps making one jab in one minute, another jab in the next half-minute, and so on, . . . . After I have completed the whole infinite sequence of jabs, i.e. at the end of the two minutes, is the lamp on or off? It seems impossible to answer this question. It cannot be on, because I did not ever turn it on without at once turning it off. It cannot be off, because I did in the first place turn it on, and thereafter I never turned it off without at once turning it on. But the lamp must be either on or off. This is a contradiction.

This is precisely the **undecidable** ([Geoffrey C. Berresford](#)) **final state** of [Thompson's lamp](#), which shows up in Quantum Theory as the **uncolorable**, *ontic*, pre-quantum, [pre-geometric Kochen-Specker state](#) (never in plural). To paraphrase [Zeno's Paradox of the Arrow](#), there are no instants of time "when" the arrow moves: at every instant of its flight, the arrow is at rest by casting its physical "[jacket](#)", like instantaneous snapshots from a [movie reel](#).

See the explanatory note below, and a brief note on "singularity" [here](#). It goes without saying that the *pre-quantum* Kochen-Specker state (called '[John](#)') is [the only option](#) to explain the Mott case examined [above](#), in line with the so-called [John's jackets](#).

Just don't mix the KS Theorem with the one from John Bell, because the latter employs counterfactual "reasoning" of the type explain [above](#). Don't dream about some "[quantum computer](#)"

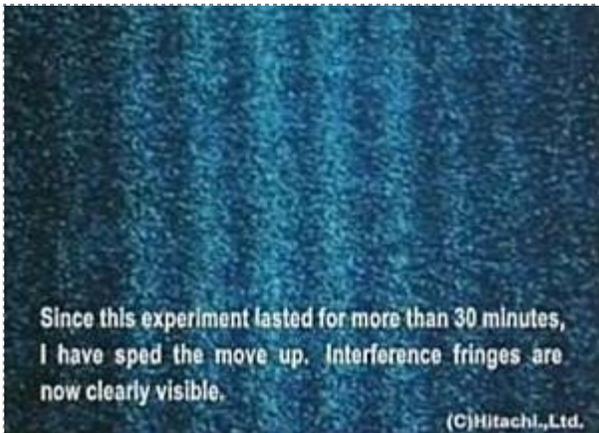
either, because the **uncolored** *ontic* quantum state (never in plural) cannot perform work at the length scale of tables and chair. No, you cannot bypass it in Hilbert dimensions 2; [you only won't see it there](#). What [your brain](#) does is a totally different story.

D. Chakalov

September 1, 2012

Last update: November 22, 2012

=====



There is no '[trajectory](#)' at the screen above, but the puzzle of 'localization of *what*?' is the same as in the case examined by [Nevill Mott](#) and the [Kochen-Specker Theorem](#): "... then measuring it does *not* mean ascertaining the value that it **has**." ([Erwin Schrödinger](#))

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Subject: [arXiv:1204.4616v2](#), p. 14 and pp. 19-20

Date: Mon, 3 Dec 2012 03:24:08 +0200

Message-ID:

<CAM7EkxmuwC9411s5WMBjOARPW+mmAzZt\_32g3yr-hDRc12a2tg@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Art Hobson <ahobson@uark.edu>

Cc: Gerhard.Hegerfeldt@physik.uni-goettingen.de,  
zee@kitp.ucsb.edu, knud.thomsen@psi.ch

Dear Dr. Hobson,

I read your article with great interest. It seems to me that we must not bypass the '[ontic](#)' issues related to the quantum state. Perhaps [Gerhard Hegerfeldt](#) will agree with the facts (known since 1929) about what happens to the quanta **after** their "localization",

[http://www.god-does-not-play-dice.net/#KS\\_Mott](http://www.god-does-not-play-dice.net/#KS_Mott)

In the case of GR, see the same "localization" at

<http://www.god-does-not-play-dice.net/#Maia>

I will appreciate your comments and the opinion of your colleagues.

Kind regards,

Dimi Chakalov

-----

**Note:** [Art Hobson](#) is right that there are no "particles" as 'objective reality out there', because what we see [above](#) are **not** some "quantum particles" due to some "interactions of a single quantum with the screen" ([p. 14](#)). By the same token, there are no genuine "[empty waves](#)", and the whole '[wave-particle dualism](#)' is just a repetition of the story about the Eskimo and his '[nose-arm dualism](#)'.

In the case of current [GR textbooks](#), see [Tony Downes et al., arXiv:1108.5220v2 \[gr-qc\]](#), p. 13: "The function  $a(t)$ , known as [the expansion parameter](#), is the ratio of the proper distance between any two galaxies at the [initial time  \$t = 0\$](#)  and the [time  \$t\$](#) ." The so-called 'trajectory' is again [visible](#), yet we have ignored the non-trivial [quantum-gravitational effects](#). We should be smarter, after [Plato](#).

D. Chakalov

December 3, 2012, 17:24 GMT

=====

Subject: Re: arXiv:1111.6597v2 [quant-ph]  
Date: Thu, 30 Aug 2012 18:31:01 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Renato Renner <renner@phys.ethz.ch>  
Cc: colbeck@phys.ethz.ch, thomas.wilson@cern.ch,  
teta@univaq.it, hartmann.roemer@physik.uni-freiburg.de,  
norbert.straumann@gmail.com, giulini@zarm.uni-bremen.de

Dear Renato,

> I would say that a minimum requirement for something to be called a "state"  
> is that there is a rule which, when I apply a measurement to the system,  
> allows me to compute the probability distribution of the possible measurement  
> outcomes.

The "probability distribution" refers only and exclusively only to the distorted twisted presentation of 'the quantum state' in the totally alien world governed by Special Relativity. In you were doing quantum chemistry, you can afford such 'shut up and calculate' (D. N. Mermin) instrumentalist interpretation of QM.

In the case of KS Theorem, you [don't have 'projective measurements'](#). The case is entirely different. Pity you ignored all references, included the opinion and arguments by Schrödinger, Margenau, Pauli, and [Jaynes](#).

There is nothing more I can do to help you solve the task at

<http://www.god-does-not-play-dice.net/#Renner>

All the best,

Dimi

> On Aug 28, 2012, at 23:02 , Dimi Chakalov wrote:

>

>> Dear Renato,

>>

>>> I had a look at the paper by Helena Granstroem, but it is still unclear to me what

>>> you mean by "states from the uncolored KS sphere"?

>>

>> These are "states" that nobody can say anything about, since any statement will  
>> introduce "color". To quote from [arXiv:quant-ph/0612103v2](http://arxiv.org/abs/quant-ph/0612103v2), p. 2: "Does the colourable  
>> fraction, using this specific construction, go to zero? In fact it does not, but  
>> instead tends to 68% as N approaches infinity." So, you have app. 32% of such  
>> \*uncolorable\* [you-name-it].

>>

>> See also [D.M. Appleby](#), ref. [6] therein.

>>

>>> What confuses me is that, in the context of the Kochen-Specker theorem, the  
>>> sphere is usually used to represent measurement directions, not states.

>>

>> By measurement directions you just count the colorable states -- see above.

>>

>> Please don't skip the links and the references there.

>>

>> Best wishes,

>>

>> Dimi

>>

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**Note:** I argued [above](#) that *some* (e.g., 32%, cf. [Helena Granström](#)) of the distorted twisted presentations of '*the quantum state*' **must** be uncolorable, because '*the quantum state*' represents the Genidentity ([Kurt Lewin](#)) of the particular quantum particle, explicated in the alien world governed by Special Relativity Theory ([STR](#)) by its "complementary observables". The latter cannot be jointly measured, so there *must* be 'uncolorable spots'. Were it possible to write down the full catalogue of expectation values, we would face 'hidden variables' with which one could calculate the exact number of unobservable, but *definitely* blond, angels one can fit on a pin of a needle (you can easily do this with [Bohmian mechanics](#)). But again, if the [Heisenberg-Bohr omelette](#) is too difficult to swallow, try the simple task from 1929 [above](#). If you are interested in Einstein's unfinished *Allgemeine Relativitätstheorie*, check out another simple task [above](#), then blend the two tasks, and you will be seeking 'the right answers to *the right* questions' (MTW, [p. 467](#)).

No, Einstein's *Allgemeine Relativitätstheorie* is [not a classical theory](#). You cannot fit the [UNdecidable](#), [UNspeakable](#), [pre-quantum Kochen-Specker state](#) (never in plural) into any Hilbert space either.

D. Chakalov  
August 31, 2012

### Addendum

In a private communication (2.09.2012), [Jürg Fröhlich](#) from [ETH Zürich](#) stated that "the result on DECOHERENCE IN POSITION SPACE contained in [our paper](#) is certainly very RELEVANT!" The paper in question is [arXiv:0810.4537v2 \[math-ph\]](#). But he can't use "decoherence" to solve the task [above](#); recall [Lev Landau](#).

Again, the task is **not** about the 'maximal probability' in the textbook interpretation of QM, which "allows to calculate the probability of ionization of atoms at points  $r_1 \dots r_N$ ", and "this probability is maximal when these points lie **close** to the classical trajectory of the electron with a given direction of initial velocity" ([Michel Dyakonov](#), private communication).

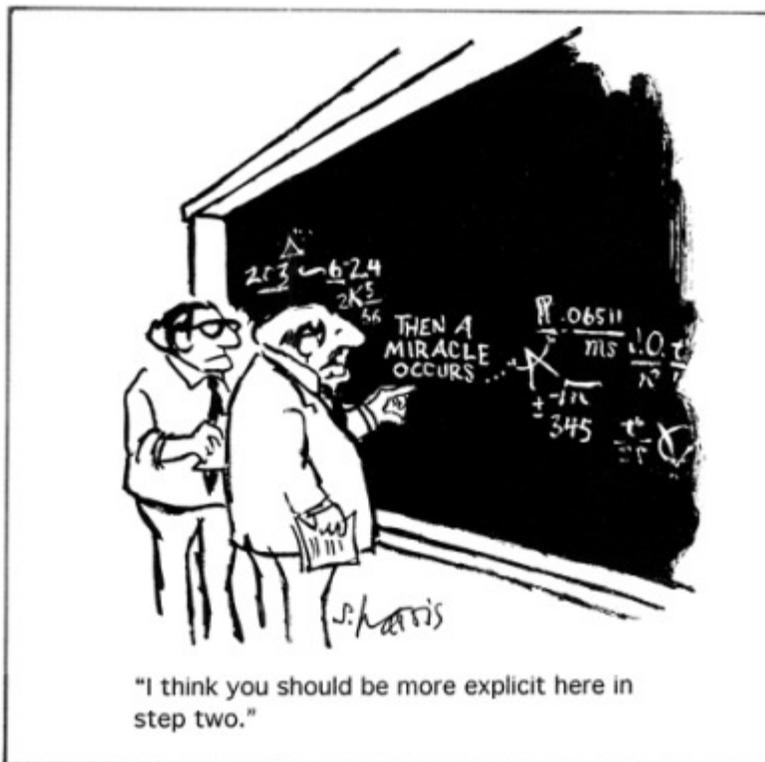
**NB:** The "probability" itself does not and cannot **drive** quantum particles -- see [above](#). You cannot even *think* of 'one single electron out there', to apply probability calculations from classical physics -- see [Erwin Schrödinger](#). No way.

You have to demonstrate the **real energy exchange** from [layer \(i\) to layer \(ii\) and back](#), to produce the two layers, for a finite time interval, as recorded with your wristwatch. Nobody, not even [CERN](#), can explain this "miracle". Nobody.

D. Chakalov

September 2, 2012

Last updated: October 28, 2012, [22:04:30 GMT](#)



=====  
Subject: The \*ontic\* quantum state vs [arXiv:1211.1179v1 \[quant-ph\]](#)  
Date: Wed, 7 Nov 2012 13:07:07 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Serge Massar <smassar@ulb.ac.be> ,

Manas Patra <manas@cs.york.ac.uk>,  
Laurent Olislager <lolislag@ulb.ac.be>  
Cc: Diederik Aerts <diraerts@vub.ac.be>,  
Nicholas Harrigan <nicholas.harrigan04@imperial.ac.uk>,  
Robert W Spekkens <rspekkens@perimeterinstitute.ca>,  
Renato Renner <renner@phys.ethz.ch>,  
Matthew Pusey <m@physics.org>,  
Terry <t.rudolph@imperial.ac.uk>

Dear colleagues,

You have enormous problems due to Mott, Schrödinger, and the Kochen-Specker Theorem,

[http://www.god-does-not-play-dice.net/#KS\\_Mott](http://www.god-does-not-play-dice.net/#KS_Mott)

<http://www.god-does-not-play-dice.net/#Morrison>

I think only people like [Terry](#) cannot understand the issue, but if you have questions, please don't hesitate.

All the best,

Dimi Chakalov

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**Note:** As [Plato](#) would have said, we can only see the distorted shadows from the genuine quantum- and-gravitational reality on 'the curved wall of the cave'. Many centuries later, Karel Kuchar tried to explain the real [Unmoved Mover](#), but [couldn't use math](#) either.

D. Chakalov  
November 7, 2012

=====

Subject: Energy in General relativity, [arXiv:1211.1407v1 \[gr-qc\]](#), Sec. 2  
Date: Thu, 8 Nov 2012 14:42:36 +0200  
Message-ID:  
<CAM7EkxmqNtNh+cx23OjHJ6ZRZtxwTKuy1mFY-TUc9s=XnQXitVw@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Mu-Tao Wang <mtwang@math.columbia.edu>  
Cc: Xiao Zhang <xzhang@amss.ac.cn>,  
Chiu-Chu Melissa Liu <ccliu@math.columbia.edu>,  
[Adam Helfer](#) <helfera@missouri.edu>,  
Laszlo Szabados <lbszab@rmki.kfki.hu>,  
Lau Loi So <s0242010@gmail.com>,  
Richard M Schoen <schoen@math.stanford.edu>,  
brendle@math.stanford.edu,  
pnchen@math.columbia.edu,  
g.w.gibbons@damtp.cam.ac.uk,  
j.d.barrow@damtp.cam.ac.uk,  
yau@ims.cuhk.edu.hk

Dear Dr. Wang,

We agree that only in Minkowski spacetime one can think about an energy-momentum tensor "attached" to a "point" and obtain [the conservation law](#) (Eq. 1). In GR, nobody can obtain any "energy momentum tensor for gravitation": there is no \*local\* density for gravitational energy (p. 2), as we know since 1921 (Hermann Weyl, [p. 3](#)).

Then you wrote: "An isolated system is modeled on an unbounded and asymptotically flat space-time where gravitation is weak at infinity."

Weak gravitation yet fueled by "dark energy" of what ?

Please define an '[isolated system](#)' endowed with dynamical "dark energy" of [[you-name-it](#)], and rewrite your notion of **quasilocal** mass that "corresponds to a non-isolated system where gravitation could be strong" (p. 4). Details at

[http://www.god-does-not-play-dice.net/#Fred\\_Hehl](http://www.god-does-not-play-dice.net/#Fred_Hehl)

If you or some of your colleagues [can do the math](#), please do write me back. I'm afraid [Garry Gibbons](#) can't solve the task, but maybe you are better.

Sincerely,

Dimi Chakalov

**Note:** Very briefly: in order to talk about 'time in GR' (see [below](#)), the gravitational energy *must* be [conserved](#) at every [spacetime point](#) (details [above](#)), which is currently impossible, as shown by Roger Penrose in [1982](#). Notice that in the [dual age model](#) both 'the universe as ONE' and every *quasi-local* wristwatch (sub-system) read [simultaneously](#) the proper (cosmological) time along the [Arrow of Space](#), elapsed since their common "zero point" ([Christopher Hirata](#)) in the [global mode](#) of spacetime. Because of this "zero point", the [conservation of energy](#) in the [conformal time](#) is valid *only and exclusively only* for the global mode, while in the local (physical) mode the same "zero point" of The Beginning (e.g., 200 million years "after" The Beginning, [Wei Zheng et al.](#)) does **not** exist, hence energy [cannot be defined nor conserved](#).

Thus, is the energy conserved in order to talk about "time"? YAIN. It depends on whether you consider the global or the local mode, yet at the instant 'now' from the [luxonic time](#) in the Arrow of Space they **coincide**, as elaborated with the so-called *biocausality* [above](#). Let me explain.

Read carefully the excerpt by Hermann Weyl from *Space-Time-Matter*, [p. 270](#) (4th ed., Dover Publications, New York, 1922; see [p. 3](#) from Mu-Tao Wang's paper):

“Nevertheless it seems to be physically meaningless to introduce the  $T_{\mu\nu}^*$ , as [energy components of the gravitational field](#); for, these quantities are neither a tensor nor are they symmetric. In fact by choosing an appropriate coordinate system all the  $T_{\mu\nu}^*$  can be made to vanish at any given point; for this purpose one only needs to choose a geodesic (normal) coordinate system. And on the other hand one gets  $T_{\mu\nu}^* \neq 0$  in a 'Euclidean' completely gravitationless world when using a curved coordinate system, but where no gravitational energy exists. Although the [differential relations](#) ( $\nabla^\mu T_{\mu\nu}^* = 0$ ) are without a physical meaning, nevertheless by [integrating them over an isolated system](#) one gets invariant conserved quantities”.

1. The [energy components of the gravitational field](#) are **dynamical** phenomena. They are produces

by the dynamics of spacetime and the [sufficient conditions](#) for spacetime. Your [current GR textbooks](#) cannot include the Unmoved Mover ([Karel Kuchar](#)), which makes them essentially incomplete, as stressed many years ago by [Albert Einstein](#).

2. The "differential relations" (details [above](#)) could be considered "without a physical meaning" only in a genuine classical theory. But they do not describe 'classical reality *out there*' fixed at particular "point", because Einstein's Allgemeine Relativitätstheorie is **not** a genuine classical theory. Namely, the *wegtransformierbar* faculty of gravity 'at a point' (Afriat and Caccese, [p. 27](#)) enforces the general idea of [Erwin Schrödinger](#): "measuring it does *not* mean ascertaining the value that it **has**", as it would have been in the case of 'classical reality *out there* at a point'. Which makes the [localization](#) of gravitational energy-momentum a genuine quantum-gravitational phenomenon: the very geometrical "points" become *quasi-local*. Your differential geometry textbooks (e.g., [Chris Isham](#)) are essentially incomplete regarding [Quantum Geometry](#). The only way -- let me repeat: *the only way* -- to restore the notion of 'reality' in quantum-gravitational realm is by 'potential reality' evolving along the Arrow of Space, because the current paradox or "problem" of time is unavoidable due to "the invariance of classical general relativity under the group Diff(M) of diffeomorphisms of the spacetime manifold M (Chris Isham, [pp. 4-5](#)).

In both QM and GR we face a genuine *flexibility* of quantum and gravitational systems, because their fleeting macroscopic presentations *cannot* be derived exclusively from the relativistic support in their past light cone -- this is the lesson from the [Free Will Theorem](#). The main difference is that in [QM](#) we have probabilistic *expectations* about the explication of these '[jackets](#)' at macroscopic length scale, while in the proper [GR](#) 'the universe as ONE' performs "measurements" by halting (or "collapsing") the so-called [freely falling elevator](#) to produce gravity & inertial mass (and also eliminates the "negative" mass at every instant 'now' in the *local* mode), yet in both cases the joint quantum-gravitational world is **not** a genuine 'classical reality *out there* at a point' (hence the [aether](#) is *physically* nonexistent).

3. Notice the underlined puzzle in the last sentence: how come we use a manifestly wrong theory about '*isolated system*' (see [above](#)), yet obtain [invariant conserved quantities](#) ?

It is like asking why we use a [wrong "projection postulate"](#) and obtain correct results, or bluntly ignore the quantum vacuum (John Baez, [case 4](#)), yet again obtain correct results.

Because we **eliminate** the global mode of spacetime, particularly the '[sufficient conditions](#)', by calculations with [linearized gravity](#). Physically, we can only obtain *one* single dead frozen and **perfectly localized** universe in the **local mode** of spacetime. The latter is a [perfect continuum](#), like instantaneous snapshots from a movie reel "[separated](#)" by **zero** '[dark Zen gaps](#)'. Such instantaneous *physical* universe contains **no** "dynamical dark energy" and **no** gravitation, in line with the [Equivalence Principle](#). **None**. We may think of it as an asymptotically flat (Friedman) universe which has become an '*isolated system*' due to eliminating its gravitational **source**, hence obtain [invariant conserved quantities](#) (see Hermann Weyl above). We may also use the "[conservation law](#)", Eq. 1 in the paper [above](#), and also fix the [GPS system](#), but **cannot** use such handicapped *linear* theory for objects [larger than the solar system](#). No way. Forget it.

Again, both the gravitational energy and "[dark energy](#)" are **caused** by accumulating and **binding** such point-like local universes **by** the [Arrow of Space](#) and the '[sufficient conditions](#) for spacetime': see option YAIN (iii) [above](#). Surely you can ignore them in [particular circumstances](#) but, if you study the [gravitational waves](#) and the dynamics of spacetime *itself*, you cannot derive '[time in GR](#)', gravity, and their "[dark energy](#)" *exclusively* from the '[necessary conditions](#) for spacetime' of your current [GR textbooks](#).

The [quasi-local](#) geometrical "points" of the dynamical spacetime of Machian quantum gravity are indeed [emergent phenomena](#). You also need the [Arrow of Space](#) to explain (cannot "prove" with theorems) the obvious positivity of mass -- "an important test for quasi-local energy expressions" ([Lau Loi So et al.](#)). The Machian quantum gravity is *the only way* to explain [the physical absence](#) of "negative" matter residing in [the dark Zen gaps](#), which "[accelerates](#)" the physical, positive-mass universe by '[self-action](#)'. Thus, the energy of the universe springs from a dimensionless geometrical point ([Luke 17:21](#)), and of course cannot be traced back, which makes it sort of "[dark](#)" to people like [Chuck Norris](#).

Just like with the [human brain](#), we cannot *physically* observe the mind and consciousness, but only a

self-acting and bootstrapped physical system: *Der Geist bewegt die Materie.*



You have no choice. None. **Zilch.**

Says who? "[Just another crank](#)", of course. More from [Max Planck](#).

D. Chakalov

November 9, 2012

Last updated: November 13, 2012, [08:50:34 GMT](#)

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$$R_{ij} - \frac{1}{2}g_{ij}R = \frac{8\pi G}{c^4}T_{ij}$$

«Space acts on matter, telling it how to move. In turn, matter reacts back on space, telling it how to curve.»

C.W. Misner, K.S. Thorne, J.A. Wheeler – *Gravitation*. Freeman & Co., 1973 (p.5).

As a necessary condition we want to demand that  $(M, g)$  be globally hyperbolic, that is, it possesses a Cauchy surface  $\Sigma$  (an 'instant of time') on which initial data can be described to determine uniquely the whole space-time, see for example, Wald (1984) or Hawking and Ellis (1973) for details. In such cases, the classical initial value formulation makes sense, and the Hamiltonian form of GR can be constructed. The occurrence of **naked singularities** is prohibited by this assumption.

An important theorem states that for a globally hyperbolic space-time  $(M, g)$  there exists a global 'time function'  $f$  such that each surface  $f = \text{constant}$  is a Cauchy surface; therefore,  $M$  can be foliated into Cauchy hypersurfaces, and its topology is a direct product,

$$M \cong \mathbb{R} \times \Sigma. \quad (4.38)$$

The topology of space-time is thus fixed. **But not on the boundary!**

Claus Kiefer, *Quantum Gravity*, 2nd ed., 2007, [p. 106](#).

Subject: Once a [coordinate](#) is chosen to be the time...

Date: Fri, 30 Nov 2012 13:52:23 +0200

Message-ID:

<CAM7Ekxm3agJ7h4KMQkQdL1hcDQiV8iLr9HD+QbkW=-Cw7g=8Qg@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Marcos Duarte Maia <maia@unb.br>

Cc: capistranoaj@unb.br,

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dmalamen@uci.edu,

rmwa@midway.uchicago.edu,

c.isham@imperial.ac.uk

Dear Professor Maia,

Thank you very much for your wonderful article [[Ref. 1](#)]. It is amazing to me how you managed to compress an enormous volume of knowledge into five pages.

May I share with you and your colleagues some ideas and alternative proposals.

1. Surely the cosmological "constant" originates from the contracted Bianchi identity, but I think the latter is totally unclear, because we don't know how to explain the "[conservation](#)" (if any) of energy in GR and the gravitational energy density at a "point" (MTW, [p. 467](#)), to attach some [tangent vector](#) at this (quasi-local) "point".

2. Surely we need to reach from GR some 'limiting case' resembling, but not necessarily identical to, the Minkowski spacetime [[Ref. 1](#)], provided we can understand task (1) and the underlying Equivalence Principle, but I think the 'limiting case' can only be defined **after** we solve the problems of spacetime from Quantum Theory,

[http://www.god-does-not-play-dice.net/#KS\\_Mott](http://www.god-does-not-play-dice.net/#KS_Mott)

In other words, first things first.<sup>1</sup>

3. Once we solve tasks (1) and (2), we might (hopefully) understand [the nature of time](#), which I think is defined by the dynamics of space, namely, time emerges not as 'change in space' but from 'change \*of\* space', which leads to the so-called Arrow of Space,

<http://www.god-does-not-play-dice.net/#inherited>

To sum up, once we unravel the proper mathematical formalism for quantum gravity, there will be no need for "black holes" nor "multidimensional superstitions" (Sheldon Glashow) to explain the propagation of gravitation, and those [dark tunnels of LIGO](#) will be converted to wine cellars -- all we need is to keep the temperature around 14 degrees C.

Any other ideas?

All the best,

Dimi Chakalov

[Ref. 1] M. D. Maia, On The Topological Nature of the Cosmological Constant, [arXiv:1211.6883v1 \[gr-qc\]](#); International Journal of Modern Physics: Conference Series, Vol. 18 (2012) [109-114](#).

p. 1: "From the mathematical point of view, the cosmological constant originated from the contracted Bianchi identity  $(XXX)=0$ . This conveys to the conclusion that the Einstein tensor (between the parenthesis) should be proportional to  $(g_{xx})=0$  which is the defining condition for the Levi-Civita connection.

.....

"... so that the existence of the Minkowski space-time as a solution of the classical Einstein's equations would be guaranteed.

.....

p. 2: "In this case, once a [coordinate](#) is chosen to be the time, ..."

.....

"Thus, in Einstein's theory, the gravitational field does not possess the same four-dimensional constraint, meaning that gravitation may propagate along extra dimensions in excess of four, but it also propagate in a space-time subspace of some higher-dimensional space."

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[4] M. D. Maia [Geometry of the Fundamental Interactions](#). Springer, New York (2010).

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<sup>1</sup> After solving the measurement and macro-objectification "problems" in Quantum Theory, the spacetime *manifold* becomes "quantized" from the outset, namely, the local (physical) mode of spacetime is presented with a [perfect continuum](#) at *all length scales*, while the '[dark Zen gaps](#)' (global mode of spacetime) are totally eliminated as 'physical reality' due to the "[collapse](#)" and the

"flattening" of spacetime -- one-at-a-time by the [Arrow of Space](#). The latter does indeed "determine uniquely the whole space-time" (C. Kiefer, [p. 106](#)), but only for *one* dead frozen instant 'now' (see option YAIN (iii) [above](#)). Otherwise you won't be reading these lines, because the [human brain](#) cannot function in the dead frozen spacetime of your GR textbooks ([László Szabados](#)); details from [Max Tegmark](#).

Don't be fooled by the '[nose-arm dualism](#)' either -- recall the *pre-established* or EPR-like [[Ref. 2](#)] harmony from [Gottfried Wilhelm Leibniz](#): the UNSpeakable, *pre-quantum* [Kochen-Specker state](#) exists like the monads which "have no windows through which something can enter or leave" (Leibniz, [Monadology §7](#)). Only in our case we've introduced the so-called [John's jackets metaphor](#), in which the *physicalized* 'jackets' (as observed in the double-slit experiment [above](#)) resemble (but are not identical to) the [physicalized sayings](#) in the example with the human brain provided previously. We cannot *in principle* observe the UNSpeakable, pre-quantum monad or [Platonic Idea](#) -- only its distorted "shadows", as in the [double-slit experiment](#). If you nevertheless insist on applying the laws of Special Relativity, you'll get "into a blind alley from which nobody has yet escaped" [[Ref. 3](#)], firstly because if you really insist on some *particle-like* interpretation (cf. [Art Hobson, p. 14](#)), you will have to introduce the notion of 'objective reality *out there*' from Special Relativity, and face the question of the relativistic history of that "particle" in the past light-cone of your reference frame, way down in the "[blind alley](#)", just as in the case with the [past state of the Sun](#).

To avoid misunderstandings, check out three *physicalized* "particles", or rather '[jackets](#)', with your brain:

1. All are not hunters that blow the horn.
2. La robe ne fait pas le médecin.
3. Es ist nicht jeder ein Koch, der ein lang Messer trägt.

Simple, no? If you can do it, '[the universe as a brain](#)' can do it as well; maybe even [better](#). The main idea from GR is that the *physicalized* "jackets" are driven **by** the [Arrow of Space](#). Only the non-Archimedean geometry of '[the quantum state](#)', embedded in 'the universe as ONE' (global mode of spacetime), is [missing](#). More from [James Dungundji](#).

As to converting LIGO tunnels to wine cellars (what else?), recall the main issues with the BMS group of Hermann Bondi, published in 1962 (cf. [Evangelos Melas](#)): (i) the assumption that the Minkowski metric -- "a shadow without power", [Hermann Weyl](#) -- would be *perturbed* by the [incoming GWs](#), and (ii) Bondi's *news functions* ([Paper VII](#)), related to the alleged [loss of mass](#) by the gravitating system (cf. Marcos D. Maia, Gravitational Waves from Coalescing Binary Sources, *Int. J. Mod. Phys. D*, 19 (2010) [2295-2298](#)).



" . . . and we can save 700 lire by not taking soil tests."

D. Chakalov

December 1, 2012

Last updated: December 6, 2012, 05:45 GMT

[Ref. 2] John C. Polkinghorne, *Quantum Theory: A Very Short Introduction*, Oxford University Press, 2002, [p. 81](#).

"It is as if a singer at 1 was singing a random series of notes and a singer at 2 was also singing a random series of notes and only if one were able to hear them both together would one realize that the two singers were in some kind of harmony with each other."

[Ref. 3] Richard Feynman, *The Character of Physical Law*, The MIT Press, Cambridge (MA), 1965, [p. 129](#).

On the other hand, I think I can safely say that nobody understands quantum mechanics. So do not take the lecture too seriously, feeling that you really have to understand in terms of some model what I am going to describe, but just relax and enjoy it. I am going to tell you what nature behaves like. If you will simply admit that maybe she does behave like this, you will find her a delightful, entrancing thing. Do not keep saying to yourself, if you can possibly avoid it, 'But how can it be like that?' because you will get 'down the drain', into a blind alley from which nobody has yet escaped. Nobody knows how it can be like that.



Subject: On the total mess in GR, [arXiv:1212.0147v1 \[gr-qc\]](https://arxiv.org/abs/1212.0147v1)

Date: Tue, 4 Dec 2012 10:23:17 +0200

Message-ID:

<CAM7Ekx=fadw89v6yAOTHsmiDzP2JiWw\_MzSU5RTTzLghcRwo8A@mail.gmail.com>

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Hi there,

The so-called "gauge conditions on closed spacelike hypersurfaces" and "spacetimes which are asymptotically flat at spatial or null infinity" cannot exist, for reasons explained at

<http://www.god-does-not-play-dice.net/#Maia>

Thus, [you shouldn't muse](#) on some "two-surface integrals on spheres at the spatial and (e.g. future) null infinity." Unless, of course, you enjoy the total mess in your GR textbooks and arXiv:1212.0147v1 [gr-qc],

<http://arxiv.org/abs/1212.0147>

As always, I will be happy to provide specific arguments.

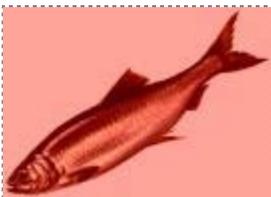
All the best,

Dimi

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**Note:** Read the paper by László Szabados below; I emphasized some notions from it, but will refrain from posting mathematical arguments at [this web site](#). As explained [above](#), the rule is "do not throw your pearls to pigs" ([Matthew 7:6](#)).

Firstly, you simply can't outsmart Nature with math. The [red herring](#) in GR textbooks is the *mathematical* presentation of 'time', which inevitably requires the **points** of 'time instants', with well-defined, localized gravitational energy *density* at these **points**. Which is, again, [red herring](#). We need quantum gravity to develop the correct General Relativity, not its classical approximations, such as those in the current GR textbooks.



If László Szabados defines the "strength" of the gravitational 'field' at some "instant" represented with some "closed hypersurface", such magic calculation [will inevitably require](#) localized and finite energy *density* of the same gravitational 'field' at *that* point/instant. You may try to bypass the gravitational density problem at an 'instant', like [Niall Murchadha](#) did, but will again end up with [red herrings](#), and [pigs will fly](#).

No matter what you do, even if you try to speculate about 'regions', the latter are made up by "points" that **cannot** be defined with the classical approximation of General Relativity from your GR textbooks. Since spacetime is defined by matter & energy, but the latter cannot be mathematically defined at any "point" with classical approximations, you need quantum gravity to resolve the localization of matter & energy at [geometrical quasi-local points](#), and their temporal existence and dynamics. It's a bundle, because the nature of [time](#) is the *dynamics* of spacetime itself (forget about

LIGO) in terms of 'change of space' ([Arrow of Space](#)).

You may [ignore](#) the absence of *mathematical* presentation of 'time' *only* in some very limited case such as 'flat background spacetime'. Then you may imagine that this fixed flat background spacetime has provided "time" and "localization at a point", and subsequently some well-defined "points" with which you may calculate the "[conservation](#)" of energy and the "[total mass](#)", after which you may amend the lame incomplete math with the seemingly *obvious*, [yet mathematically non-existent](#) phenomenon of 'time'. But **not** in General Relativity.

You may *not* invoke the idea of some "*isolated system*" in order to "get invariant conserved quantities" (cf. Hermann Weyl, *Space-Time-Matter*, 1922, p. 270 [above](#)), because you cannot define an [isolated gravitational system](#) in the first place. Only [Chuck Norris](#) can see and verify 'the only truly isolated system' -- the universe as a whole, from which we have 'time' due to the so-called '[sufficient conditions](#)' for spacetime'. The math is still [unknown](#), so don't try to replace it with some "obvious" imagination and wishful thinking.

The *obvious* difference between a "[point](#)" vs "finite region" is that the latter is comprised from the former, and should be calculated by integration, but without any "background". You need 'time' to mimic this process [mathematically](#), but 'time' is absent in GR textbooks: you have to deal with only **one** dead frozen instant/point, regardless of how "large" the chunk of spacetime "obviously" *is*. Mathematically, you have *eliminated* the phenomenon of time ([Bob Geroch](#)) and are left with only **one** dead frozen instant, which is why you cannot discriminate between the *obvious* 'points' and 'finite region'. You're nevertheless tempted to amend your math with your "obvious" imagination, but this is exactly what makes [pigs fly](#).

D. Chakalov

December 4, 2012

Last updated: December 8, 2012, 11:17 GMT

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[László B Szabados](#), On total masses in GR, [arXiv:1212.0147v1 \[gr-qc\]](#).

On total masses in GR

5

Since the expected general form of the energy-momentum in General Relativity is a two-surface integral, it does not seem to be possible to associate any well defined notion of total energy-momentum, or at least total mass, with *closed universes*. However, this does *not* mean *a priori* that a reasonable and useful notion of total mass cannot be associated with closed universes in some other way. This could perhaps be based on the idea that the total mass should be some *positive definite measure* of the strength of the gravitational 'field'.

Since  $M$  was defined as the infimum of an expression on a set of certain smooth spinor fields, it is not *a priori* obvious that there is a smooth spinor field which saturates the inequality on the right. Nevertheless, one can in fact show that *such a spinor field does exist* [19]. We will call such a spinor field a *minimizer spinor field*.

The (geometrical and physical) significance of  $M$  is shown by our key result [19]:

**Theorem 1.** *Let the matter fields satisfy the dominant energy condition. Then  $M = 0$  if and only if the spacetime is flat and the topology of  $\Sigma$  is torus:  $\Sigma \approx S^1 \times S^1 \times S^1$ .*

Through simple examples we illustrated how the geometry of the data sets for closed universes can be characterized by the spectrum of the Sen–Witten and the 3-surface twistor operators. In these examples we also calculated the quantity  $M$  and its time derivative. The results support the interpretation of  $M$ , suggested the general properties listed above: It, as a positive definite measure of the strength of the gravitational ‘field’, can be interpreted as the *total mass density* of closed universes at the instant represented by the closed hypersurface  $\Sigma$ . Nevertheless, the ultimate answer to the question whether this is a reasonable and useful notion will be given by the future applications.

=====

"In his inaugural lecture, Einstein discussed the metric field as a kind of ether, acting on, and (at *the same instant* - D.C.) being acted upon by matter; a definite state of motion, however, could **not** be ascribed to it. In deference to Lorentz, he even said that "the ether of the general theory of relativity is the outcome of the Lorentzian ether, through relativization"; see Einstein, Äther (ref. 2), p. 13; 178."

Jeroen van Dongen, [arXiv:1211.3309v1](https://arxiv.org/abs/1211.3309v1), footnote a, p. 1.

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Subject: Time in GR: [arXiv:1211.1718v1 \[gr-qc\]](https://arxiv.org/abs/1211.1718v1), Sec. 2

Date: Fri, 9 Nov 2012 13:39:45 +0200

From: Dimi Chakalov <dchakalov@gmail.com>

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Dear Dr. Szybka,

Regarding your projection diagrams, I wonder if you can introduce [time parameter](#) from the scale factor,

[http://www.god-does-not-play-dice.net/#Fred\\_Hehl](http://www.god-does-not-play-dice.net/#Fred_Hehl)

Otherwise you simply cannot model the [stable causality](#) and [global hyperbolicity](#), I'm afraid.

The professional opinion of your colleagues will be greatly appreciated, too. Please pass this email to Dr. Christa Ölz as well.

Kind regards,

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**Note:** I don't like "miracles", such as the emergence of Lorentzian metric from some "[foam](#)". Besides, 'time as *change*' doesn't make sense in GR textbooks, because there is no motionless background spacetime to define *relationally* 'time as change'. If you wish to introduce some "big bang" to play the role of reference object with fixed '[zero cosmological time](#)', you'll have a "half-dynamical" spacetime, while we need a genuine reference object, such as [the reference fluid in GR](#) -- it can't "move" anywhere, simply because it is ONE.

People try to introduce some background [by hand](#), and fail miserably. They also try to "explain" the obvious [positivity of mass](#), the [stable causality](#) and [global hyperbolicity](#) by introducing some "theorems" that would resemble "explaining" the phenomenon of heat *only* by postulating its existence, because otherwise the world would look totally different, while we need to explain it as [emerging](#) from something entirely different, like 'kinetic energy'. Following this (certainly rough) analogy, we introduce the notion of '[sufficient conditions](#) for spacetime' and zoom on the [geometry of spacetime](#).

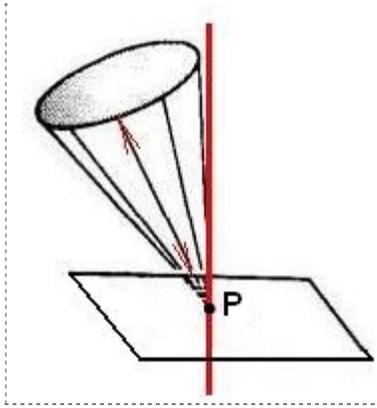
Notice the metaphysical presumption about 'transience' and 'flow of time' in option YAIN (iii) [above](#), which treats the unfortunate idea about "curvature" as a [wrong statement](#) by some 3-D Flatlander who cannot in principle "see" the [w-axis](#) of the Arrow of Space.

In a nutshell, we claim that the *physical* influences -- matter acts on geometry by determining spacetime -- and the *physicalized* (due to the [sufficient conditions](#)) influences -- geometry "acts back" on matter *via* its spacetime -- lead to *self-acting* matter, as these bi-directional **instantaneous** influences (cf. Escher's hands below) converge on **every quasi-local** point **P** in the first drawing below. Also, the *quasi-local* point **P** carries these bi-directional influences along the Arrow of Space (the *flow* of [Heraclitean time](#)), from the **inherited** and irreversible past toward the **potential** and "open" ([James Dungundji](#)) future, hence constituting a new retarded causality dubbed [bi-causality](#).



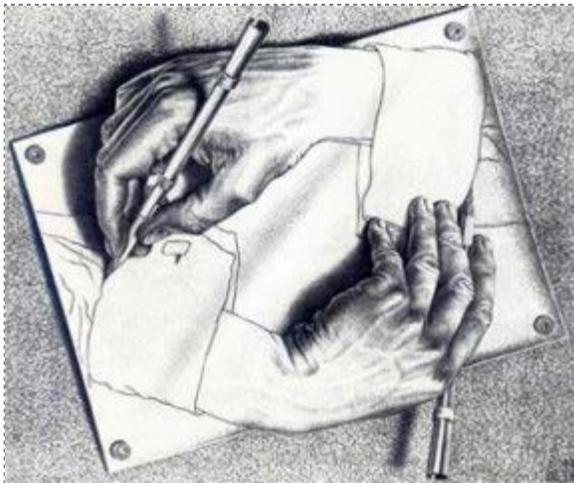
The initial ideas about [Quantum Geometry](#) and [torsion](#) are based on the Arrow of Space and bi-causality (notice the red arrow in the elevator [above](#)), and include the following statements: we can only claim (not physically observe) the *actual* existence of an instant 'now', which is fixed simultaneously at **all** points **P** constituting a linearized or *physical* universe 'now' (local mode of spacetime), and also consider this instant 'now' to be "slippery" due to its **different** referential states -- inherited past and potential future -- which are stacked on a "skewer" along the [w-axis](#) of the Arrow of Space in the *global mode* of spacetime (cf. the first drawing below).

The only change of the instant 'now' comes from the change of its *referential* 'past' and 'future' states, but due to [the "speed" of light](#) these **different** states can be identified *post factum* only. Also, the **re**-creation of the universe, in terms of [emergence of spacetime](#), is the essence of the Arrow of Space: physically, it can only be detected *post factum*, and because it runs [continuously](#) along the [w-axis](#) arrow, the [potential states](#) available for the **selection** of the **next**, and [certainly different](#), 'past' and 'future' *physical* states ("[jackets](#)") are **shifted** in the [potential future](#), like in a pocket of *propensities*. Physically, these potential states cannot be observed *in principle*, because we inevitably "flatten" (or "collapse", as in QM textbooks) the Arrow of Space at the very *instant* of observations: see the [Kochen-Specker Theorem](#) and the "mysterious cat Macavity" ([Adam Helfer](#)).



The w-axis of the Arrow of Space

We cannot witness [the transition itself](#) "online", firstly because no [unanimated clock](#) can read the *luxonic* time (cf. the animation by [John Walker above](#)) from the [Arrow of Space](#). The nonlinearity and self-action of *matter*, from being [bootstrapped](#) by its gravity, come from the **global** temporal nature of the metric field ([Albert Einstein](#)), shared also by all [living creatures](#): at any *quasi-local* instant **P** we have **two** simultaneous **nonlinear** interactions (marked with small **red** arrows in the drawing above), such that "the metric is treated as a field which not only affects, but also is (at the same *instant* - D.C.) affected by, the other fields" ([John Baez](#)). "All agree that in general relativity, the metric tensor  $g_{ij}$  is (or better: represents a field that is) dynamical: it **acts** and is (at the same *instant* - D.C.) **acted on**. They also agree that it is a special field since it couples to every other one, and also cannot vanish anywhere in spacetime. Many authors go on to say that the metric tensor represents geometry, or spacetime structure, so that geometry or spacetime structure **acts** and is (at the same *instant* - D.C.) **acted on**" ([Jeremy Butterfield](#)).



$$R_{ij} - \frac{1}{2}g_{ij}R = \frac{8\pi G}{c^4}T_{ij}$$

«Space acts on matter, telling it how to move. In turn, matter reacts back on space, telling it how to curve.»

C.W. Misner, K.S. Thorne, J.A. Wheeler – *Gravitation*. Freeman & Co., 1973 (p.5).

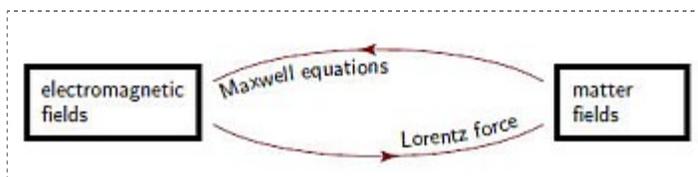
Which goes first? Because of [well-known reasons](#), your [unanimated](#) classical "wrist watch!" ([Chris Isham](#)) cannot answer this question, and you have to seek refuge in the old "[linearized](#)" approximation.

The solution comes with the *quasi-local* "points" in [Quantum Geometry](#). The Escher hands above can easily explain the puzzle of **self-action**: picture *one* of the **mirror** hands as *quasi*-instantaneous (thanks to the '[sufficient conditions](#)') influence of 'the school of fish' on every *quasi-local* 'fish' from the picture [above](#). And at the same *quasi*-instantaneous instant of "writing", the other **mirror** hand also "writes on" or influences the rest of *quasi-local* 'fish' from 'the school of fish' (=the whole universe as ONE) *by* their gravitational field, and *via* their gravitational field that has [bootstrapped](#) the whole 'school of fish'. Again, the mirrored hand(s) display a fundamentally *non-linear* interaction (dynamical "talk") of all tangible and intangible ([Hermann Bondi](#)) forms of energy, *quasi*-simultaneously at each and every quasi-local point **P**, which makes the observable, *physical* "hand" in the right-hand side of Einstein field equations **self-acting**. Physically, we cannot observe the whole 'school of fish' *en bloc*, which is why we need the '[sufficient conditions](#) for spacetime'.

The only way to *animate* this bi-directional and *quasi*-instantaneous "talk" between the two sides of the Einstein field equations is with the [w-axis](#) of the Arrow of Space, depicted above. We need a pocket ("cone") of *propensities* to **separate** the two "hands" and allow them to interact [non-linearly](#) on every point **P**, which is the crux of [Quantum Geometry](#).



We **cannot** resort to the simple case of linearized "talk" over a *fixed background* spacetime in classical electrodynamics, as depicted in the picture from [Alex Altland](#) below.



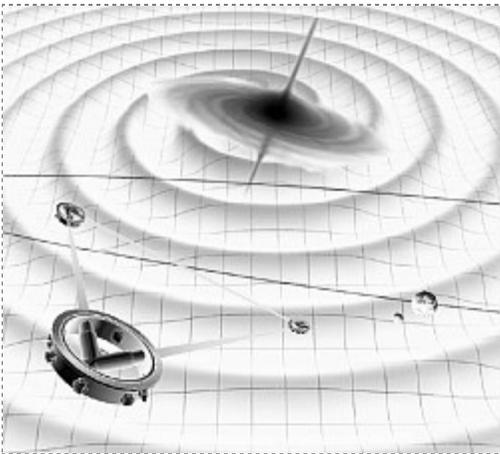
Details from Ruben Aldrovandi and Jose Geraldo Pereira [above](#). Physically, we can only claim that a [positive](#) matter has been *post factum* selected to represent [the physical world](#), and has also been *post factum* endowed with '**self action**' by its gravitational energy, after which we inevitably face its '[dark](#)' [origin](#).

In summary, if you don't like "miracles", you will need [new math](#) to explain the fundamental

**nonlinear** connection at all **self-acting** points  $\mathbf{P}$  , starting from a plain Borel set. The task goes back to 1912 ([Jean-Pierre Provost](#)):

1912, 100 years ago, is a remarkable date for relativity and gravitation because it marks the end of Relativistic Dynamics (R.D) and the beginning of General Relativity (G.R), both involving the energy momentum tensor ( $T^{\mu\nu}$ ) in a crucial way. When turning from a scalar to a tensor theory, Einstein acknowledges that *“the general validity of the conservation laws [(C.L.)  $\partial_\mu T^{\mu\nu} = 0$  or  $f^\nu$ ] and the law of inertia [ $T^{i0} = T^{0i}$ ] is the most important new advance in the theory of relativity . . . The problem to be solved always consists of finding how  $T^{\mu\nu}$  is to be found from the variables characterizing the processes under consideration”.*

But if you prefer [miracles](#) in mathematical physics, you may enjoy Murphy's Law No. 15: Complex problems have simple, [easy-to-understand](#) wrong answers:



Check out [Harvey S. Reall](#), *General Relativity 2012* (M24), 19/11/12, Sec. 5.2, [p. 53](#) (“the gravitational field can **do work** on the matter in the spacetime”), and Sec. 8.5, [p. 92](#), “the gravitational waves arise **when  $I_{ij}$  varies in time**”.

First you need to discover the spacetime *event*  $\mathbf{P}$  at which the gravitational field **does work** on the matter in spacetime, presented in the r.h.s. of the Einstein field equations (MTW, [p. 467](#)), and then explain exactly how “gravitational waves arise **when  $I_{ij}$  varies in time**” (Harvey Reall, [p. 92](#)), as read by your “wrist watch!” ([Chris Isham](#)). But the first task **requires** (not “implies”) that the gravitational energy *density* at the point  $\mathbf{P}$  *does exist* in the first place, which in turn **requires** that the [spacetime metric](#) is dead locked on this same point  $\mathbf{P}$  , and the spacetime itself becomes a dead fixed background, “which is there **before** the wave arrives and **after** it passes” ([Bernard Schutz](#)), hence enables people like Harvey Reall and [LIGO operators](#) to record with their wristwatches the instants at which the “[ripples](#)” of spacetime metric pass through LIGO, just as the local disturbances (e.g., minor earthquakes) do in Minkowski spacetime.

In other words, you **must assume** from the outset that the well-known problem of gravitational energy 'at a point' (MTW, [p. 467](#)) can be solved *in principle*, as if it were only a matter of changing the calculation technique, say, by changing the type of coordinates. In you case, you simply “go to second order in perturbation theory” and proceed by “setting  $\mathbf{h}$  to zero” (Harvey Reall, [p. 92](#)). Thus, you consider zero amplitude of gravitational waves, which match [zero torsion](#) and zero amplitude of [quantum waves](#) (macroscopic, classical, and gravity-free world), and expect to detect by [2020](#) some **work** (Harvey Reall, [p. 53](#)) done on the matter in spacetime by such [dimensionless](#) amplitude/strain.

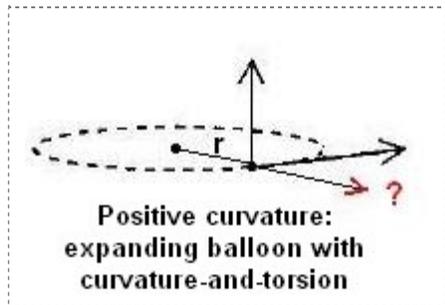
[Forget it](#). Detecting GWs with LIGO is a [pink unicorn](#). Or red herring, if you prefer something more realistic. The **self-acting** faculty of matter-and-gravity requires (not "implies") that gravity "can **do work** on the matter in the spacetime" (Harvey Reall, [p. 53](#)) at *the same point/event* in spacetime in which the gravitationally affected (past perfect) matter had *already* defined *the same* spacetime that was acting on it in the first place.

*Which goes first?* That's the origin of the problem of time in [GR textbooks](#). You need to **derive** a new type of [background](#), ensuing from "the fact that gravity carries energy and is thus a [source of more gravity](#) (emphasis mine - D.C.). In this sense gravity differs fundamentally from the electric field, which does not carry charge and thus is **not** the source of more electric field" (Ron J. Adler, [p. 14](#); see details in [p. 301 and Ch. 9](#) from Ronald Adler *et al.*, *Introduction to General Relativity*, McGraw-Hill, New York, 1975).

Surely the **self-action** of matter coupled to **itself** by its own gravity is fundamentally nonlinear ([Hermann Bondi](#)). Besides, we can *only* detect matter in the r.h.s. of the filed equations, **acting on itself** *via* gravity in the l.h.s. of these filed equations, just as we can *only* measure the self-action of the [human brain](#) -- not its unphysical "field" called mind and consciousness (or [geometry](#), in our case). The solution to this very old and widely known *which-goes-first* puzzle is explained at this web site, and those LIGO people can do nothing to avoid it. They can only keep dead quiet and [waste taxpayers' money](#).

D. Chakalov  
November 15, 2012  
Last update: November 29, 2012, [17:17:17 GMT](#)

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Subject: A picture is worth a thousand words: The geometry of torsion & curvature coupling

Date: Fri, 16 Nov 2012 03:42:42 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Yu-Huei Wu <yhwu@phy.ncu.edu.tw>, Chih-Hung Wang <chwang@phy.ncu.edu.tw>, Seyen Kouwn <seyen@skku.edu>, Carlos Romero <cromero@fisica.ufpb.br>, Miguel Socolovsky <socolovs@nucleares.unam.mx>, Eric Adelberger <eric@npl.washington.edu>, Nikodem Poplawski <nipoplaw@indiana.edu>, Andre Tilquin <tilquin@cppm.in2p3.fr>, Thomas Schücker <thomas.schucker@gmail.com>, Vincenzo Cardone <winnyenodrac@gmail.com>

Dear colleagues,

Please excuse my unsolicited email.

In order to think about how spacetime "bends" in GR, I believe we should explain curvature-and-torsion with a clear and simple drawing. The usual reference to the book by Manfredo Perdigão do Carmo (Differential geometry of curves and surfaces, [1976](#)) wasn't helpful regarding a picture which would "worth a thousand words".

If possible, may I ask you to help me find the geometrical presentation/picture of 'torsion', together with the geometrical presentation of 'curvature' and [Levi-Civita connection](#). For example, I've been trying to explain 'curvature' with the horizontal green vector, and 'torsion' with the orthogonal yellow and dark blue vectors in the drawing attached (cf. [torsion.jpg](#)), borrowed from

[http://upload.wikimedia.org/wikipedia/commons/7/7b/Circle\\_nebeneinander\\_animated.gif](http://upload.wikimedia.org/wikipedia/commons/7/7b/Circle_nebeneinander_animated.gif)

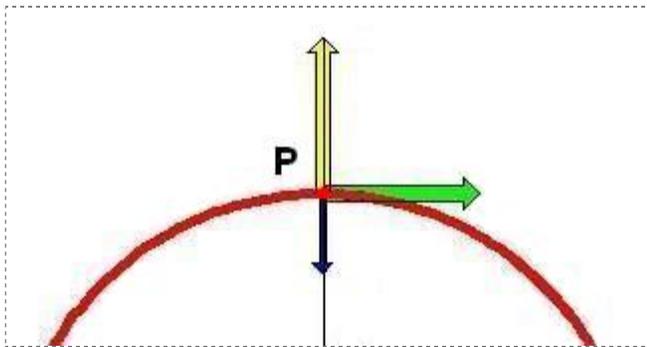
I'm afraid the geometrical picture is far more complicated, and will appreciate your help.

Kind regards,

Dimi Chakalov

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Drawing attached:



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**Note:** To understand about how spacetime "bends" (it doesn't) along the [Arrow of Space](#), let me reiterate that the notions of "curvature" and "dark" [[you-name-it](#)] are artifacts from "binding" the consecutive states of gravitational systems on a dead frozen manifold which has no 'flow of time' at all. If we **bind** them properly (cf. option YAIN (iii) [above](#)), we can examine **only one** instantaneous *physical* snapshot from the [Arrow of Space](#), in which there is no "curvature" nor "dark" [[you-name-it](#)], and the total gravitational interactions over this whole instantaneous 'now' universe are *already* made **linear**, so we may use the insights of [Einstein](#) and the [Bianchi identities](#), but again: only for one instant 'now'.

However, once we admit the phenomenon of [flow of time](#) specified with option YAIN (iii) [above](#), all "dark" effects of gravity, the curvature and torsion included, are resulting from the *physically* undetectable **binding** by the [Arrow of Space](#) (cf. the [dark Zen gaps](#)) of an infinite "number" of such independent and fully linearized instants 'now', and the task of explaining the curvature and [torsion](#) is shifted to the [global mode](#) of spacetime.

Namely, instead of *one* "**horizontal**" snapshot of *one* dead frozen physical universe 'now' ([Robert Geroch](#)), we have a "**vertical**" fusion of [uncountably infinite](#) universes 'now' along the "skewer" **w** of the [Arrow of Space](#). People wrongly "bind" these universes into one "horizontal" universe endowed

with "memory", because they are terribly misled by the fact that every wristwatch ("I can certainly read the time on my wrist watch!", [Chris Isham](#)) *does* read the [Arrow of Space](#), even though it cannot read the [luxonic](#) time and cannot detect the dynamic *emergence* -- one-at-a-time -- of the continuous chain of universes 'now', endowed with curvature and torsion.

Briefly, in both cases we **bind** the "points" to mimic Nature and obtain 'one composite universe', but the difference is that, since the theoretical physicists cannot find the [Unmoved Mover](#), they 'put the cart before the horse' with [thermodynamics](#), although it is [agonizingly clear](#) that no *physical stuff* can ultimately '[move itself](#)' to produce the *flow of time*. Thus, all they can do is shrug their shoulders and claim that the flow of time [doesn't exist](#), "because" (notice the Marxist-Leninist "logic") it *cannot* exist in their textbooks that failed to explain up to 96 per cent of the world in the first place, and consider it "[dark](#)".

Alternatively, in the Machian quantum gravity, the **binding** of *quasi-local* points by the [Unmoved Mover](#) is presented with the '[sufficient conditions](#) for spacetime' in the *global mode* of spacetime [between](#) the quasi-local "points", thanks to which in the local (physical) mode of spacetime these '[dark Zen gaps](#)' **totally** disappear, and the resulting *physical* continuum is [perfect](#), at *all length scales*. Again, we need the global mode to make 'the ONE universe' an **isolated** system with [boundaries](#): the unphysical or ambient "part" of the universe, with respect to which the physical one is defined, has not been swept under the carpet with some "[asymptotic](#)" recipes, but is **brought back** into spacetime in the form of '[global mode of spacetime](#)', and the universe is *self-determined*.

Recall also that the pocket (or "cone") of propensities in the previous drawing [above](#) exists only along the [w-axis](#) of the Arrow of Space; physically, it is always **zero**, as shown with the [Kochen-Specker Theorem](#). Physically, we can only observe [distorted shadows](#) from the genuine quantum-and-gravitational reality projected on 'the [curved wall](#) of the cave'.

This is *the only possible* solution, and if we put aside some terminological suggestions, this solution is known for centuries: *Der Geist bewegt die Materie*. Physically, it (not He) may look like 'the ideal monad [without windows](#)', also known as [Luke 17:21](#).

Sorry for repeating this here; please bear in mind that there is **no other option** to suggest for 'spacetime geometry of *the ONE universe*'. Now let's go back to the curvature-and-torsion, which induce the impression that the wall in [Plato's cave](#) may be "[curved](#)".

Let me first stress that the geometrical presentation of curvature-and-torsion at a point **P** is *not* relevant to the Frenet-Serret equations. People may claim that 'curvature' measures deviation of a curve from lying along a straight line, while 'torsion' measures deviation of the same curve from lying in a plane, but our task is strictly focused on the geometry and topology of spacetime, [which cause specific physical effects on matter](#) -- not abstract mathematical musings.

For examples of irrelevant math, see an excerpt from Victor Toponogov and Vladimir Rovenski, *Differential Geometry of Curves and Surfaces*, 2005, Sec. 1.8, [p. 45](#):

Let a curve  $\gamma$  be of class  $C^2$  and have nonzero curvature at a point  $P_1$ . Then, by continuity, the curvature of  $\gamma$  is nonzero on some neighborhood of  $P_1$ . Take an arbitrary point  $P_2$  in this neighborhood. By Theorem 1.6.2 there exist unique osculating planes  $\alpha_1$  and  $\alpha_2$  at the points  $P_1$  and  $P_2$ . Denote by  $\Delta\theta$  the angle between them, and by  $\Delta s$  the length of the arc  $P_1 P_2$  of  $\gamma$ .

**Definition 1.8.1.** The value

$$\kappa = \lim_{P_2 \rightarrow P_1} \frac{\Delta\theta}{\Delta s} = \lim_{\Delta s \rightarrow 0} \frac{\Delta\theta}{\Delta s},$$

if it exists, is called the *absolute torsion* of the curve  $\gamma$  at the point  $P_1$ .

See also the Java animation [Osculating plane and torsion](#) by Martin Raussen (the torsion is depicted

with small **green** segment), from his 2008 book *Elementary Differential Geometry: Curves and Surfaces*, [p. 79](#).

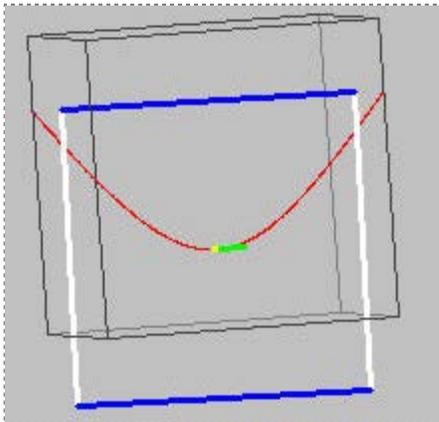


Fig. 1

Recall that a 3-D Flatlander is inevitably confined in the "inflating" (by its "dark energy") space with its three possible directions defined by the metric, yet he can measure the scale factor and subsequently its '[time read by a clock at P](#)' along the **radius** of [Ned Wright's balloon](#), which is why the poor guys (Ned included) **cannot** see the **w-axis** compactified exclusively on the **red** point **P**, nor the genuine geometry and topology of spacetime depicted with the **green** curvature-and-torsion segments (not arrows) in Fig. 2 below (compared it to the initial torsion drawing [above](#)).

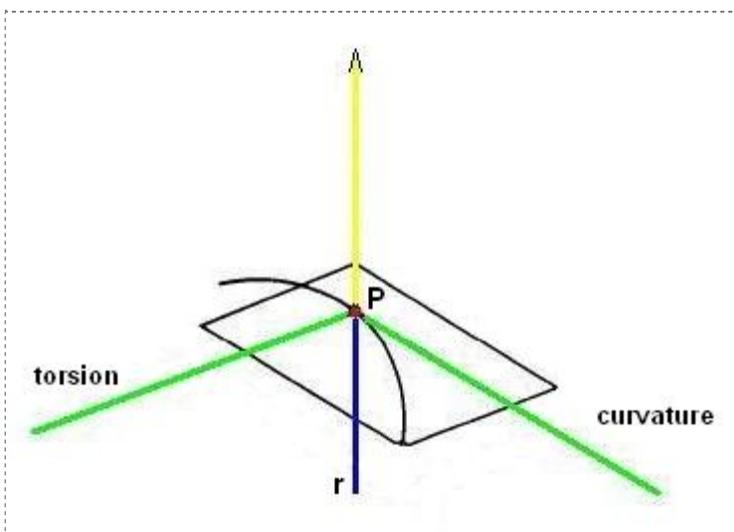


Fig. 2

Notice that in the case of negative curvature ("saddle" from a torus), the two green segments and the yellow "arrow" will be reversed, as in '[catching a lion in Sahara](#)'.

Unfortunately, all these kinematic examples cannot address the crucial question about how geometry and topology "[strike back](#)" on matter at the *very same* instant **P** at which matter acts on geometry-and-topology (or the other way around) due to [the flow of time](#).

Notice that a 3-D Flatlander would be tempted to introduce the two orthogonal **green** axes at the

[quasi-local](#) point **P** , hence produce altogether **three** orthogonal unphysical axes, yet **none** of which can display the [w-axis](#) (not shown) compactified *exclusively* on the **red** point **P** ([Luke 17:21](#)).

So, why is that all quantum and gravitational systems have "spin" or "[rotate](#)"? Because of some "[supermassive black hole](#)" or maybe "[dark energy](#)", or because of some intrinsic **topological** property of spacetime introduced jointly with 'curvature' and called 'torsion'?

Perhaps the torsion originates from the [sufficient conditions](#) for spacetime, and its coupling to matter becomes evident at quantum scale as "spin" ("eigentümlichen, klassisch nicht beschreibbaren Art von Zweideutigkeit", Wolfgang Pauli) and at galaxy scale as "[rotation](#)", ultimately covering the [observable universe](#). Notice that the point **P** in the drawing [above](#) matches the point **P** in the drawing from [Greg Galloway](#). The line along which the yellow and dark blue vectors are positioned also matches the radius of the "inflating balloon" from [Ned Wright](#).

It seems plausible that the *asymmetric* torsion corresponds to topological degrees of freedom from the [sufficient conditions](#) for spacetime, and that it must be **nullified** in the local (physical) mode of spacetime, because it acts along the new [w-axis](#) (from *wunderbar*, after [Theodor Kaluza](#)) and is related to the flow of time, in line with the option YAIN (iii) [above](#). If so, the torsion may only cast two components orthogonal to the green "[tangential vector](#)" in the drawing [above](#), and will alter matter at the point **P** jointly with "[curvature](#)", but along the [w-axis](#) (**not** shown) [orthogonal](#) to the drawing plane [above](#).

The easiest way to proceed would be to seek comfort in the old geometrical model and its [Levi-Civita connection](#), and ignore the efforts since the past fifty years, but the torsion question of 'how space curves' leads to considerations of the *relative* length of the radius of the "[inflating balloon](#)", which some people consider "unphysical" and have chosen to sweep it under the carpet, although they set the same length of the "balloon radius" to approach asymptotically infinity in order to define '[positive mass](#)'. Also, the [green](#) "tangential" vector is commonly used in [GR textbooks](#), although it also presupposes the same unphysical balloon radius and its [quasi-local](#) point **P** on which we **cannot** define the [gravitational stress-energy tensor](#) and the torsion degrees of freedom in the first place.

Obviously, a simple drawing of *all* geometrical connections converging on the [quasi-local](#) point **P** is urgently needed to verify the [w-axis](#) orthogonal to all drawings above. It is very difficult to bridge the abstract musings of mathematicians with the insights of mathematical physicists trying to understand the bi-directional "talk" executed at every [quasi-local](#) point **P** by matter & geometry-and-topology. Surely it isn't "[linear](#)". [Tough](#).

Bear in mind that the current GR cannot determine the topology of spacetime, because (i) it uses the unfortunate "splitting" of spacetime, "thereby doing **grave injustice** to space-time covariance that underlies general relativity" ([Abby Ashtekar](#)), and (ii) presumes that the universality of [the rate of acceleration](#) of (positive) matter is an *evidence* (not proof) in support of metric theories of gravity, provided that the *torsion* and *negative* matter are excluded from the outset. Based on these shaky presumptions, people imagine some **asymptotically flat** cosmological spacetime, in which they assume that gravity *might* be "neglected" (Xiang-Song Chen, [Eq. 5](#)), but cannot say anything on its actual topology, which must be determined by all the "dark" stuff in spacetime *and* by including the negative curvature (cf. Fig. 2 above) to derive the [Dynamic Equilibrium Conjecture](#). [Very tough](#).

Regrettably, we cannot use an example with parallelogram [[Ref. 1](#)], because we need a [quasi-local](#) point **P** interpreted as "[singularity](#)". Then we have to make **P** [self-acting](#), bearing in mind that it builds the geometry and topology of 'the universe as a [brain](#)', which resembles an *unbroken ring with no circumference*, for the ([asymptotic](#)) "circumference" is *nowhere*, and the (singularity) "center" is *everywhere*.

## Acknowledgment

It is a pleasure to thank [Thomas Schücker](#) for suggesting his textbook co-authored by [Meinulf Göckeler](#) [[Ref. 1](#)], and to [Martin Raussen](#) for his valuable feedback.

[Ref. 1] M. Göckeler and T. Schücker, *Differential Geometry, Gauge Theories, and Gravity*, Cambridge University Press, 1987; Sec. 5.9, Geometric interpretation of curvature and torsion, [pp. 78-80](#).

The equivalence principle is independent of the choice of the action. Nevertheless Einstein's equation implies that a spinless test mass in torsion-free space flies on geodesics. The proof given by Einstein, Infeld & Hoffmann (1938) and subsequently by Einstein & Infeld (1940, 1949) is difficult: Einstein's equations, being nonlinear, cannot be viewed as differential equations for distributions and point masses described by delta-like energy densities make no sense. There is, however, a simple argument which plausibly explains why trajectories of test particles are determined by the field equations in Einstein's theory, in contrast to Maxwell's theory. Forces and trajectories follow from energy-momentum conservation of matter and we have seen that Einstein's equations imply energy-momentum conservation, while Maxwell's equations only imply charge conservation. Energy-momentum of charged matter has to be defined independently by the Lorentz force law.

### 5.9 Geometric interpretation of curvature and torsion

In this section we do not need a metric. We start from a frame  $\beta$  and a connection, which with respect to the frame  $\beta$  we denote by  $\Gamma$ . Curvature and torsion are defined by Cartan's structure equations (5.9) and (5.12). They are both 2-forms to be evaluated on two tangent vectors. Let us fix a point  $x_0$  in  $\mathcal{M}$  and consider two vectors  $v$  and  $w$  at  $x_0$ ,

$$v, w \in T_{x_0}\mathcal{M}.$$

We shall now construct a family of 'geodesic parallelograms' from  $v$  and  $w$  indexed by  $\tau_0$ , see fig. 5.1. The construction works for small enough  $\tau_0$  (locally). Let  $Q_1(\tau)$  be the geodesic starting at  $x_0$  in direction of  $v$ . Parallel transport  $w$  from  $x_0$  to  $Q_1(\tau_0)$  along  $Q_1(\tau)$ . Call the resultant vector  $w_1$ . Construct the geodesic  $Q_2(\tau)$  starting at  $Q_1(\tau_0)$  in direction of  $w_1$ . Let  $v_2$  be the parallel transport of  $v$  from  $x_0$  to  $Q_2(\tau_0)$  along  $Q_1$  and  $Q_2$ . Construct the geodesic  $Q_3(\tau)$  starting at  $Q_2(\tau_0)$  in direction  $-v_2$ . Then  $w_3$  is the parallel transport of  $w$  from  $x_0$  to  $Q_3(\tau_0)$  along  $Q_1$ ,  $Q_2$ , and  $Q_3$ .

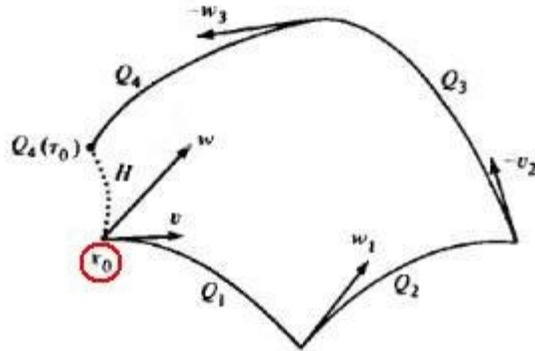


Fig. 5.1. A geodesic 'parallelogram'.

and  $Q_4(\tau)$  is the geodesic from  $Q_3(\tau_0)$  in direction  $-w_3$ . This geodesic ends at  $Q_4(\tau_0)$ , a point in  $\mathcal{U}$ . Considered as a function of  $\tau_0$  the point  $Q_4(\tau_0)$  sweeps out a curve  $H(\tau_0)$  with initial point

$$H(0) = x_0. \quad (5.93)$$

This curve has the following properties: Its tangent vector in  $x_0$  is zero,

$$\frac{d}{d\tau_0} H^\mu(0) = 0, \quad (5.94)$$

and

$$\frac{d^2}{d\tau_0^2} H^\mu(0) = 2T^\mu|_{x_0}(v, w). \quad (5.95)$$

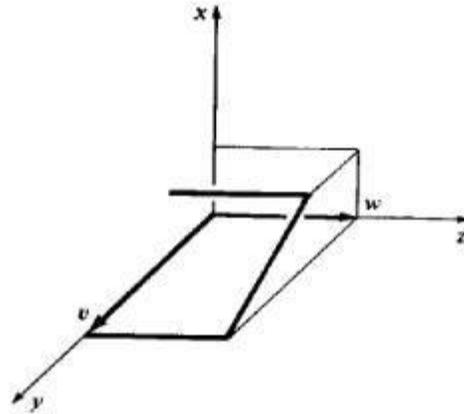
In words: Nonclosure of an infinitesimal geodesic parallelogram is proportional to its 'area'  $\tau_0^2$  and measured by the torsion 2-form. For any  $\tau_0$  (small enough) we define a linear mapping  $G(\tau_0) \in GL(T_{x_0}\mathcal{U})$ :

$$\begin{aligned} G(\tau_0): T_{x_0}\mathcal{U} &\rightarrow T_{x_0}\mathcal{U} \\ r &\mapsto G(\tau_0)r. \end{aligned}$$

$G(\tau_0)r$  is the parallel transport of  $r$  along  $Q_1, Q_2, Q_3, Q_4$  and backwards along  $H$ . Considered as a curve in the space of  $4 \times 4$  matrices,  $G(\tau_0)$  has the following properties:

$$\frac{d}{d\tau_0} G(0) = 0, \quad (5.96)$$

$$\frac{d^2}{d\tau_0^2} G(0) = 2R|_{x_0}(v, w) \in \mathfrak{gl}_4. \quad (5.97)$$

Fig. 5.2.  $\mathbb{R}^3$  with torsion.

This is a slightly different formulation of the defining property of the field strength in the general case (chapter 4).

Curvature and torsion are local properties of the connection.

We have already seen a space with curvature and without torsion: a piece of the 2-sphere. We now discuss a space without curvature and with torsion. This example is due to E. Cartan and one might suspect a relation between torsion and spin.  $\mathcal{U}$  is  $\mathbb{R}^3$  and parallel transport of vectors is defined as follows: In the  $x$ - and  $y$ -directions they are transported by ordinary translations, while in the  $z$ -direction they are translated and at the same time rotated around the  $z$ -direction in the clockwise sense by an angle proportional to the  $z$ -displacement. This parallel transport is metric with respect to the Euclidean metric. A geodesic is either a straight line or a helix. The parallel transport has vanishing curvature because it is path independent. To see that it has torsion we construct a geodesic parallelogram with  $v$  in the  $y$ -direction and  $w$  in the  $z$ -direction (see fig. 5.2).

### Problems

5.1 Derive the metric condition (5.23).

5.2 Show that the connection (5.51) is metric and torsion-free.

=====

Subject: The reference manifold, [arXiv:1207.0626v1 \[gr-qc\]](https://arxiv.org/abs/1207.0626v1)

Date: Wed, 4 Jul 2012 13:53:16 +0300

Message-ID:

<CAM7EkxnMrqsSTP4GheEmw\_Lt1diZj3DsXHk=htmekQPFN=4L2Q@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Angelo Tartaglia <angelo.tartaglia@polito.it>

Cc: Sergio Doplicher <dopliche@mat.uniroma1.it> ,

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Dear Angelo,

With all due respect, I think 'the reference manifold' [[Ref. 1](#)] should be the reference fluid of GR ("The particles of the reference fluid identify the points of space, and clocks carried by these particles identify the instants of time." J.D. Brown and K.V. Kuchar, [arXiv:gr-qc/9409001](#)). The latter should be sought by offering solutions to (i) the measurement and macro-objectification problems in Quantum Theory, and (ii) the exact [energy conservation principles in General Relativity](#) (MTW, p. 467) and the dynamics of spacetime itself,

[http://www.god-does-not-play-dice.net/#first\\_principles](http://www.god-does-not-play-dice.net/#first_principles)

<http://www.god-does-not-play-dice.net/#Munchhausen>

<http://www.god-does-not-play-dice.net/#ESI>

In simple words, we need first to fix the problems of GR and QM, to introduce a **\*perfect continuum\*** from the latter into the former. The notorious "quantum jumps" (S. Weinberg, [arXiv:1109.6462v4 \[quant-ph\]](#), Sec. 5) and all "dark" stuff ([CDM and DDE](#)) should be eliminated from the outset.

As a bonus, we may explain the puzzle of the brain dynamics,

<http://www.god-does-not-play-dice.net/#Seung>

As always, I will be happy to elaborate, should you or your colleagues are interested. The task is strictly mathematical.

All the best,

Dimi

-----  
[Ref. 1] Angelo Tartaglia, On the emergence of the Lorentz signature in an expanding universe, arXiv:1207.0626v1 [gr-qc], <http://arxiv.org/abs/1207.0626>

p. 2: "According to the considerations I made above the reference manifold should be an Euclidean one. Mentioning two metric tensors gives the impression that I am presenting a bimetric theory. This however is not the case. Only one of the manifolds is actually existing: the one corresponding to our space-time (the natural manifold). The reference manifold is not present anywhere; it is not even a background. It simply is part of a logical description in which the universe is thought to behave as a deformed continuum. For this reason the mentioned metric tensor of the Euclidean manifold is no metric at all in the natural manifold.

[snip]

"Of course this is so in an entirely classical approach, but so far the puzzle of the role of time and of some background in the attempts to quantize gravity remains unsolved."



**Note:** I stated [above](#) that all "dark" stuff should be eliminated from the outset, in the sense that these [tug-of-war](#) effects of gravity are **not** produced by 'matter' alone (any stuff with positive energy density is 'matter'), but are *purely geometrical effects* from 'the whole universe as ONE' -- please see 'the *sufficient* condition for spacetime' [above](#). To be precise, I postulate "dark gaps" in the *global* mode of spacetime (cf. Eq. 1, p. 35, in [ExplanatoryNote.pdf](#)), in which the universe is in a [Macavity state](#) -- the [negative energy densities](#) are *always* "present" **iff** there's nobody "there" (local mode of spacetime) to observe them. It may sound complicated, but the idea of such '[quantized spacetime](#)' is very old, from Chuang-Tzu: "Before Zen, a tree is a tree and a mountain is a mountain. During Zen, a tree is not a tree and a mountain is not a mountain. After Zen, a tree is again a tree and a mountain is again a mountain." Remove the "dark Zen gaps" with the so-called [speed of light](#), and you'll be half way toward the [asymptotically flat spacetime](#) and its [dual age cosmology](#) ([Luke 17:21](#)).

Again, the task is strictly mathematical. There is [a lot more to be said](#), but since nobody's interested, I will stick to 'The Two Rules of Success':

Rule #1: Never tell them everything you know.

D.C.

July 4, 2012

Last updated: July 12, 2012

=====

Subject: Re: The reference manifold, [arXiv:1207.0626v1 \[gr-qc\]](#)

Date: Thu, 27 Dec 2012 04:31:08 +0200

From: Dimi Chakalov <dchakalov@gmail.com>

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P.S. In addition to my email from [Wed, 4 Jul 2012 13:53:16 +0300](#) regarding some errors in your arXiv:1207.0626v1 [gr-qc], notice that the speculation about some "[propagating disturbances of the curvature](#)" in your latest [arXiv:1212.6024v1 \[gr-qc\]](#) is 'not even wrong'. Details at

[http://www.god-does-not-play-dice.net/#thank\\_you](http://www.god-does-not-play-dice.net/#thank_you)

E sarà mia colpa se così è ?

D.

=====



Subject: Re: Why are you keeping quiet?  
Date: Tue, 4 Sep 2012 14:52:55 +0300  
Message-ID:  
<CAM7Ekxk8oe=jBRWbT0tR2MqXcLvL-5CXw=xdPoPrpGJ0nbxV1A@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Luciano Rezzolla <luciano.rezzolla@aei.mpg.de>  
Cc: [\[snip\]](#)

Hi Luciano,

> what you say is right, students are like kids and you want to teach them right.

Yes I do. [How about you?](#)

> I do believe in the existence of gravitational waves and in their detection.

But it isn't about 'believing' in the existence of gravitational waves. I also believe in the existence of gravitational waves, for many reasons.

It is all about their \*detection\* with any "theory" based on the linearized approximation of GR. Here, we totally disagree. And you have enormous problems, starting from the 1944 paper by Hermann Weyl.

You do not have any "theory" based on GR, because you can only offer a wild guess which, as we all know, run against the full non-linear GR: check out the first link from my initial email below.

> Besides, these are all big kids and you can be sure they have independent minds:  
> they do what they want and not what I tell them to do.

Fine. [You and your adult students](#) can find the references at my web site.

Once LIGO and Virgo collaborations fail to detect GWs with your "advanced" -- and horribly expensive -- upgrade of your 'dead turkey', I will again remind you and your colleagues that you have DELIBERATELY wasted \*billions\* of US dollars and Euro for your obsession.

NB: Energy transport by GWs is a [fundamentally non-linear phenomenon](#). If you use the linearized approximation of GR, you will kill, with your math, the very effect you wish to measure. It makes no sense to "enhance the sensitivity" of what has been a **dead turkey** from the outset.

Again, I will not allow you to put the blame on Einstein:

"It is worth reminding ourselves why and where GR might fail. (...) Any such failure of GR should point the way to new physics." (B. F. Schutz et al., [arXiv:0903.0100v1 \[gr-qc\]](#))

GR will not "fail", because you don't have, and cannot produce, any theory based on GR in the first place. The only link you make to GR is with your wild uneducated guess (see again the links in my initial email), which runs against the full non-linear GR -- see again the references at my web site. And if you wish to mention PSR1913+16, check out the facts at

<http://www.god-does-not-play-dice.net/#Oiao>

Please don't try to claim that you don't understand your problems. Because you are **not** stupid, Luciano.

Dimi

On Tue, 4 Sep 2012 01:44:25 +0300, Dimi Chakalov <dchakalov@gmail.com> wrote:

>

>> Hi Luciano,

>>

>> Your students are kids, and kids have the right to know everything you know.

>>

>> Be honest to them. Don't waste their time. There is no way for LIGO, no matter how "advanced", to detect GWs, firstly because your dream is based solely on wishful thinking:

>>

>> [http://www.god-does-not-play-dice.net/#LIGO\\_Prague](http://www.god-does-not-play-dice.net/#LIGO_Prague)

>>

>> <http://www.god-does-not-play-dice.net/#Bondi>

>>

>> You know the objections to "GW astronomy" at my web site, the main references start from 1944, so why are you keeping quiet? Is this because [Bernie Schutz](#) will go mad and you may lose your salary? If that is the case, please don't reply to my email, as you haven't done so since last year.

>>

>> Now, if you are serious about GR, check out a simple task at

>>

>> <http://www.god-does-not-play-dice.net/#Fewster>

>>  
>> I suggest you discuss it with your students. Tell them everything you  
>> know about GR. If you believe can find some solution, please write me  
>> back, and we'll have a professional discussion which will prove,  
>> again, that LIGO is for the birds.  
>>  
>> Just don't keep quiet. It's \*not\* fair to your students.  
>>  
>> All the best,  
>>  
>> Dimi  
>

---

### **Addendum**

[LIGO is for the birds](#). You must stop wasting taxpayers' money **immediately**.

I will not offer any mathematical paper until this first off issue is resolved.

Why? Because I don't make presents to people who totally disregard the basic basics of gravity: it is a [non-linear phenomenon](#).

Don't use "[linear approximations](#)". Nobody is stupid, [Luciano Rezzolla](#) included. Period.

Dimitar G. Chakalov  
September 27, 2012, [01:33:43 GMT](#)

=====



" . . . and we can save 700 lire by  
not taking soil tests."

Subject: Re: Request for opinion

Date: Sun, 10 Mar 2013 22:57:44 +0200

Message-ID: <CAM7EkxkZ1=JE=EULCu++h8PAoyFoe0hSqd85Z-o9PotqB\_\_46g@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

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Chris Isham <c.isham@imperial.ac.uk> ,

Marcos Maia <maia@unb.br> ,

John Klauder <john.klauder@gmail.com>

On Sun, 10 Mar 2013 15:54:13 -0400, newman <newman@pitt.edu> wrote:

>

> Dimi,

> This is TOTAL nonsense - i never said a SINGLE thing about not wanting to

> get involved in "exposing the essential errors of LIGO" as YOU say. All I

> said to you is that I do not want to get into arguments with you or anyone

> that go nowhere.

Ted:

The arguments [against LIGO](#) are not mine. I quoted articles published in peer reviewed academic journals many years ago. The fact of the matter is that there is only 1 (one) approach to GWs, based on the Bondi-Metzner-Sachs group, and it has nothing to do with LIGO. Moreover, I have proved, with explicit quotes from the proponents of LIGO, that their approach is based solely on wishful thinking -- nothing to do with GR.

> Basically I am in complete disagreement with you

Prove it. All references are one-click away from you. Don't hesitate to show your professional knowledge.

[Josh Goldberg](#) is also keeping quiet, although he knows very well that energy transport by GWs is a fundamentally nonlinear phenomenon -- nothing in common with the approximation used to build [LIGO](#).

> I see NOTHING WRONG with LIGO.

No need to shout like a [Russian](#). Get real. Face the facts.

But of course, you will keep dead quiet, as if you know nothing about transport of energy by GWs.

You can find all references in the links in my preceding emails. Your first task is to prove Hermann Bondi and Hermann Weyl wrong -- with math.

All the best,

D.C.

> On Mar 10, 2013, at 10:09 AM, Dimi Chakalov wrote:

>

> P.S. Please see

> <http://www.god-does-not-play-dice.net/#ETH>

>

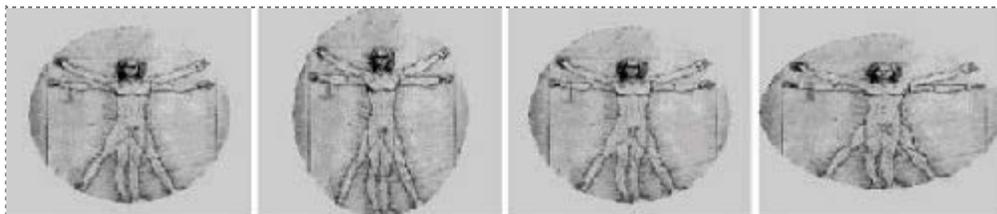
> Simple, no?

>

> Best - D.

>

=====



Subject: Re: Request for opinion

Date: Mon, 11 Mar 2013 13:49:51 +0200  
Message-ID: <CAM7EkxkFa3+C9mREi-RxKx9hp3wF5MajSE4L3GeAcF9r=2eDWQ@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Ted <newman@pitt.edu>  
Cc: Evangelos Melas <evangelosmelas@yahoo.co.uk>,  
Josh Goldberg <goldberg@phy.syr.edu>,  
Bill Bonnor <w.b.bonnor@qmul.ac.uk>,  
Adam Helfer <helfera@missouri.edu>,  
Laszlo Szabados <lbszab@rmki.kfki.hu>,  
Hans Ohanian <hohanian@uvm.edu>,  
Chris Isham <c.isham@imperial.ac.uk>,  
Marcos Maia <maia@unb.br>,  
John Klauder <john.klauder@gmail.com>,  
Luciano Rezzolla <rezzolla@aei.mpg.de>,  
Christian <cherubini@icra.it>,  
Christoph.Affeldt@aei.mpg.de,  
Heather.Audley@aei.mpg.de,  
Berit.Behnke@aei.mpg.de,  
Katrín.Dahl@aei.mpg.de,  
Marina.Dehne@aei.mpg.de,  
Kyriaki.Dionysopoulou@aei.mpg.de,  
Maike.Lieser@aei.mpg.de,  
Giulio.Mazzolo@aei.mpg.de,  
Natalia.Korsakova@aei.mpg.de,  
Daniel.Siegel@aei.mpg.de,  
Gunnar.Stede@aei.mpg.de,  
Yan.Wang@aei.mpg.de,  
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Roger Blandford <rdb3@stanford.edu>,  
Jirí Bicák <Jiri.Bicak@mff.cuni.cz>,  
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Karel V Kuchar <kuchar@physics.utah.edu>,  
Hermann Nicolai <Hermann.Nicolai@aei.mpg.de>,  
Paul Tod <tod@maths.ox.ac.uk>,  
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Karsten Danzmann <office-hannover@aei.mpg.de>,  
Pedro Marronetti <pmarrone@nsf.gov>,  
Jorge Pullin <pullin@lsu.edu>,  
Kip Thorne <kip@tapir.caltech.edu>,  
Jeremiah P Ostriker <ostriker@princeton.edu>,  
Jörg Frauendiener <joergf@maths.otago.ac.nz>,  
Robert Beig <robert.beig@univie.ac.at>

On Sun, 10 Mar 2013 20:44:32 -0400, newman <newman@pitt.edu> wrote:

>

> dimi - as i told you before i will not get into an argument with you.

Ted:

As I told you many times, you have problems with facts about detection of GWs, explained many years ago by theoretical physicists. These facts were published on paper, and I have provided the main references. See again my preceding email from Sun, 10 Mar 2013 22:57:44 +0200 at

<http://www.god-does-not-play-dice.net/#BMS>

I am not offering you my additional, and certainly not original, arguments from my website, which are perfectly clear even to students. Very briefly, [LIGO "scientific" collaboration](#) has to offer at least one example with "stretching and squeezing" of a massive body, such as a Coca Cola bottle:

<http://www.god-does-not-play-dice.net/#Bondi>

You and LIGO people need quantum gravity to explain the effects of passing GW through a plastic bottle at the length scale of  $2.3 \times 10^{-26}$  m, corresponding to GW amplitude of PSR J1603-7202 (B. Abbott et al., LIGO Scientific Collaboration, Phys. Rev. D 76, 042001, 2007).

But first, don't forget that the hypothetical GW from PSR J1603-7202 will have to trespass 5345ly to Earth, and at each and every point from its path to LIGO you have to demonstrate the conversion of intangible GW energy to some tangible form of energy: see the facts in my preceding email at the first link above.

Of course, nobody can perform such calculations. You can't even start from any hypothetical case of strong GWs emitted by realistic astrophysical sources: "it will be hopeless" (Michele Maggiore, Gravitational Waves: Theory and Experiments, Oxford University Press, 2007, p. 32, footnote 19).

You know these facts very well, Ted. You are *\*not\** stupid.

You and your colleagues must stop this madness, or else "by 2020 at least 3-4 billion dollars will have been invested by a dozen national and international scientific organizations in building gravitational wave detectors on the ground and in space" ([Bernard Schutz](#), arXiv:1203.3090v1).

Don't try to run away from your responsibilities.

D.C.

On Sun, 10 Mar 2013 22:57:44 +0200, Dimi Chakalov <dchakalov@gmail.com> wrote:  
[snip]

-----  
**Note:** Nobody, Ted Newman included, is taking into account alternative explanations, such as tidal friction from white dwarf [[Ref. 1](#)]; check out also [here](#) and [here](#).

Theoretically, there are many mathematical facts rejecting either "[stretching and squeezing](#)" or producing **stress** in bodies [[Ref. 2](#)], e.g., a [plastic bottle](#), due to passing GWs with  $2.3 \times 10^{-26}$  [dimensionless "amplitude"](#): read Angelo Loinger in [physics/0312149v3](#) and [0804.3991v1](#).

Also keep in mind that, according to [LIGO proponents](#), "if we displace a mass, its gravitational field and the related curvature of the interested manifold *displace themselves along with the mass*" (*Idem*, [physics/0506024v2](#), p. 2).

With respect to *what?* There is no background whatsoever in General Relativity. Only [red herrings](#).

D. Chakalov  
March 11, 2013

[Ref. 1] S.A. Balbus and K. Brecher, Tidal friction in the binary pulsar system PSR 1913+16, *Astrophysical Journal* 203 (1976) [202-205](#).

## 204

be estimated. If the energy dissipation arises predominantly from viscous effects in the tidal distortion, it has been shown that tidal phenomena will probably be negligibly small (Will 1975). However, there is another interesting possibility first recognized by Goldreich and Soter in planetary systems. Tidal interactions may result in turbulent atmospheric flow at the surface of the tidally distorted body, which in our case is taken to be a white dwarf, and the resultant energy loss may be significant.

### III. CONCLUSION

In summary, it appears that even the binary pulsar may not offer an unambiguous test of the existence of gravitational radiation. The observation of an increase in the orbital period of PSR 1913+16 will almost surely imply a white dwarf companion. Such an effect would be unique in either stellar or planetary astronomy, and provide a way to determine further properties of a white dwarf (e.g., of its atmosphere).

[Ref. 2] Robert M. Wald, *Space, Time, and Gravity*, University Of Chicago Press, 1992, [p. 120](#).

120

Chapter 9

How may gravitational radiation be detected? If a gravitational wave passes through matter, the ripples in the space-time curvature will induce stresses in the matter. If these extremely tiny stresses can be measured, one can detect gravitational waves.

=====

Subject: [arXiv:1305.0777v1 \[gr-qc\]](https://arxiv.org/abs/1305.0777v1), "After all, one call always ask: [where are the waves?](#)"  
Date: Tue, 7 May 2013 03:22:00 +0300  
Message-ID: <CAM7Ekx=kJMSPr+peKVpGV3MELmzF-8RqRF48jAx5eeE3V8TdQQ@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Jose Geraldo Pereira <jpereira@ift.unesp.br>  
Cc: Ruben Aldrovandi <ra@ift.unesp.br>,  
Lars Andersson <laan@aei.mpg.de>,  
Evangelos Melas <evangelosmelas@yahoo.co.uk>,  
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Karel V Kuchar <kuchar@physics.utah.edu>,  
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Clifford Will <cmw@wuphys.wustl.edu>,  
Karsten Danzmann <office-hannover@aei.mpg.de>,

Pedro Marronetti <pmarrone@nsf.gov>,  
Jorge Pullin <pullin@lsu.edu>,  
Kip Thorne <kip@tapir.caltech.edu>,  
Jeremiah P Ostriker <ostriker@princeton.edu>,  
Jörg Frauendiener <joergf@maths.otago.ac.nz>,  
Robert Beig <robert.beig@univie.ac.at>,  
Ted <newman@pitt.edu>

There:  
[http://www.god-does-not-play-dice.net/#RS\\_gravity](http://www.god-does-not-play-dice.net/#RS_gravity)

D.C.

-----  
Jose Geraldo Pereira, Gravitational waves: a foundational review, arXiv:1305.0777v1 [gr-qc]  
<http://arxiv.org/abs/1305.0777>

"Strictly speaking, this conservation law says that, at this order, a mechanical system cannot lose energy in the form of gravitational waves. Since any wave must have energy to exist, what this conservation law is saying is that linear (or dipole) gravitational radiation does not exist.  
.....

"The reason is that either a gravitational wave does or does not carry energy. If it carries, it cannot satisfy a linear equation. If applied to a Yang-Mills propagating field, it would correspond to assume that, for a gauge field with small-enough amplitude, its evolution could be accurately described by a linear equation. Of course, this is plainly wrong: a Yang-Mills propagating field must be nonlinear to carry its own source, otherwise it is not a Yang-Mills field. Analogously, a gravitational wave must be nonlinear to transport its own source, otherwise it is not a gravitational wave. This is not a matter of approximation, but a conceptual question.\*

-----  
\*It is interesting to remark that even the well-known exact plane gravitational wave solution of Einstein equations [13] transports neither energy nor momentum [14]. This is in accordance with the nonlinear nature of the transport of energy-momentum by gravitational waves.  
.....

"It is clear by now that none of the existing antennas has succeeded in detecting any sign of gravitational waves. Of course, it is possible that the detectors did not meet the necessary sensibility to detect them, or that the magnitude of the gravitational waves when reaching a detector on Earth is smaller than originally expected.

"However, it is also possible that a [faulty approach](#) has led all detectors to look for the wrong sign. The analysis presented in these notes, whose purpose was to call the attention for potential problems in the currently accepted theory, suggests that this possibility should not be neglected. After all, one call always ask: **[where are the waves?](#)**"

=====

Subject: Re: [arXiv:1305.0777v1 \[gr-qc\]](http://arxiv.org/abs/1305.0777v1), "After all, one call always ask: **where are the waves?**"

Date: Tue, 7 May 2013 12:55:59 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Jose Geraldo Pereira <jpereira@ift.unesp.br>  
Cc: Alex <afriat@gmail.com>,  
Orfeu <orfeu@cosmos.ist.utl.pt>,  
Michal Chodorowski <michal@camk.edu.pl>,  
Marco Spaans <spaans@astro.rug.nl>

P.S. You also wrote (p. 4): "The problem of the non-localizability of the energy and momentum of the gravitational field [16] is not relevant for the present discussion, and will not be considered here."

I'm afraid you can't escape from the problem of the non-localizability of the energy and momentum of the gravitational field, even if "the physically relevant second-order gravitational wave is longitudinal" (p. 8).

If you really wish to learn "where are the waves", see the link below.

D.

On Tue, May 7, 2013 at 3:22 AM, Dimi Chakalov <dchakalov@gmail.com> wrote:

>  
> There:  
> [http://www.god-does-not-play-dice.net/#RS\\_gravity](http://www.god-does-not-play-dice.net/#RS_gravity)  
>  
> D.C.  
>  
>  
> -----  
> Jose Geraldo Pereira, Gravitational waves: a foundational review,  
> arXiv:1305.0777v1 [gr-qc]  
> <http://arxiv.org/abs/1305.0777>  
[snip]

=====

Subject: Re: [Why are you keeping quiet?](#)  
Date: Mon, 11 Mar 2013 01:25:46 +0200  
Message-ID: <CAM7Ekx=hJf9-RLM+Q=PyAJZcBJ51gtmPrjY+gBSGdf+iEXjrOg@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Luciano Rezzolla <rezzolla@aei.mpg.de>  
Cc: Evangelos Melas <evangelosmelas@yahoo.co.uk>,  
Ted <newman@pitt.edu>,  
Josh Goldberg <goldberg@phy.syr.edu>,  
Bill Bonnor <w.b.bonnor@qmul.ac.uk>,  
Adam Helfer <helfera@missouri.edu>,  
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Marcos Maia <maia@unb.br>,  
John Klauder <john.klauder@gmail.com>,  
John Stachel <john.stachel@gmail.com>,

Jose Geraldo Pereira <jpereira@ift.unesp.br>

Lucianno,

Do you know that the energy transport by GWs is fundamentally non-linear phenomenon? I can send you and your colleagues [many references](#), some of which are from [GR textbooks](#).

The problem of LIGO is that it is build on a dream that is backed only by wishful thinking -- nothing to do with GR. Then by using some "[weak GW's in flat spacetime](#)" (Kip Thorne, Caltech's Physics 237-2002), you and LIGO "scientific" collaboration kill the very effect you wish to measure -- the non-linear transport of 'tangible' ([Hermann Bondi](#)) energy by GWs.

Namely, what kills your linearized speculation is the fact that flat spacetime cannot act back on its "weak GWs". As Hermann Weyl explained in 1944, the linearized approximation of GR is "a shadow without power" (How Far Can One Get With a Linear Field Theory of Gravitation in Flat Space-Time? American Journal of Mathematics, Vol. 66, No. 4, Oct., 1944, pp. 591-604).

Recall the first off question: how do you explain the transition between "the intangible energy of the gravitational field (as it will be called here), which is not described by the energy-momentum tensor, and the tangible forms which are so described" (Hermann Bondi, Conservation and non-conservation in general relativity, Proc. R. Soc. Lond. A 427 (1990) 249-258) ?

In fact, there is only 1 (one) approach to GWs, and it is based on the Bondi-Metzner-Sachs group -- nothing to do with LIGO. But if LIGO and Virgo "scientific" collaborations wish to build a brand new GW detector based on BMS group, you must use gravitational shielding as well, which is impossible (John Stachel, gr-qc/0507078v2, footnote 46, pp. 21-22).

Forget it. There's no sense to "enhance the sensitivity" of what has been a [dead turkey](#) from the outset.

Details at

<http://www.god-does-not-play-dice.net/#BMS>

<http://www.god-does-not-play-dice.net/#Rezzolla>

Any comments?

D.C.

-----

**Note:** To understand how LIGO "scientific" collaboration eliminated the very effect they wished to measure, imagine that you decide to measure *macroscopic effects* of quantum waves, corresponding to some  $2.3 \times 10^{-26}$  m *dimensionless* [\[whatever\]](#). You expect these effects to be incredibly weak, comparable to the [Compton wavelength](#) effects of your car, say.

But you don't want to study QM. What can you do? Use classical physics, "because" these quantum effects are very weak, of course. Then all you need is [money](#) [\[Ref. 1\]](#).

D. Chakalov

March 12, 2013, 10:52 GMT

[Ref. 1] John Stewart, [Advanced General Relativity](#), Cambridge University Press, 1991, p. 54, p. 75 (our spacetime must be [time-orientable](#)), p. 114 ("gravitational energy density"), and p. 115:

If we bend the surface up until it becomes timelike then radiation emitted to the future of the intersection of the hypersurface with the source will intersect the surface a second time, and so will contribute twice to the mass! It seems clear therefore that we should bend the hypersurface such that it becomes null at far distances from the source, i.e., we should approach asymptopia along null directions. The corresponding mass is the *Bondi mass* and one might reasonably expect it to decrease for radiating sources.

Another major problem is that we have no exact radiating solutions which become flat asymptotically. Thus we can only guess what structure to expect far from an isolated source. This requires great care. (Of course, but LIGO mafia wants easy money! - D.C.)

-----

Subject: Re: Grape, maybe?  
Date: Tue, 12 Mar 2013 03:27:01 +0200  
Message-ID: <CAM7EkxkNq\_p4mi\_tkLgtxF7ZnMYKwD4ug\_gCEOGH-X1SL-jVyA@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: [LSC Spokesperson Gabriela Gonzalez](mailto:gonzalez@lsu.edu) <gonzalez@lsu.edu>  
Cc: Jorge Pullin <pullin@lsu.edu>,  
cornish@physics.montana.edu,  
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lsc-webcomm@ligo.org,  
lsc-pp@ligo.caltech.edu,  
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bkeister@nsf.gov,

elomon@nsf.gov,  
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SciTech.Editorial@esa.int

Gabriela,

Seven years ago, I suggested to your husband and his colleagues to get ready for converting LIGO tunnels to wine cellars (cf. below). You can never make it, so what can we do with LIGO when you ultimately fail?

See the latest developments at  
<http://www.god-does-not-play-dice.net/#BMS>

D. Chakalov

-----  
Subject: Grape, maybe?  
Date: Wed, 01 Mar 2006 04:59:31 +0200  
From: Dimi Chakalov <dimi@chakalov.net>  
To: Jorge Pullin <pullin@lsu.edu>  
CC: David Shoemaker <dhs@ligo.mit.edu>,  
Paul McNamara <Paul.McNamara@esa.int>,  
Neil J Cornish <cornish@physics.montana.edu>

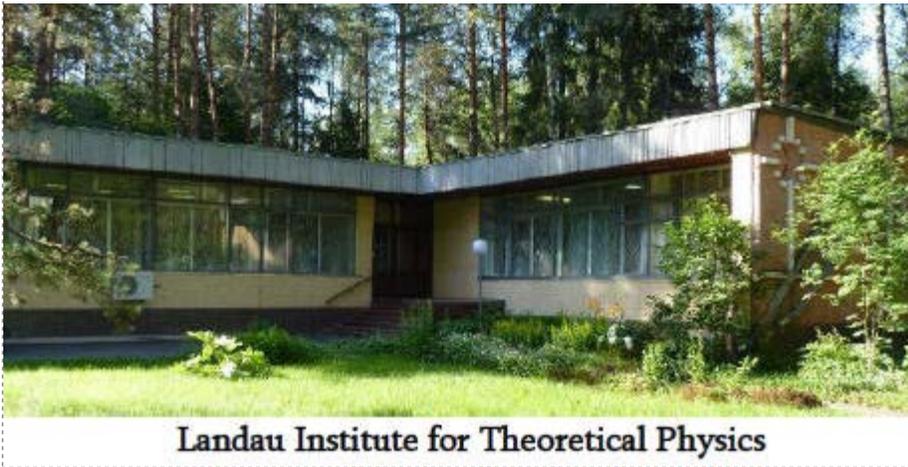
Hi Jorge,

I learned from your last MOG No. 27, Spring 2006, that at the APS April meeting in Dallas, one of the Lead Speakers, Neil Cornish, will deliver the talk "The LISA Observatory: Preparing for a bountiful harvest".

Grape, maybe? I think your colleagues should be prepared to convert those long dark tunnels of LIGO to wine cellars

[snip]

-----  
All you need is blank notepads, sharp pencils, and a quiet cheap office:



D. Chakalov

-----

Subject: Advanced LIGO and Virgo detectors, [arXiv:1211.0021v1 \[gr-qc\]](https://arxiv.org/abs/1211.0021v1)

Date: Fri, 2 Nov 2012 02:46:19 +0200

Message-ID:

<CAM7Ekx=0JAnhctBW57K2MJbpX3BNEwrB2kiU3EMGzA1mzfSTMw@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Keith Riles <kriles@umich.edu>

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Josh Goldberg <goldberg@phy.syr.edu>,  
Adam Helfer <helfera@missouri.edu>,  
Laszlo Szabados <lbszab@rmki.kfki.hu>,  
Jörg Frauendiener <joergf@maths.otago.ac.nz>,  
Robert Beig <robert.beig@univie.ac.at>

Mr. Riles,

It is impossible in principle to detect any GWs by LIGO and Virgo collaborations:

[http://www.god-does-not-play-dice.net/#LIGO\\_Prague](http://www.god-does-not-play-dice.net/#LIGO_Prague)

<http://www.god-does-not-play-dice.net/#Bondi>

<http://www.god-does-not-play-dice.net/#Rezzolla>

All you can do is waste hundreds of million dollars and Euro, and keep dead quiet.

Shame on you, LIGO, and Virgo. You are **total disgrace** to the GR community.

Dimitar G. Chakalov

--

<http://tinyurl.com/dollar-ratio>

<http://tinyurl.com/steel-evaporation>

=====



Subject: Re: [On the total mess in GR](#), arXiv:1212.0147v1 [gr-qc]

Date: Wed, 5 Dec 2012 02:09:34 +0200

From: Dimi Chakalov <dchakalov@gmail.com>

To: Laszlo B Szabados <lbszab@rmki.kfki.hu> ,

Adam Helfer <helfera@missouri.edu> ,

Harvey S Reall <H.S.Reall@damtp.cam.ac.uk> ,

Jörg Frauendiener <joergf@maths.otago.ac.nz> ,

Karel V Kuchar <kuchar@physics.utah.edu> ,

Helmut Friedrich <hef@aei.mpg.de> ,

Robert M Wald <rmwa@midway.uchicago.edu> ,

Paul Tod <tod@maths.ox.ac.uk> ,

Robert Beig <robert.beig@univie.ac.at> ,

Bernard J Carr <b.j.carr@qmul.ac.uk> ,

John Baez <baez@math.ucr.edu> ,

Luca Bombelli <bombelli@olemiss.edu> ,

Gary Horowitz <gary@physics.ucsb.edu> ,

Domenico Giulini <giulini@zarm.uni-bremen.de> ,

Claus Kiefer <kiefer@thp.uni-koeln.de> ,

Shing-Tung Yau <yau@ims.cuhk.edu.hk> ,

Ed Witten <witten@ias.edu> ,

Richard M Schoen <schoen@math.stanford.edu> ,

Niall Ó Murchadha <niall@ucc.ie> ,

Xiao Zhang <xzhang@amss.ac.cn>

Dear Laszlo and colleagues,

I have posted (Dec 4 2012, 23:54:44 GMT) a brief explanatory note at

<http://www.god-does-not-play-dice.net/#mess>

If you and/or some of your colleagues disagree, [please explain why](#).

Just don't hesitate -- the issue is strictly mathematical.

As ever,

Dimi

-----

**Note:** All agree that the gravitational energy density at a "point" (MTW, [p. 467](#)) *cannot* be defined mathematically. Here, I claim that we **must not** even *try* to define it in the present GR textbooks, because the phenomenon in question belongs to quantum gravity.

Therefore, we **must not** use an initially inadequate theory such as the incomplete mathematical theory of some "classical" gravitational field: "Not for a moment did I doubt that this formulation was merely a makeshift in order to give the general principle of relativity a preliminary closed-form expression. For it was essentially no more than a theory of the gravitational field, which was isolated somewhat artificially from a total field of as yet unknown structure", [Albert Einstein](#).

Now, some people are trying very hard to avoid quantum gravity with bypassing the initial problem 'at a point', and claim some hints about "surface energy expression" and "the total energy,  $E_S$ , of this surface", which "does NOT imply an expression for the energy density", as Niall Murchadha writes [below](#).

[Sorry](#). Any definition of "the total energy,  $E_S$ " located on such "surface", and formulated in the current classical approximation of the *unfinished* General Relativity, is *mathematically* wrong.



It is wrong *in principle* to use a classical approximation to General Relativity. I will be happy to elaborate on the recipe mentioned by [Niall Murchadha](#) and [the errors](#) in his withdrawn paper 'Quasilocal Energy in General Relativity', [arXiv:0905.0647v2 \[gr-qc\]](#): see below an excerpt from my email to Niall Murchadha three and a half years ago ([Wed, 6 May 2009 13:14:25 +0300](#)), regarding the first (and *very* messy) version of 'Quasilocal Energy in General Relativity', [arXiv:0905.0647v1 \[gr-qc\]](#).

The "obvious" (again) [positivity of mass](#) and violations of ANEC on timeless or "[achronal geodesics](#)" are immensely important issues, but I cannot say more at this website, for reasons explained [above](#). Let me just stress that we *must* have **both** "sharply fixed points of time" (Erwin Schrödinger, *Die gegenwärtige Situation in der Quantenmechanik*, 1935, [Sec. 14](#)) in the local (physical) mode of spacetime, **and** nonlocal "points" from the [global mode of spacetime](#), spanned to the "size" of 'the whole universe as ONE'. This is what 'quasi-local' is all about. We need 'the' binding phenomenon which can assemble [in time](#) infinitesimal points into **finite**, be it "small" or "large", spacetime domains, in which we can look around and see "as far as we can" ([Lee Smolin](#)).

This is the underlying *dynamics* of what we call '[time](#)' -- the *dynamics* of spacetime itself (forget about [LIGO](#)) in terms of 'change of space' ([Arrow of Space](#)).

D. Chakalov

December 7, 2012

Last updated: December 12, 2012, 04:36 GMT

=====



Subject: The total mess in GR, [arXiv:0905.0647v1 \[gr-qc\]](#)  
Date: Sat, 8 Dec 2012 04:48:17 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Niall 'O Murchadha <niall@ucc.ie>,  
Roh-Suan Tung <tung@shnu.edu.cn>,  
Naqing Xie <nqxie@fudan.edu.cn>  
Cc: Mu-Tao Wang <mtwang@math.columbia.edu>,  
Hwei-Jang Yo <hjyo@phys.ncku.edu.tw>,  
Szabados Laszlo <lbszab@rmki.kfki.hu>,  
Xiao Zhang <xzhang@amss.ac.cn>,  
Adam Helfer <helfera@missouri.edu>,  
Lau Loi So <s0242010@gmail.com>

Dear colleagues,

Please recall my email sent three and a half years ago (Wed, 6 May 2009 13:14:25 +0300) and my prediction about your efforts in [arXiv:0905.0647v1 \[gr-qc\]](#).

Later, your original paper was withdrawn ([arXiv:0905.0647v2 \[gr-qc\]](#)), because you were "currently not happy with the results".

The main reason for your mathematical problems has been briefly explained at

[http://www.god-does-not-play-dice.net/#Niall\\_last](http://www.god-does-not-play-dice.net/#Niall_last)

Should you have questions, please don't hesitate.

All the best,

Dimi Chakalov

-----

Subject: "The positivity for interior two-surfaces is still an open question."  
Date: Wed, 6 May 2009 13:14:25 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Niall 'O Murchadha <niall@ucc.ie>  
Cc: tung@shnu.edu.cn,  
nqxie@fudan.edu.cn,  
mtwang@math.columbia.edu,  
Lau Loi So <s0242010@cc.ncu.edu.tw>,  
Hwei-Jang Yo <hjyo@phys.ncku.edu.tw>,  
Szabados Laszlo <lbszab@rmki.kfki.hu>,  
Xiao Zhang <xzhang@amss.ac.cn>

Dear Dr. Murchadha,

I would like to make a prediction regarding your arXiv:0905.0647v1 [gr-qc] and forthcoming calculations: you will fail to produce an unambiguous proof of the alleged positivity for interior two-surfaces. [snip]

=====

Subject: The boundary conditions vs canonical quasilocal formalism (CQF),  
[arXiv:gr-qc/0010024v3](http://arxiv.org/abs/gr-qc/0010024v3)  
Date: Sat, 8 Dec 2012 15:17:30 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: David Brown <david\_brown@ncsu.edu>,  
Stephen R Lau <lau@unm.edu>,  
James York <york@astro.cornell.edu>  
Cc: Karel V Kuchar <kuchar@physics.utah.edu>,  
Ian Lawrie <I.D.Lawrie@leeds.ac.uk>,  
Alan Rendall <rendall@aei.mpg.de>

Dear David,

Regarding your article [Ref. 1], may I offer you and your colleagues an alternative approach (cf. [update.jpg](#) attached), which was outlined at

[http://www.god-does-not-play-dice.net/#explain\\_why](http://www.god-does-not-play-dice.net/#explain_why)

I hope this can bring you back to the crucial requirement that "the evolved data must obey the boundary conditions" [Ref. 1], and you can upgrade the "spacelike hypersurfaces" (*ibid.*) with the so-called Arrow of Space.

Wishing you and your colleagues a happy white Christmas,

Dimi

[Ref. 1] J. D. Brown, S. R. Lau, and J. W. York, Action and Energy of the Gravitational Field, arXiv:gr-qc/0010024v3, 15 Apr 2002, <http://arxiv.org/abs/gr-qc/0010024>

"The drawback of Einstein's approach is that the (XX) action is not fully diffeomorphism invariant (it is invariant modulo **boundary terms**), and his gravitational sem is coordinate dependent. At the quasilocal level there is no obvious general prescription for how one should choose **coordinates**.  
.....

"... and in Sec. VI we apply our formalism to spacetimes with are asymptotically flat in spacelike directions, in the process making some novel observations about total gravitational energy at spatial infinity.  
.....

#### "VI. ENERGY-MOMENTUM AT SPATIAL INFINITY

"In this section we consider the quasilocal energy as applied to spacetimes that are asymptotically flat in spacelike directions [27,65-67],15 and discuss its relationship with the standard treatment of energy at spatial infinity (spi). We begin by recalling the key observation from Regge and Teitelboim, [65] namely, that for asymptotically flat spacetimes the gravitational Hamiltonian must have well defined functional derivatives and **must** preserve the boundary conditions on the fields.  
.....

p. 36: "The key difference between the quasilocal analysis and the asymptotically flat analysis is that in the quasilocal case we do not require, as in step (ii), that the Hamiltonian should preserve the boundary conditions. The reason is the following. In the asymptotically flat case the spacelike hypersurfaces E are Cauchy surfaces. Thus, the data on one slice E completely determines the future evolution of the system. For consistency the evolved data must obey the **boundary conditions**, otherwise the Hamiltonian on future E slices will not have well defined functional derivatives.

"On the other hand, in the quasilocal context, the surfaces E are not Cauchy surfaces. They do not carry enough information to determine the future evolution of the system (the spacetime interior to

dM). Therefore, we see that in the quasilocal case step (ii) cannot, and should not, be taken."

=====

Subject: Re: a [surface energy expression](#) does NOT imply an expression for the energy density

Date: Fri, 7 Dec 2012 03:31:38 +0200

Message-ID:

<CAM7EkxnionDBCDAnzn\_=zgSfdpyn9AEV-QjzyzGx7otJ0m0Hgw@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Niall <n.omurchadha@ucc.ie>

Cc: Laszlo B Szabados <lbszab@rmki.kfki.hu> ,

Adam Helfer <helfera@missouri.edu> ,

Harvey S Reall <H.S.Reall@damtp.cam.ac.uk> ,

Jörg Frauendiener <joergf@maths.otago.ac.nz> ,

Karel V Kuchar <kuchar@physics.utah.edu> ,

Helmut Friedrich <hef@aei.mpg.de> ,

Robert M Wald <rmwa@midway.uchicago.edu> ,

Paul Tod <tod@maths.ox.ac.uk> ,

Robert Beig <robert.beig@univie.ac.at> ,

Bernard J Carr <b.j.carr@qmul.ac.uk> ,

John Baez <baez@math.ucr.edu> ,

Luca Bombelli <bombelli@olemiss.edu> ,

Gary Horowitz <gary@physics.ucsb.edu> ,

Domenico Giulini <giulini@zarm.uni-bremen.de> ,

Claus Kiefer <kiefer@thp.uni-koeln.de> ,

Shing-Tung Yau <yau@ims.cuhk.edu.hk> ,

Ed Witten <witten@ias.edu> ,

Richard M Schoen <schoen@math.stanford.edu> ,

Xiao Zhang <xzhang@amss.ac.cn> ,

Chris Isham <c.isham@imperial.ac.uk> ,

Andrzej Mariusz Trautman <amt@fuw.edu.pl> ,

James York <york@astro.cornell.edu> ,

Bjoern Schmekel <bss28@cornell.edu> ,

Andrew Lundgren <andrew.lundgren@ligo.org> ,

Saul Teukolsky <saul@astro.cornell.edu> ,

David Brown <david\_brown@ncsu.edu> ,

Robert Geroch <geroch@midway.uchicago.edu> ,

Lee Smolin <lsmolin@perimeterinstitute.ca>

Dear Niall,

Thank you for your kind reply from Thu, 6 Dec 2012 13:02:27 +0000.

> Let me respond one point you made in criticising [Laszlo's article](#). Think  
> about what you would need to do to convert a surface formula to a definition  
> of energy density.

It would be like converting red herrings to pink elephants, since they both are kinda red-ish... :-)

See the second link from my preceding email below. For your convenience, I'll reproduce it here:

<http://www.god-does-not-play-dice.net/#Seung1>

The unavoidable gauge freedom "comes with a price" (James York, [arXiv:gr-qc/0405005v1](#); cf.

Andrzej Trautman therein), meaning that "point particles do not exist" (Bjoern Schmekel, [arXiv:0708.4388v1\[gr-qc\]](https://arxiv.org/abs/0708.4388v1)) and the crucial mathematical object called 'gravitational stress-energy-momentum (SEM)' cannot be defined at **\*any\*** quasi-local spacetime region that is both spatially and temporally bounded (David Brown et al., [arXiv:gr-qc/0010024v3](https://arxiv.org/abs/gr-qc/0010024v3)).

In GR, everything that exists as 'matter & gravity at a point' depends on (i) the global asymptotic properties of spacetime and the [dynamics from the "dark" energy](#) producing 'time' (not the York Time), and (ii) the other way around.

Which means to me -- please correct me if I'm wrong -- that the first off task is to define mathematically 'the whole universe as isolated system'.

Now, because we use our brains, we must use our **\*relational\*** knowledge, which means that we can define 'the universe as ONE isolated system' **iff** we have a referential object w.r.t.w. the 'isolated universe' makes sense. Here, there is only one **\*logical\*** option: define the "ambient" unphysical [\[whatever\]](#), w.r.t.w. the asymptotic boundaries of 'the ONE universe' can be mathematically constructed, in terms of 'global mode of spacetime', and bring the latter back into 'the ONE universe'.

But where to insert such metaphysical object? How? That's what my web site is all about. You'll automatically obtain the correct mathematical expression of 'quasi-local points': the geometrical "points" themselves become 'quasi-local'. Which of course brings us to Quantum Geometry -- not to the textbooks by [Bob Wald](#) or [Bob Geroch](#), to name but a few.

Please recall my email sent eight years ago (Fri, 03 Dec 2004 17:39:06 +0200) to James York, with copy to you and many other people. It's a matter of logical constraints -- we simply do not any other option.

If you or someone else can use different logic and type of knowledge, please let me know.

> Pick a point P, and pick a small surface S surrounding it.

[Bingo!](#) The problems with that "small surface S surrounding it" are explained at the link above. You need **'the'** binding phenomenon which can assemble infinitesimal points into such "small" albeit **\*finite\*** surface. This is what people call **'time'**. You might eventually bypass-and-ignore it only and exclusively only by invoking some [dead fixed background](#) spacetime -- not in GR.

- > Work out the total energy,  $E_S$ , of this surface. An estimate for the energy density at P would be  $\rho_P \approx E_S / \Delta V$ , where  $\Delta V$  is the volume enclosed by S. Shrink this surface S inwards, continuing to enclose P.
- > Now you need to show that
- >
- > (i)  $E_S / \Delta V$  converges to a finite number; and
- > (ii) this number is independent of the way you converge to P.
- >
- > One can **get around** point (ii) by constructing a special coordinate system centered at P and finding a preferred sequence of surfaces converging to P.
- > This is what [Brown, Lau, York](#) do in their 'small spheres' article. They get
- > [nice numbers](#), in vacuum they get the Bel-Robinson energy, and in non-vacuum
- > they get the matter-field energy. Nevertheless, I think no one would want to
- > call this 'the' energy density.

Surely "a surface energy expression does NOT imply an expression for the energy density", as you put it in the subject line, and I hope nobody would call this 'the' energy density either, simply because red herrings and pink elephants do not exist.

Any time we look at objects in space and try to "see as far as we can" (Lee Smolin, Three Roads to Quantum Gravity, Phoenix, 2000, [p. 205](#)), we face the formidable mystery of dynamical buildup of 3-D space. We cannot monitor this binding process of 'transience' ([Arrow of Space](#)), but can only observe it [post factum](#), due to the "speed" of light.

Please read the text at the links below and follow the references. We have to correct the current mathematical formalism of GR, or else will be tempted to "amend" it with some wild imagination and wishful thinking, as did, in my opinion, Laslo Szabados in his latest [arXiv:1212.0147v1 \[gr-qc\]](https://arxiv.org/abs/1212.0147v1).

I regret that cannot say more at this website. As [Chris Isham](#) boldly declared, I am "just another crank" who does "not know enough theoretical physics to help with any research in that area." Besides, this whole mathematical task is far more important than what it might look like at a first glance.

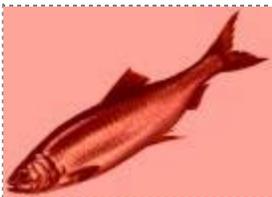
I also hope that you and your colleagues would excuse me for this long unsolicited email. Sorry also for being frank and biased, but the ultimate source of the quasi-local "points" does exist ([Luke 17:21](#)). Only the math is still unknown.

Wishing you and your colleagues a very merry Christmas,

Dimi

> -----Original Message-----  
> From: Dimi Chakalov [mailto:dchakalov@gmail.com]  
> Sent: Thu 12/6/2012 10:54  
> To: Laszlo B Szabados; Adam Helfer; Harvey S Reall; Jörg Frauendiener; Karel  
> V Kuchar; Helmut Friedrich; Robert M Wald; Paul Tod; Robert Beig; Bernard J  
> Carr; John Baez; Luca Bombelli; Gary Horowitz; Domenico Giulini; Claus  
> Kiefer; Shing-Tung Yau; Ed Witten; Richard M Schoen; O'Murchadha, Niall;  
> Xiao Zhang; Chris Isham  
> Subject: Re: On the total mess in GR, arXiv:1212.0147v1 [gr-qc]  
>  
> P.S. Regarding my preceding email,  
> <http://www.god-does-not-play-dice.net/#mess>  
>  
> See a simple drawing at  
>  
> <http://www.god-does-not-play-dice.net/#Seung1>  
>  
> Any comments?  
>  
> D.  
>  
> On [Wed, 5 Dec 2012 02:09:34 +0200](#), Dimi Chakalov <dchakalov@gmail.com>  
> wrote:  
> [snip]  
>

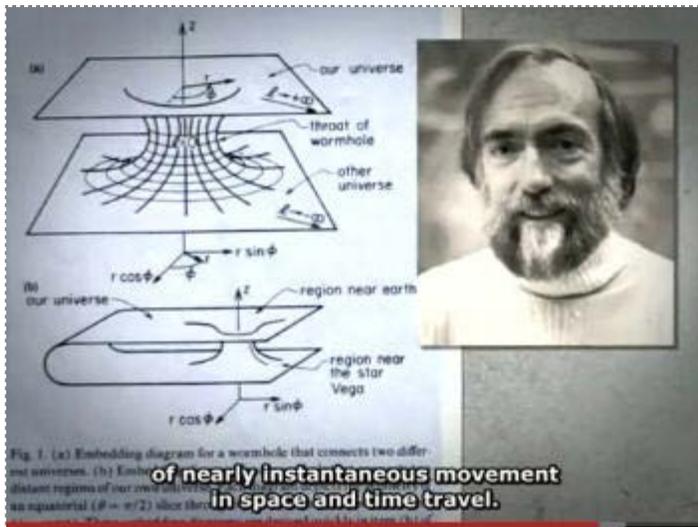
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**Note:** Consider a red herring and a typical pink elephant, then find their centers of mass, and bridge these two points with a rope. You may claim to have suggested a mathematical recipe for converting

red herrings to pink elephants, only 'more research is needed'.

Well, I believe math by itself is a language, and if you speculate about red herrings and pink elephants, it will be all wrong, even if you use a rigorous mathematical description of 'rope', as shown with impeccable math by [Kip Thorne](#).



To this accuracy, the stress-energy tensor for gravitational waves is on an equal footing with any other stress-energy tensor. It plays the same role in producing background curvature; and it enters into conservation laws in the same way. For example, one can show, either by direct calculation or from the identity  $G^{(B)\mu\nu}_{|\nu} = 0$ , that

$$T^{(GW)\mu\nu}_{|\nu} = 0 + \text{error}, \tag{35.71}$$

where the error  $\sim (\lambda/\mathcal{R})(T^{(GW)\mu\nu}/\mathcal{R})$  is negligible in the shortwave approximation.

There is none so blind as they that won't see.

D. Chakalov  
 December 7, 2012  
 Last updated: December 12, 2012, [04:11:45 GMT](#)

=====

Subject: Re: a [surface energy expression](#) does NOT imply an expression for the energy density  
 Date: Sat, 8 Dec 2012 13:35:52 +0200  
 From: Dimi Chakalov <dchakalov@gmail.com>  
 To: [[snip](#)]

P.S. Please see an excerpt ([update.jpg](#) attached) from [http://www.god-does-not-play-dice.net/#explain\\_why](http://www.god-does-not-play-dice.net/#explain_why)

The "obvious" (again) [positivity of mass](#) and violations of ANEC on timeless or "[achronal geodesics](#)" are immensely important issues, but I cannot say more at this website, for reasons explained [above](#). Let me just stress that we *must* have **both** "sharply fixed points of time" (Erwin Schrödinger, *Die gegenwärtige Situation in der Quantenmechanik*, 1935, [Sec. 14](#)) in the local (physical) mode of spacetime, **and** nonlocal "points" from the [global mode of spacetime](#), spanned to the "size" of 'the whole universe as ONE'. This is what 'quasi-local' is all about. We need 'the' binding phenomenon which can assemble [in time](#) infinitesimal points into **finite**, be it "small" or "large", spacetime domains, in which we can look around and see "as far as we can" ([Lee Smolin](#)).

This is the underlying *dynamics* of what we call '[time](#)' -- the *dynamics* of spacetime itself (forget about [LIGO](#)) in terms of 'change of space' ([Arrow of Space](#)).

D. Chakalov

December 7, 2012

Last updated: December 12, 2012, 04:36 GMT

Any comments?

D.

On Thu, 6 Dec 2012 13:02:27 +0000, O'Murchadha, Niall <n.omurchadha@ucc.ie> wrote:  
[snip]

=====  
Subject: Thank you

Date: Tue, 18 Dec 2012 16:13:59 +0200

From: Dimi Chakalov <dchakalov@gmail.com>

To: Ettore Minguzzi <ettore.minguzzi@unifi.it> ,

Domenico Giulini <domenico.giulini@zarm.uni-bremen.de> ,

Karel V Kuchar <kuchar@physics.utah.edu> ,

Xiao Zhang <xzhang@amss.ac.cn> ,

David B Malament <dmalamen@uci.edu> ,

Hans-Jürgen Schmidt <hjschmi@rz.uni-potsdam.de> ,

Stanley Deser <deser@brandeis.edu> ,

Angelo Tartaglia <angelo.tartaglia@polito.it> ,

Helmut Friedrich <hef@aei.mpg.de> ,

Harvey S Reall <H.S.Reall@damtp.cam.ac.uk> ,

Gerardus <g.thoof@uu.nl> ,

Niall <n.omurchadha@ucc.ie> ,

Adam <helfera@missouri.edu> ,

Laszlo <lbszab@rmki.kfki.hu> ,

David <david\_brown@ncsu.edu> ,

Chris <c.isham@imperial.ac.uk>

Dear colleagues,

During the past year, I believe have learned a lot from you -- see the latest note (December 18, 2012, 13:30:39 GMT) at

<http://www.god-does-not-play-dice.net/#cheat>

Thank you very much.

May God give you everything you've been asking for.

Wishing you a very merry Christmas,

Dimi

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I want to make clear that I'm only against God as an explanation, in a limited sense. It may be in the end that God exists and takes the decision of fine tuning, because in the end you've got to be open minded about reality. But, by definition, Physics is the activity of trying to explain things without appealing to God.

Dennis William Sciama, [1998](#)

Everything said at this website is based on the premise that the universe functions as a [human brain](#), based on the *flow of time* from [Heraclitus](#): see option YAIN (iii) [above](#). Ensuing from Mach's "[immediate connections](#)" and the research by Dennis Sciama [[Ref. 1](#)], the theory may help us understand (i) the non-linear [self-acting](#) interactions in the brain (cf. Escher's [drawing hands](#)), (ii) the origin of gravitation and inertial reaction "forces" in 'the universe as a brain', and (iii) the predictions regarding the smaller, finite-size human brain embedded in 'the universe as a brain', e.g., the so-called [REIM](#) and the topological bridge ([May 17, 2009](#)) by which the [two brains](#) can be entangled with their common 'potential reality' from their common [Arrow of Space](#).

In a nutshell, we need to formulate quantum gravity with some brand new mathematical formalism suitable for describing the *emergence* of spacetime ([C. Isham and J. Butterfield](#)) along the Heraclitean *flow of time* defined with respect to the [reference fluid of GR](#) in the so-called [global mode of spacetime](#). All we know for sure is that the presentation of 'time' in today's GR textbooks is [wrong](#), chiefly because it is impossible to even suggest some *physical* phenomenon **acting** as a 'clock', neither locally at a given 'world point' ([P. G. Bergmann and A. Komar](#)) nor globally **on** the whole universe *en bloc*. We haven't even reached the stage at which we would have to acknowledge that the *untraceable* energy, which springs from the dynamical spacetime [[Ref. 1](#)], must be "[dark](#)".

Instead, people prefer to "rescue" their GR textbooks by switching to metrology, and try to mimic some properties of 'time', such as the *cyclical* duration of '[one second](#)', with particular *physical process* of **finite** duration, taken from the physical world governed by the [Archimedean Axiom](#) -- not 'the *unmoved mover*' ([Karel Kuchar](#)) producing the [flow of time](#), modeled with the Arrow of Space. Then the same people have to 'kill the time' ([Robert Geroch](#)), simply because in the current GR textbooks '**space**' cannot be derived from some [evolving-in-time](#) process either.

To sum up, the only available option is to propose an Arrow of Space as 'change **of** space', because the alternative idea about 'coordinate change **in** space' leads to 'time read with a physical clock' which *must* disappear ([Bryce de Witt](#)). But to *understand* the emergence of spacetime with our relational cognition, the very "displacement" of spacetime, produced by the Arrow of Space by means of 'change **of** space' (forget about [LIGO](#)), must be *relational* as well ("displacement": with respect to [what?](#)), which is why we suggest two *modes* of spacetime, local (physical) mode and global mode, and are seeking new mathematical ideas for [Quantum Geometry](#).

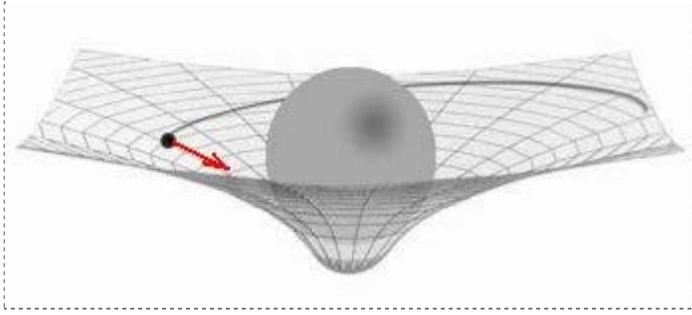
Again, the new presentation of spacetime *dynamics* is that the *emergence* of spacetime ([Isham & Butterfield](#)) produces **accumulated** physical universes and hence '[time direction](#)', but these *accumulated* physical universes **blend** into one single *physical* universe cast on a *perfect continuum* (local mode of spacetime). The "[dark Zen gaps](#)" (global mode) are *totally* eliminated there, **but** are shifted in the potential future of the Arrow of Space, in terms of '[potential reality](#)' ("[cloud](#)" of propensities) -- just as in the [human brain](#) and living matter in general.



Obviously, [LIGO](#) cannot detect the "displacement" of spacetime exhibited in '[gravitational waves](#)', firstly because the proper GW detector must be a **web** (resembling a [school of fish](#)) of numerous *quasi-local* 'world points' endowed with **self-action** -- the "ripples" in the *potential reality* will induce changes only in the *self-acting* GW detectors. Likewise, we can detect changes only in the self-acting human brain -- not in the mind.

This framework was completed on [May 31, 2012](#); the next stage on the road to quantum gravity is to explain the theory to the widest possible audience, and (hopefully) bring some [very young](#) mathematicians on board. It would have been much easier to have support from the established theoretical physicists, but they've been rejecting these proposals ever since [1972](#). Perhaps these people quietly hate 'the true monad [without windows](#)', which can only be described (not understood) mathematically, since **it** is ONE and is therefore *not*-relational. Yet **it** is real, very much indeed, only we cannot, and must *not* be able to trace it back as 'physical object', which is why in science (not theology) **it** can only show up as 'the *unmoved mover*' ([Karel Kuchar](#)) and '*Der Geist bewegt die Materie*' ([Virgil](#)).

By the end of December 2013, I hope to complete a DVD with seven video lectures, which will be offered free of charge, and will be intended to young people ([Max Planck](#)) who can understand the misleading "analogy" with some "flat spacetime" in GR textbooks (Hyun Seok Yang, [arXiv:1111.0015v3](#)):



When the massive body moves to another place, the original point where the body was placed will recover a (nearly) flat geometry like a [rubber band](#). That is, the (flat) spacetime behaves like a metrical elasticity which **opposes** the curving of space. But this picture rather exhibits a puzzling nature of flat spacetime because the flat spacetime should be a completely empty space without any kind of energy as we remarked above. How is it possible for an empty space of nothing to behave like an elastic body with [tension](#) ?

Recall that the alleged "[curvature](#)" inevitably induces "[rotation](#)": [gravitation & torsion](#) is a bundle, which we instruct to approach *asymptotically* zero '[at a point](#)', according to the misleading "analogy" with some fictitious "flat spacetime" pictured with our [euclidean eyes](#).

These misleading ideas work very well for [shut-up-and-calculate](#) purposes, but the crucial "**identity** of a world point" ([P. G. Bergmann and A. Komar](#)) requires [precise explanation](#), which leads to [quantum gravity](#). Why? Because the underlying manifold of **quasi-local** geometrical "points" is presented with two *modes* of spacetime, called *local* mode and *global* mode (cf. [Mott's paper and the Kochen-Specker Theorem](#)), and these two *modes* of spacetime produce a *perfect continuum* of quasi-local geometrical "points" in the *local* (physical) mode, as well as a 'back bone' of [the whole universe](#) by means of 'potential reality' in the *global* mode of spacetime. To explain the task, see an excerpt from [Mauricio Suárez](#) below, regarding a given state  $\Psi$  of *the* quantum system in the experimental context of particular quantum measurements in Hilbert spaces of dimension 3 and greater (emphasis and comments added):

Suppose that the state of a quantum system is  $\Psi$ , a superposition of eigenstates of the Hermitian operator that represents the observable Q. The standard interpretational rule within orthodox quantum mechanics, the eigenstate/eigenvalue link (e/e link) states that a system in state  $\Psi$  can be said to have a value of a property Q if and only if  $\Psi$  is an eigenstate of the Hermitian operator that *represents* (Sic! - D.C.) the property. (The duplicitous condition "if and only if" might induce some reminiscent idea of fixed objective reality '*out there*', which would be a *very* misleading and totally wrong analogy, as we know from [Erwin Schrödinger](#) - D.C.).

The paradigmatic question regarding these states (called '[jackets](#)'; not *the* quantum system itself called '[John](#)' - D.C.) is then the following:

What does it mean -- with respect to the property represented by the observable Q -- for a quantum system to be in state  $\Psi$  which is **not** an eigenstate of the Hermitian operator that represents Q?

As explained [previously](#), in Hilbert spaces of dimension 3 and greater, the observable Q can be [presented](#) with a single *superposition* of three observable "states" or '[jackets](#)' (not *the* quantum system itself), explained here with three sayings (or 'colors', [Ernst Specker](#)):

- |Q1> : All are not hunters that blow the horn.
- |Q2> : La robe ne fait pas le médecin.
- |Q3> : Es ist nicht jeder ein Koch, der ein lang Messer trägt.



It is manifestly **wrong** to claim that [the "dark" energy](#) is an Archimedean phenomenon, and then speculate that "as *more* space comes into existence, *more* of this energy of space would appear. As a result, this form of energy would cause the Universe to expand faster and *faster*" (R. Rakhi and K. Indulekha, [p. 5](#)). We **must** disentangle the blueprints from the [Arrow of Space](#), which are cast on the *local* mode of spacetime, from those resulting from to the *global* mode and its actual/completed infinity -- the fundamental '[time direction](#)' is a *composite* and [emergent](#) phenomenon, and so is the 3-D space. As an exercise, recall that the notions of Large and Small (which are otherwise essential for 3-D space) were derived from the deceptive *teleological* (potential infinity) "radius" of the "expanding balloon" ([Ned Wright](#)), as well as the application of Finite Infinity to the [dual age cosmology](#).

After solving the tasks above, we take the *perfect continuum* (no '[dark Zen gaps](#)' in the *local* mode of spacetime) of quasi-local **geometrical** 'world points' ([Bergmann & Komar](#)), which have been [post-factum](#) individuated **by** 'the whole universe as ONE' (recall the three superposed sayings in the example above), and drop this *physical continuum* in [General Relativity](#). Hopefully, by [25 November 2015](#) we will work out a Machian quantum gravity in which the quasi-local **geometrical** 'world point' has a *dual geometrical* nature: it is *both* a dimensionless "point" *and* 'the larges volume of 3-D space', depending on the direction we look at **it** from the *local* mode of spacetime, while in the *global* mode thus *dual* geometrical object is ONE. Recall also that the *global* mode of spacetime is [the only possible](#) solution for fixing "[boundaries](#)" on spacetime: the notion of 'asymptotic infinity' is **brought back** into spacetime in terms of 'global mode', which makes the whole universe a *self-determined* and [bootstrapped](#) ONE entity. The latter contributes to the *dynamics* of spacetime in terms of '[sufficient conditions](#) for spacetime': the **binding** of 'mass points' ([Kurt Gödel](#)) can *only* be made by some [fundamental connection](#) executed by 'the universe as ONE', which **must not exist** in the *local* mode of spacetime, namely, it is [between](#) the neighboring 'mass points'. Surely the individuation of 'world points' ([Bergmann & Komar](#)) requires their "separation", yet on the other hand this "separation" by '[dark Zen gaps](#)' must *not* exist physically, or else we won't be able to model the *perfect physical* continuum of "[Aleph-null bottles](#)".

Finally, bear in mind that we have rejected the idea of *ontological* probabilities (God does not play dice, Albert Einstein), because in both [Quantum Theory](#) and [General Relativity](#) the [correlated 'jackets'](#) are explicated along the [Arrow of Space](#) one-at-a-time *and* with [certainty](#): Dead matter makes quantum jumps; the living-and-quantum matter is smarter.

This is the crux of [Quantum Geometry](#), which I hope to explain with seven video lectures by Christmas 2013. Then comes the formidable task for uncovering the new, still unknown mathematical formalism for Machian quantum gravity. We need precise mathematical theory to proceed further, but the challenges ahead are highly non-trivial, if not severe. Frankly, the *only hope* we have right now is 'the astonishing effectiveness of mathematics in the natural sciences' ([Eugene Wigner](#)), backed by [Matthew 7:7](#).

"Whether you believe you can do a thing or believe you can't, you are right" (Henry Ford).

D. Chakalov  
December 21, 2012  
Last updated: January 7, 2013, 08:19 GMT

[Ref. 1] D.W. Sciama, On the origin of inertia, *Monthly Notices of the Royal Astronomical Society*, 113 (1953) [34-42](#).

As Einstein has pointed out, general relativity does not account satisfactorily for the inertial properties of matter, so that an adequate theory of inertia is still lacking. This paper describes a theory of gravitation which ascribes inertia to an inductive effect of distant matter. In the rest-frame of any body the gravitational field of the universe as a whole cancels the gravitational field of local matter, so that in this frame the body is "free". Thus in this theory inertial effects arise from the gravitational field of a moving universe.

Comment: The great [Dennis Sciama](#) has given us a groundbreaking research on the nature of [gravitation and inertia](#), which is still waiting to be [fully understood](#) and appreciated.

To quote from his article (emphasis added), "the universe as a whole **cancel**s the gravitational field of local matter, so that in this frame the body is "free". Thus in this theory inertial effects arise from the gravitational field of a **moving** universe."

Notice the **non**-linear cancelation of the two "fluxes" ([Merced Montesinos](#)), depicted with two 'drawing hands' in the famous drawing from Maurits Escher [above](#): this perpetual cancelation is being **repeated**, ever since [The Beginning](#), at every instant 'now' from the [Arrow of Space](#), fixing 'world points' with the astonishing precision of [one part in 10 to the power of 120th](#). Yet the cancelation does **not** create an *exactly* zero "dark" remnant, due to which we enjoy a 'moving universe' [[Ref. 1](#)] driven by the Arrow of Space and endowed with **re**-created [asymptotically flat](#) spacetime, [untraceable "dark" energy](#), and 3-D dynamic blueprints from the "[aether](#)" and [torsion](#), such as [galaxy rotation](#) and [cosmic equator](#). Enough said?

D. Chakalov  
December 29, 2012, [13:29:52 GMT](#)

=====  
Subject: The "cloud" of contextuality  
Date: Thu, 27 Dec 2012 16:50:56 +0200  
Message-ID:  
<CAM7EKxkfzttVkcNaVCv4jdmJ3Czd8igow-vs5nwQnNLEKXZRPg@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Ravishankar Ramanathan <ravishankar\_ramanathan@hotmail.com>, ravishankar\_r@nus.edu.sg,  
Pawel Horodecki <pawel@mif.pg.gda.pl>  
Cc: Michal Horodecki <fizmh@ug.edu.pl>,  
Ryszard Horodecki <fizrh@univ.gda.pl>,  
Stanislaw Kryszewski <fizsk@univ.gda.pl>,  
Graeme Mitchison <gjm12@cam.ac.uk>,  
Chris Heunen <heunen@cs.ox.ac.uk>,  
spitters@cs.ru.nl,  
landsman@math.ru.nl,  
meagan@post.harvard.edu,  
marco.zaopo@unipv.it,  
valentina.baccetti@msor.vuw.ac.nz,  
matt.visser@msor.vuw.ac.nz,  
adan@us.es,  
rspekkens@perimeterinstitute.ca,  
juerg.froehlich@itp.phys.ethz.ch,  
gian-michele.graf@itp.phys.ethz.ch,  
wolfst@inf.ethz.ch,

andreas.doering@comlab.ox.ac.uk,  
cflori@perimeterinstitute.ca

Dear colleagues,

Surely "a finite set of measurements exists whose results cannot be assigned in a context-independent manner", after the [Kochen-Specker Theorem](#), but unfortunately you totally twisted the issue in [arXiv:1212.5933v1 \[quant-ph\]](#), by talking about revealing "the contextuality of all states of a given dimension", and posed the question "when does a set of ([projective](#)) measurements reveal the contextuality of all quantum states (belonging to a particular Hilbert space of dimension  $d$ )?".

The crux of the matter is the very "cloud" of contextuality,

[http://www.god-does-not-play-dice.net/#thank\\_you](http://www.god-does-not-play-dice.net/#thank_you)

Please correct your misinterpretation of the Kochen-Specker Theorem in your next arXiv:1212.5933 v2 [quant-ph].

Recall that we cannot use "probabilities", for reasons explained by [Erwin Schrödinger](#) in November 1950, and the "cloud" of contextuality leads to a brand new truth evaluation of propositions: [YAIN](#) .

As Alexandre Grothendieck put it, "these "probability clouds", replacing the reassuring material particles of before, remind me strangely of the elusive "[open neighborhoods](#)" that populate the topoi, like evanescent phantoms, to surround the imaginary "points"."

All you need is math.

I will appreciate your professional feedback, and the opinion from your colleagues. Please do not hesitate.

Sincerely,

Dimi Chakalov

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**Note:** Perhaps the best way to explain the "cloud" of *propensities* is with the game of [Twenty Questions](#) (John and Marry Gribbin, *In Search of Schrödinger's Cat*, Black Swan, London, 1998, p. 209; quoted from: *Quantum Theory and Measurement*, ed. by J.A. Wheeler and W.H. Zurek, Princeton University Press, Princeton, 1983, pp. 182-213):

"There had been a plot *not* to agree on an object to be guessed, but that each person, when asked, must give a truthful answer concerning some real object that **was** in his mind, and which **was** *consistent with all the answers that had gone before*. With only one question left, John Wheeler guessed: "Is it a cloud?" The answer was "Yes!"

The final answer was consistent and correlated with all previous answers, and this final correlated answer -- 'cloud' -- was **not present** up until the last question, because it isn't some [non-contextual observable](#) in the first place.

Stated differently, the [initial ontic source](#) was **not** "cloud". To paraphrase [Fyodor Tyutchev](#), a spoken (explicated) thought is a "[colored](#)" thought. Back in 1935, [Erwin Schrödinger](#) emphasized that measuring a value (e.g., "cloud") of an observable does **not** mean that the observable **has had** such definite physical value from the outset, because the observable cannot in principle possess **any** definite value [before](#) we measure it.

Yet people stubbornly refuse to admit that the "**set**" of normalized *expected* values (e.g., [Richard Feynman](#)) cannot *in principle* include its [initial UNSpeakable ontic source](#), as explained [above](#). Then these people inevitably hit the [cosmological "constant"](#) paradox, by calculating the "total possible" vacuum energy from all possible *normalized expected* values (or "words", from the analogy above, plus the current "cloud") of all possible **latent** ([Henry Margenau](#)) observables, and finally

acknowledge that have only produced "[the worst theoretical prediction](#) in the history of physics". But in fact, the UNSpeakable pre-quantum [Kochen-Specker source](#) may produce **zero** physical explications, and **not** gravitate at all.

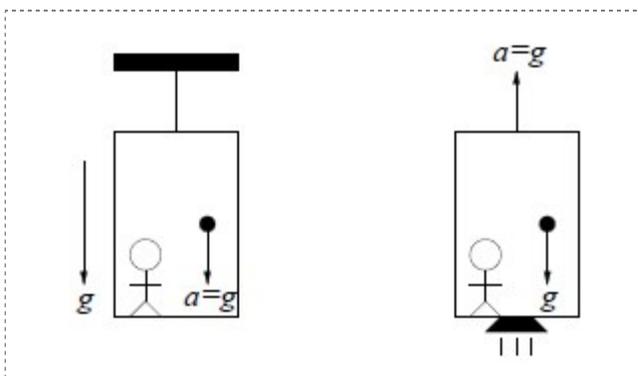
Strangely enough, if you show [the "set" errors](#) in the "[the worst theoretical prediction](#) in the history of physics", these people wouldn't care. Or will stubbornly claim that cannot understand this crucial issue from [1935](#). Or both.

The second lesson is about timing: the correlated **selection** of particular 'shadow on [Plato's cave](#)' (which in this case happened to be "cloud", after the "measurement" context was finally fixed) shows the *gradual unfolding* of context "over time" ([Mike Ivanov](#)), as read with your physical clock during the game of Twenty Questions, while in the quantum realm the **duration** of the full, quasi-instantaneous, EPR-like selection(s) is [atemporal](#).



The obvious advantage, as explained [previously](#), is that the whole *physical* spacetime (local mode) can be **re-created** with such "clouds" to define the *quasi-local* 'world points' ([Bergmann & Komar](#)): one-at-a-time along the [Arrow of Space](#), and with [unit probability](#). Why? Because we have only **one** explicated "cloud" as 'physical reality' at an instant 'now'; the rest **don't matter**, the UNSpeakable pre-quantum [Kochen-Specker source](#) included.

To move to General Relativity, think of the final, physical, [positive mass](#) "cloud" as being **re-endowed** with [inertial mass](#) at the instant 'here-and-now' from the Arrow of Space, depicted with the solid horizontal line in the first drawing from [James Ward](#) below.



Sorry for repeating this here, but one of the recipients of my email [above](#) claimed that cannot understand the issue. Now [he can surely grasp it](#), but will again keep dead quiet.

D. Chakalov

December 30, 2012

Last updated: January 1, 2013, [16:21:30 GMT](#)

=====

Subject: Re: М. Г. Иванов, 'Как понимать квантовую механику', 2012, с. 30  
Date: Mon, 31 Dec 2012 00:02:50 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Iegor <dominiqueleconte@yahoo.xx>

Dear Iegor,

Thank you for the feedback. I very much respect [your work](#), and haven't spotted even a trace from [Russian poetry](#) in it.

Surely "there is a component of the particle whose value cannot be predetermined in the theory" ([arXiv:1008.3661v1](#)), but I think your amendment "God doesn't play dice, but lets the dice play" ([arXiv:1203.2945v1](#)) requires precise explanation of the genuine **flexibility** (not "uncertainty") of quantum particles -- please see the two explanatory notes added at

<http://www.god-does-not-play-dice.net/#cloud>

<http://www.god-does-not-play-dice.net/#Ivanov>

I wish you joy and happiness in 2013 and beyond.

Dimi

=====

Subject: Corrections  
Date: Mon, 31 Dec 2012 16:05:14 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Brenda Dunne <bjd@icrl.org>,  
Larissa-Emilia Cheran <larisa\_cheran@hotmail.com>,  
Jean Burns <jeanbur@earthlink.net>,  
Richard Amoroso <amoroso@noeticadvancedstudies.us>,  
Matti Pitkanen <matpitka@luukku.com>,  
James Lake <egret4@sbcglobal.net>,  
Brian Millar <bmillar@ymail.com>,  
Lian Sidorov <liansidorov@gmail.com>,  
Ulrich Mohrhoff <ujm@auromail.net>

Dear colleagues,

I will be happy to offer corrections to [your efforts](#). If you are interested, check out some prerequisites at

<http://www.god-does-not-play-dice.net/#cloud>

Wishing you a joyful and prosperous New Year,

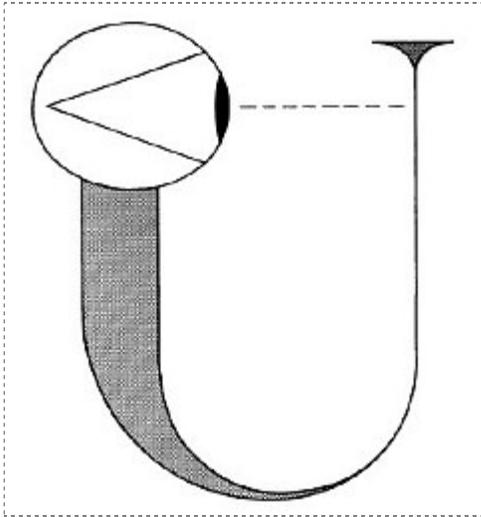
Dimi Chakalov  
Operator #99  
PEAR Lab, Princeton University  
May 22, 1989

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**Note:** I visited the PEAR Lab in Princeton University in May 1989, and had the chance to test briefly some of their "devices". Also, I was fortunate to have a lunch with John A. Wheeler in the cafeteria at the Physics Department, and offered him an explanation of a famous statement, which he has seen in 1976, on a wall in the Pecan Street Cafe in Austin, Texas (J.A. Wheeler, 'Time Today', in *Physical Origins of Time Asymmetry*, ed. by J.J. Halliwell, J. Pérez-Mercader, and W.H. Zurek, Cambridge UP, Cambridge, 1994, p. 1):

"Time is nature's way to keep everything from happening all at once."

John Wheeler was a famous theoretical physicist and wasn't at all interested in solving his problems, but look at his drawing below from '[Law Without Law](#)', p. 209:



I hope you will immediately understand the **atemporal** nature of the common source of [matter & psyche](#), after Wolfgang Pauli (H. Atmanspracher and H. Primas, [The Hidden Side of Wolfgang Pauli](#), *Journal of Consciousness Studies*, 3 (1996) 112-126; cf. Sec. VI, *Matter and Psyche as Two Aspects of One Reality*, p. 122). There's no need for any "[multiverse](#)" and [anthropic](#) speculations.

If you are interested, check out some prerequisites at

<http://www.god-does-not-play-dice.net/#cloud>

D. Chakalov  
January 1, 2013, 16:15 GMT

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Subject: Re: "I bet \$100 that the Higgs will not be discovered". Thursday, January 9, 2003, 15:56:04 GMT  
Date: Fri, 4 Jan 2013 04:17:10 +0200  
Message-ID:  
<CAM7EkxmqvObh34TEViDnNC9yWUJ=JZbOkQkLL5UV9pFp1j=SEQ@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: [David J Miller](mailto:djm@hep.ucl.ac.uk) <djm@hep.ucl.ac.uk>  
Cc: [snip]

David,

Let me set the record straight: Ten years ago, I predicted that "the Higgs will not be discovered. Instead, the number of quarks will jump to 8 and more, in a Fibonacci sequence" (Thursday, January 9, 2003, 15:56:04 GMT).

Check out  
[http://www.god-does-not-play-dice.net/#pure\\_energy](http://www.god-does-not-play-dice.net/#pure_energy)

If you and/or any of your colleagues wish to have professional discussion, please notice the conditions (i) and (ii) at

[http://www.god-does-not-play-dice.net/#CERN\\_2013](http://www.god-does-not-play-dice.net/#CERN_2013)

"... please (i) reply professionally and (ii) post a copy from your ideas online at arXiv.org server. I will respond immediately, without referring to my website."

As ever,

Dimi

On Wed, 2 Jan 2013 16:35:54 -0000, [David J Miller](mailto:djm@hep.ucl.ac.uk) <djm@hep.ucl.ac.uk> wrote:  
[snip]

**Note:** Again, we cannot *directly* observe the **pure dark energy** of 'the universe as ONE', for reasons explained [above](#). If we use the [school of fish metaphor](#), the task is tantamount to detecting *directly*

the very **bootstrapping agent** which keeps all *quasi-local* fish *en bloc* and determines their *quasi-local* energy that depends on the whole school -- no way, absurd. All we can *infer* from our observations is that an *observable* quasi-local fish (e.g., [boson](#)) has obtained the "dark" faculty of **self-acting** (like Baron Munchausen), because the **pure dark energy** of the **bootstrapping agent** itself cannot be observed directly. We cannot **derive**, as people try at [CERN](#), the **pure dark energy** of 'the whole school of fish' from **any** new, previously unknown quasi-local 'fish', after increasing the energy used with our detectors, such as the [upgraded LHC](#) near Geneva -- no way, absurd. And if we take a look at a deeper level of bootstrapping 'the whole school of fish' toward the *Small*, "the number of quarks will jump to 8 and more, in a Fibonacci sequence" (Thursday, January 9, 2003, 15:56:04 GMT). If we choose the opposite direction toward the *Large*, it would be like trying to discover some "last fundamental" volume of 3-D space, "after" which there were some "quiet nothing out there", so we could imagine that the 3-D space can "expand further" into such "nothing", along some "4th spatial dimension" ([Ned Wright](#)). Forget it.

This is what happens when people try to reduce the **non**-Archimedean 'universe as ONE' to its **finite**, physical constituents obeying the [Archimedean axiom](#) -- see the excerpt below. Describing these two worlds is a fundamental, and still unresolved, *mathematical* task.

If we use the cocktail-party metaphor suggested by [David J. Miller](#) in 1993, and try to "actually see the Higgs particle *itself*", it will be tantamount to detecting *directly* the **last fundamental** "rumour" that produces the **last fundamental** "clustering" of (quasi-local) *observable* people bootstrapped at the cocktail party -- no way, absurd. The nature of space does not permit to "reach" the **non**-Archimedean 'universe as ONE' from the physical, [Archimedean world](#). Why? Because if people could *physically* reach 'the 'universe as ONE', they will be able to move **further**, and hence contradict the Aristotelian Unmoved Mover ([Karel Kuchar](#)) and [First Cause](#).

Recall 'the grin of the Cheshire cat *without* the cat' [above](#): can you detect *the* pure geometry *itself*? Check out a brief outline of General Relativity [above](#). People like [Lev Okun](#) are still obsessed by the Marxist-Leninist idea 'only matter can **act** on matter', and then try to calculate the **pure dark energy** as some *physical* field with [positive energy density](#), only to reach "[the worst theoretical prediction](#) in the history of physics" known since 1930s: the radius of the universe "could not even reach to the moon" ([Wolfgang Pauli](#)).

Last but not least, the [Arrow of Space](#) forbids *direct* observations of the **pure dark energy** "online" - - we can detect only the physical, quasi-local, *already*-correlated, and *self-acting* particles (e.g., [bosons](#)), and only *post factum* due to [the "speed" of light](#). Which in turns produces quantum-gravitational "waves" of propagation of these EPR-like correlated particles along the [Arrow of Space](#) (explanation with four dice [above](#)), without *any* [physical. "waving" source](#) -- **nothing** is "waving" in the quantum world to produce [quantum waves](#). The generation of such quantum-gravitational "waves" is made **jointly** by (i) an individual object and (ii) 'the whole universe as ONE', in line with (i) the *necessary* and (ii) the *sufficient* conditions for 'spacetime' (cf. [above](#)).

Keep also in mind that in the Machian quantum gravity, the [reference fluid](#) of GR (global mode of spacetime) is an atemporal *pre-geometric* medium [\[between\]](#) the geometric points, in which the geometrical-and-physical content of 'world points' ([Bergman & Komar](#)) is being **re**-determined -- one-at-a-time along the [Arrow of Space](#). Thus, the mathematical continuum of "points" is being **re**-created at every instant 'now' along the [direction of time](#): "You cannot step into the same river twice, for fresh waters are ever flowing in upon you" (Heraclitus). To be precise, the 'river' is the *physical* universe, but it is never 'the same'.

But why 'Machian quantum gravity'? Here's a quote from Mario Novello, [arXiv:1008.2371v1](#), p. 9:

"We start by considering Mach principle as the statement according to which the inertial properties of a body A are determined by the energy-momentum throughout [all space](#). How could we describe such universal state that takes into account the whole contribution of the rest-of-the-universe onto A?"

As a first step, we include the opposite contribution of A back on the rest-of-the-universe. It is an [atemporal bi-directional](#) "talk" in the global mode of spacetime, which fixes 'world points' and hence **acts** as the [reference fluid](#) of 'the universe as ONE'. Needless to say, this atemporal, *pre-geometric* and *pre-quantum* medium acts by **pure dark energy** only.



Trouble is, we haven't yet developed the proper mathematical formalism for modeling the **pure dark energy** of 'the universe as ONE' -- see the excerpt below.

Strangely enough, if you show [the "set" errors](#) in the "[the worst theoretical prediction](#) in the history of physics", these people wouldn't care. Or will stubbornly claim that cannot understand this crucial issue from [1935](#). Or both.

**NB:** The task is strictly mathematical. There's no need to waste [BILLIONS and BILLIONS](#) of taxpayers' money -- recall my prediction from Thursday, January 9, 2003, 15:56:04 GMT.

D. Chakalov  
January 4, 2013  
Last updated: January 6, 2013, [16:57:30 GMT](#)

=====

Subject: Re: "I bet \$100 that the Higgs will not be discovered". Thursday, [January 9, 2003, 15:56:04 GMT](#)  
Date: Wed, 2 Jan 2013 19:52:23 +0200  
Message-ID:  
<CAM7EkxnGcz3a1\_DeoQUs\_50SXAooRrkgSvQ-rw+XRsyij0trmQ@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: djm@hep.ucl.ac.uk  
Cc: [Roman Jackiw](#) <jackiw@Ins.mit.edu>, vitiello@sa.infn.it, jaffe@mit.edu, georgi@physics.harvard.edu, philip.mannheim@uconn.edu, maccone@unipv.it, bryan.sanctuary@mcgill.ca, James.Gillies@cern.ch, owgreen@umd.edu, witten@theory.caltech.edu, wilczek@mit.edu, John.Ellis@cern.ch

David,

> I could not find your previous email in my files.

I found 9 (nine) at my web site: see [search\\_djm.jpg](#) attached.

> Maybe I never received it.

I like your sense of humo(u)r.

- > Nevertheless I can confess that I have recently come round to
- > conceding that the object observed by the LHC experiments
- > could well be [the Higgs boson](#).

But you don't have any theory in the first place, [David](#). Just a bunch of speculations, which run against everything we know since 1935,

<http://www.god-does-not-play-dice.net/#cloud>

- > I asked [John Ellis](#) a few weeks ago whether he was ready to break
- > his pencils, but he adamantly sticks to his expectation that SUSY
- > will eventually emerge.

As John von Neumann put it, "There's no sense in being precise when you don't even know what you're talking about." Read the note at

<http://www.god-does-not-play-dice.net/#Kibble>

Should you or any of your colleagues wish to respond professionally, please study the facts. First thing first.

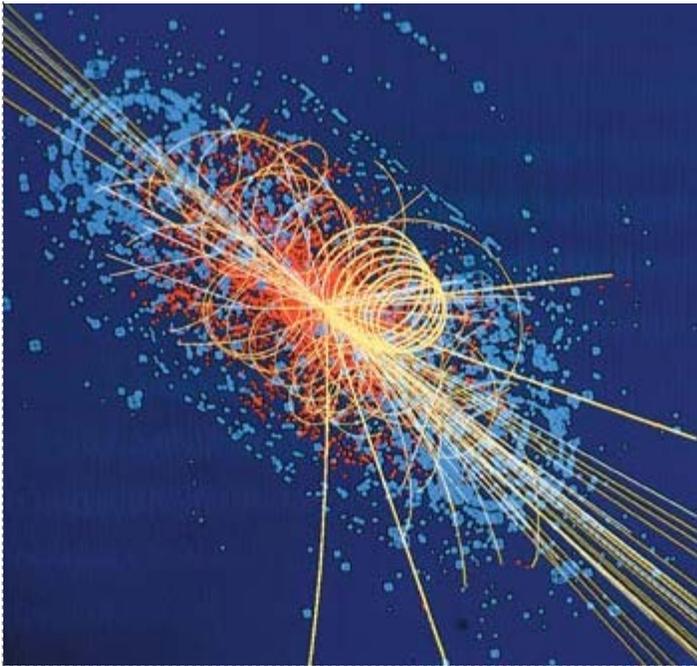
As ever,

Dimi

-----

- >
- >> P.S. Regarding my email from Fri, 6 Jan 2012 16:37:26 +0200, see an
- >> update at
- >>
- >> <http://www.god-does-not-play-dice.net/#Nernst>
- >>
- >> You've kept quiet for a **whole year**. Any comments?
- >>
- >> D.C.
- >>
- >

=====



Strangely enough, if you show [the "set" errors](#) in the "[the worst theoretical prediction in the history of physics](#)", these people wouldn't care. Or will stubbornly claim that cannot understand this crucial issue from [1935](#). Or both.

Subject: Re: I bet \$100 that [the Higgs](#) will not be discovered.

Date: Thu, 3 Jan 2013 03:24:14 +0200

Message-ID:

<CAM7Ekx==JkXML7OkNYhW900qbjZuEqjDq7dQwSO-sfWp-OsY6Q@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: GERALDINE.SERVANT@cern.ch,

CEDRIC.DELAUNAY@cern.ch,

GIAN.GIUDICE@cern.ch,

CHRISTOPHE.GROJEAN@cern.ch,

GILAD.PEREZ@cern.ch,

JAMES.WELLS@cern.ch,

ANDREA.THAMM@cern.ch,

CHRISTIAN.THOMAS.BYRNES@cern.ch,

ANNE-MARIE.PERRIN@cern.ch,

SUSANNE.REFFERT@cern.ch,

IGNATIOS.ANTONIADIS@cern.ch,

JULIEN.LESGOURGUES@cern.ch,

GEORGI.DVALI@cern.ch,

HYUN.MIN.LEE@cern.ch,

GRAEME.WATT@cern.ch,

GEORGE.ZOUPANOS@cern.ch,

John.Ellis@cern.ch,

James.Gillies@cern.ch

CC: [Tom Kibble](#) <t.kibble@imperial.ac.uk> ,

[David J Miller](#) <djm@hep.ucl.ac.uk> ,

jackiw@lns.mit.edu,

georgi@physics.harvard.edu,

witten@theory.caltech.edu,

wilczek@mit.edu

Ladies and Gentlemen,

No reply has been received to my email sent [one year ago](#), on Sun, 8 Jan 2012 22:25:25 +0200.

Just don't even \*think\* that I will let you waste BILLIONS and BILLIONS of taxpayers' money for your hobby: it contradicts the basic facts of Quantum Theory,

<http://www.god-does-not-play-dice.net/#cloud>

Check out the latest entry at

<http://www.god-does-not-play-dice.net/#DJM>

**NB:** All this is just the beginning. Ignore it at your peril.

Sincerely,

Dimi Chakalov  
35 Sutherland St  
London SW1V 4JU

=====

Subject: Re: "[A spoken thought is a lie](#)"

Date: Thu, 3 Jan 2013 17:47:39 +0200

Message-ID:

<CAM7EkxngEj4v+Pusjp-xd0K1fSP34YQyyJ7q2xt6BwGGC95PQw@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Lev Okun <levokun@gmail.com>, Lev Okun <okun@itep.ru>

Cc: Andrei Khrennikov <Andrei.Khrennikov@lnu.se> ,

Stanislav.Babak@aei.mpg.de,

Serge Krasnikov <gennady.krasnikov@pobox.spbu.ru> ,

Irina Basieva <irina.basieva@lnu.se> ,

Mike Ivanov <mgi@mi.ras.ru> ,

Slava Mukhanov <mukhanov@theorie.physik.uni-muenchen.de> ,

"A. Novikov-Borodin" <novikov.borodin@gmail.com> ,

Dmitry Slavnov <slavnov@goa.bog.msu.ru> ,

Рылов Юрий <yrylov2006@yandex.ru> ,

andrei\_grib@mail.ru,

Daniil Yerokhin <denyerokhin@gmail.com> ,

Glib Ivashkevych <glib.ivashkevych@gmail.com> ,

Yuri L Bolotin <ybolotin@gmail.com> ,

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cosmograv@yandex.ru,

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melnikov@phys.msu.ru,

ignatev\_yu@rambler.ru,

yusvlad@rambler.ru,

vladimir@lukash.asc.rssi.ru,

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ivashchuk@mail.ru,

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CHRISTOPHE.GROJEAN@cern.ch,  
GILAD.PEREZ@cern.ch,  
JAMES.WELLS@cern.ch,  
ANDREA.THAMM@cern.ch,  
CHRISTIAN.THOMAS.BYRNES@cern.ch,  
ANNE-MARIE.PERRIN@cern.ch,  
SUSANNE.REFFERT@cern.ch,  
IGNATIOS.ANTONIADIS@cern.ch,  
JULIEN.LESGOURGUES@cern.ch,  
GEORGI.DVALI@cern.ch,  
HYUN.MIN.LEE@cern.ch,  
GRAEME.WATT@cern.ch,  
GEORGE.ZOUPANOS@cern.ch,  
John.Ellis@cern.ch,  
James.Gillies@cern.ch,  
Tom Kibble <t.kibble@imperial.ac.uk>,  
David J Miller <djm@hep.ucl.ac.uk>,  
Roman Jackiw <jackiw@Ins.mit.edu>,  
georgi@physics.harvard.edu,  
witten@theory.caltech.edu,  
wilczek@mit.edu,  
indico@astro.ru.nl,  
av@star.sr.bham.ac.uk,  
vdbroeck@nikhef.nl,  
nelemans@astro.ru.nl,  
sotiriou@sissa.it,  
rezzolla@aei.mpg.de,  
hiramatz@yukawa.kyoto-u.ac.jp,  
hotoke@tap.scphys.kyoto-u.ac.jp,  
masaki.ando@nao.ac.jp

Lev dorogoi,

- > Please indicate explicitly (without references to your blog)
- > to which statements in your email you want me to reply.

You want from me to *ignore* my work since 1972, posted on my website (you called it "blog"), and only "indicate explicitly" the basic facts of Quantum Theory and General Relativity (you called them "statements").

You are indeed Russian:

<http://www.god-does-not-play-dice.net/#Nernst>

Of course I will *not* ignore my work. Here's why.

As I stated in my latest email at the link above (Tue, 1 Jan 2013 20:03:58 +0200), you are "personally responsible for implanting many wrong ideas in theoretical physics, both in USSR and in the normal world."

Just one very simple example.

The perpetual localization of one single quantum particle has been studied in 1929 by Sir Nevill Mott. You weren't even born in 1929. But you stubbornly resist to acknowledge the bold fact that neither you nor *any of your colleagues* can explain the emergence of these finite tracks made by individual quantum particles.

You cannot even think of infinite instances of "[collapse](#)" nor "[decoherence](#)" of **one** single particle. If you were able to solve this 1929 task with your textbooks, you would automatically introduce some

"quantum time" that matches the duration of the visible path, then "time operators" in QM, and reconcile the latter with Special Relativity: *reductio ad absurdum*.

You need to learn the basic basics of Quantum Theory from Erwin Schrödinger and the KS Theorem,

<http://www.god-does-not-play-dice.net/#cloud>

<http://www.god-does-not-play-dice.net/#Ivanov>

Your colleagues from CERN cannot explain the bold fact of 'finite continuous track from one single particle' either. They don't want to study the basic facts of Quantum Theory either.

All they want is money:

<http://www.god-does-not-play-dice.net/#DJM>

The poetic statement by Fedor Tyutchev, "A spoken thought is a lie" (cf. the subject line), encapsulates the unsolved task from 1929. Ignore it at your peril.

Notice that I haven't mentioned the localization of gravitational energy density 'at a point', which leads to the same puzzle from 1929, but is known much earlier, thanks to David Hilbert -- check out the links above, regarding the "dark energy".

I hope this is enough, for a start. It is not about my website (you called it "blog").

Should you or \*any of your colleagues\* is ready to work (instead of indulging in your hobbies), please (i) reply professionally and (ii) post a copy from your ideas online at arXiv.org server. I will respond immediately, without referring to my website.

But if you still prefer to behave as a [Russian](#) -- don't bother to reply.

Sincerely,

D. Chakalov

P.S. For the record, you can read this email at [http://www.god-does-not-play-dice.net/#CERN\\_2013](http://www.god-does-not-play-dice.net/#CERN_2013)

Soon on DVD as well.

D.C.

=====

**Der Herrgott würfelt nicht!**

Subject: Re: "[A spoken thought is a lie](#)"

Date: Sat, 19 Jan 2013 15:51:25 +0200

Message-ID: <CAM7EkxmcTScX0AfsmiAQ==f2++VU7mYNBxaVE2L8kSdkjyxkmQ@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>  
To: Lev Okun <levokun@gmail.com>, Lev Okun <okun@itep.ru>  
Cc: [snip]

Lev dorogoi,

Thank you for your feedback from Sat, 19 Jan 2013 14:12:43 +0400. May I ask a few questions.

You wrote:

> Following your advice I studied the 1929 article by [Sir Nevill Mott](#)

1. Did you discover the process of generation of continuous observable path from the underlying "[collapse](#)" or "[decoherence](#)" (anything else?) of one single particle?

1.1. If you have made such discovery, did you confirm (or denounce?) the stipulation that the [position-and-momentum](#) of one single particle can be collapsed/decohered \*infinite times\* to \*map\* the continuous observable macroscopic track left from it?

1.2. If you've discovered some successive collapse/decoherence/whatever of one single particle, did you also discover some "time operators" in QM valid for [position-and-momentum](#) of one single particle, with which you can recover the finite duration of the observable macroscopic track left from it, hence reconcile the non-relativistic QM with [Special Relativity](#)?

2. Alternatively, if you have not discovered the process of generation of continuous observable path from the underlying "[collapse](#)" or "[decoherence](#)" (anything else?) of one single particle, what did you actually achieve, if anything, regarding the puzzle from 1929?

The professional opinion from your colleagues will be highly appreciated as well.

All the best,

Dimi

P.S. By the way, what have you been smoking?

D.

> On Fri, Jan 18, 2013 at 4:34 AM, Dimi Chakalov <dchakalov@gmail.com> wrote:

>

>> P.S. Details at

>>

>> <http://www.god-does-not-play-dice.net/#Klauder>

>> <http://www.god-does-not-play-dice.net/Klauder.pdf>

>>

>> Any comments?

>>

>> D.

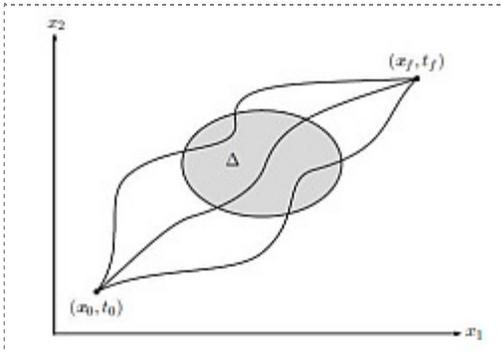
>>

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**Note:** May I offer an advice. If you have a *localization* of an object, which (i) can be observed (see [above](#)) and (ii) **must** occur at a point (e.g., the localization of the *intangible* gravitational energy, [Hermann Bondi](#)), but cannot be calculated nor [understood](#) because it involves **energy exchange**, please proceed with [caution](#) -- the most obvious thing, which we call 'spacetime', may be the most difficult to explain as *emerging* from 'something else' ([Isham and Butterfield](#)).

For example, [people at CERN](#) look at the track from one single elementary particle, and try to think

about it with [Feynman path integrals](#).



J.J.Halliwell and J.M.Yearsley, [arXiv:1301.4373v1](#)

But as [Roger Penrose](#) explained in *The Road to Reality*, pp. 667-668 (emphasis added), "the complex amplitude to be assigned to that particular history is then given by the deceptively simple formula [XXX]. Part of the deception, in the simplicity of this formula, lies in the fact that the 'amplitude' is not really a (complex) number, here (which, as written, would have to have unit modulus), but some kind of **density**. (...) But here we have a *continuous* infinity of classical alternatives. Our above 'amplitude' thus has to be thought of as an 'amplitude **density**' (...). But the bad news here is that the 'space of classical paths' will almost certainly turn out to be *infinite-dimensional*." It will be [mathematically impossible](#) to represent such continuous tracks of [cyclical bi-directional conversions](#), from quantum regime to classical and back, with *energy exchange*.

Crudely speaking, if you cannot explain the quantum-classical and *cyclical* energy exchange between the two "vertical" layers, you cannot explain the two "horizontal" trajectories made of successive 'positions' **one after another**. It's a bundle.

We have at least three issues: (i) continuous (ii) energy exchange between (iii) two layers, which lead to the classical trajectory at the *observable* layer, like trails left in the sky from some invisible (quantum, in this case) jet plane. Then you have to explain **both** trajectories at **both** layers. To be precise (emphasis and notes added): "The chamber is filled by a supersaturated vapour which can undergo local phase transitions induced by the **exchange** of even a small amount of **energy**. The tracks have usually the form of straight lines (or of curved lines (recall the CERN photo [above](#) - D.C.) whenever magnetic and/or electric fields are applied) and they can be considered as the experimental manifestation of the "trajectory" of the alpha-particle (Alessandro Teta, [arXiv:0905.1467v1](#), pp. 8-9).

Regarding issue (i), recall Werner Heisenberg (emphasis added): "By path we understand a series of points in space which the electron takes as 'positions' **one after another**" (W. Heisenberg, *Über den anschaulichen Inhalt der quantentheoretischen Kinematik und Mechanik*, *Zeit. für Physik.*, 43 (1927) 172-198).

**NB:** Here we have *two continuous paths* made by 'positions' **one after another**, and these 'positions' are defined by *energy exchange* between the two paths, which results in **propagation**, as seen with its observable, classical counterpart. We aren't talking about "the direction" of propagation, ensuing from "wave function having the form of a spherical wave" (Alessandro Teta, [p. 9](#)), but about the **propagation** itself. Strangely enough Lev Okun wasn't able to understand the first off issue of **propagation** itself.

Mapping the two layers over a finite time interval, as recorder with your wristwatch, is a formidable challenge, which Lev Okun and his [CERN colleagues](#) persistently ignore, although this unsolved puzzle is perhaps *the* most widely known public secret in theoretical physics. And it costs **billions**.

The puzzle with localization in [gravitational physics](#) also costs **billions**; the main difference is that the *energy exchange* involves quantum-gravitational **pure dark energy**, yet you can again read **time** made by the [already-linearized](#) tangible energy ([Hermann Bondi](#)) in the right-hand side of the Einstein field equations with your "wrist watch!" ([Chris Isham](#)).

It looks like [Renato Renner](#), [Luciano Rezzolla](#), and all people at [CERN](#) may never be able to understand this simple and unsolicited advice. Hope you can and will.

D. Chakalov

January 19, 2013

Last updated: January 23, 2013, 23:13 GMT

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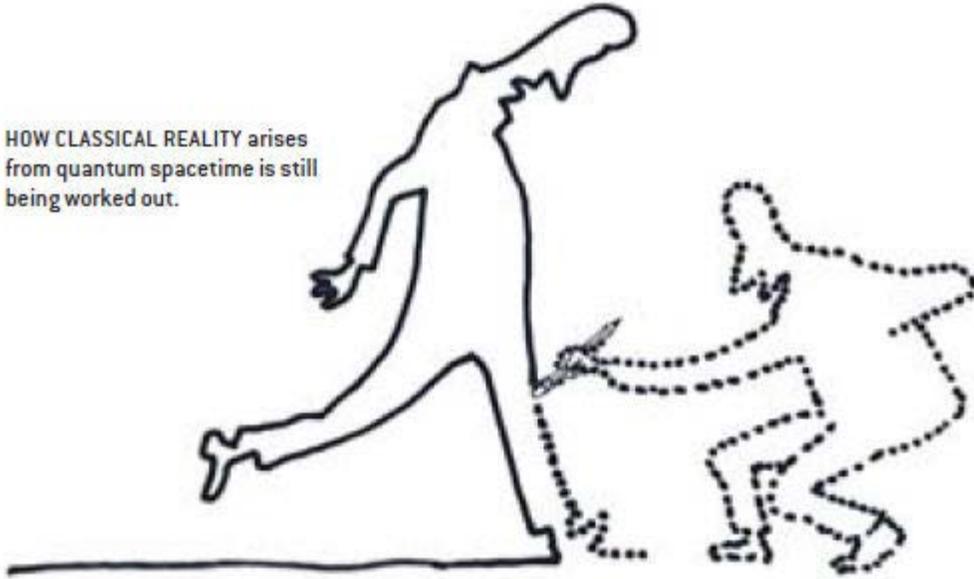
Jacob D. Bekenstein: "Already in the 1960's [Wheeler](#) made the case that at Planck scale quantum fluctuations of the space geometry must become strong enough to disrupt the smoothness of the space-time manifold, even to the extent of introducing multi-connected topology [12]. On this same scale the geometry fluctuates violently in time. Can we "see" this quantum foam? (...) Generalizing we realize that the Achilles heel of many procedures for making [quantum foam graphic](#) is in the requisite amount of **localization** of the probes."

Just a hint: because we don't live in some privileged or unique place in the universe, consider a finite volume of space with radius 7.3 billion light years (cf. [Yuan K. Ha](#)), which amounts to radius of  $690 \cdot 10^{25}$  cm and volume of  $1,376,055,281 \cdot 10^{25}$  cm<sup>3</sup>, each of which contains  $10^{99}$  "atoms of volume". We have  $1,376,055,281 \cdot 10^{124}$ , or roughly  $10^{133}$  "atoms of volume" in which we can (i) picture 3 orthogonal dimensions of space, and (ii) see "as far as we like" ([Lee Smolin](#)). But because LQG is inherently relational, background-free theory, there is nothing at our disposal to 'hold onto', to avoid all **errors** in the binding of these  $10^{133}$  "atoms of volume".

Obviously, LQG is a joke. Even in [CDT](#), which is not supposed to suffer from the splitting of spacetime, the best guess yields spatial Hausdorff dimension  $d_h = 3.10 \pm 0.15$  (cf. [Renate Loll et al.](#), [arXiv:hep-th/0404156v4](#), p. 7), which is also a joke. You just can't recover *the continuum*.

**Comment:** The calculation above (click the image with dotted lines, from [December 25, 2010](#)) is incorrect. Sorry. I was hoping that someone will respond to the *localization* task from [1929](#), because usually people are prone to react to errors, but nobody did. Let me correct my calculation and try to explain the *emergence* of spacetime from 'something else' ([Isham and Butterfield](#)), such that we can "see as far as we like" ([Lee Smolin](#)), thanks to the *emergent* (along the [Arrow of Space](#)) topological *dimensions* of spacetime.

HOW CLASSICAL REALITY arises from quantum spacetime is still being worked out.

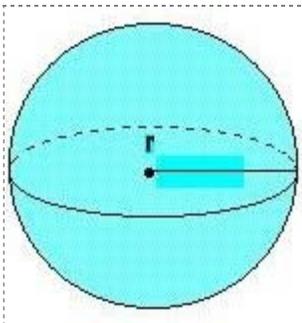


Currently, we can see [undisturbed spacetime](#) 7.3 billion light years from Earth (Yuan K. Ha, [pp. 8-9](#)), and will assume, after the [Cosmological Principle](#), that the spacetime has *the same* properties, most notably [Lorentz covariance](#), everywhere along all directions. Let's consider a volume of 3-D space, with *radius* 7.3 billion light years, and calculate the **finite** number of "atoms of volume" in such **finite** 3-D space, ensuing from L. Smolin's suggestion (he is [very good in math](#)) that, according to "loop quantum gravity" or LQG, roughly  $10^{99}$  "atoms of volume" are contained in every cubic centimeter of space, as he explained in *Scientific American* from January 2004, [pp. 66-75](#):

■ Loop quantum gravity predicts that space comes in discrete lumps, the smallest of which is about a cubic Planck length, or  $10^{-99}$  cubic centimeter. Time proceeds in discrete ticks of about a Planck time, or  $10^{-43}$  second. The effects of this discrete structure might be seen in experiments in the near future.

68 SCIENTIFIC AMERICAN

To calculate the number of cubic centimeters in a *sphere* with radius 7.3 billion light years (and later multiply it by  $10^{99}$  "atoms of volume", in line with the [Archimedean Axiom](#)), I used Google and some 'spherical cow' approximations:



1 light year is  $9.46 \times 10^{17}$  cm; the *radius* ( $r$ ) of 7.3 billion light years will contain app.  $69 \times 10^{26}$  cm, and the total number of cubic cm in a *sphere* with radius ( $r$ )  $69 \times 10^{26}$  cm will approach  $69 \times 10^{32}$  cm<sup>3</sup> ( $V = 4/3 \pi r^3$ ), each of which, according to the [Archimedean Axiom](#), is made of  $10^{99}$  "atoms of volume".

Thus, the total number of "atoms of volume" is roughly  $7.10^{132}$ , each of which is directly **rooted** on some "[spacetime foam](#)" in which "points become *fuzzy* and *locality loses any precise meaning*" (S. Doplicher, [p. 21](#)), yet [people skilled in math](#) wish to imagine that one can "erect a locally inertial coordinate system in which matter satisfies the laws of special relativity" (S. Weinberg, [pp. 62-68](#)) and [Lorentzian metric](#) within  $10^{-30}$  seconds "during" the inflation, and safely store it *there* for [13.73 billion years](#) during which the same 3-D space has been "inflated" by its "dark energy", along the radius ( $r$ ) that does **not** exist as some "4th spatial dimension" ([Ned Wright](#)) in the first place. Forget it.

Nobody can recover *the continuum* ([Georg Cantor](#)) from stipulations based on **wrong** localization (cf. Sir Nevill Mott [above](#)) and incomplete geometry based **exclusively** on the [Archimedean Axiom](#). We need the [non-Archimedean](#) global mode of spacetime [as well](#).



'All right,' said the Cat; and this time it vanished quite slowly, beginning with the end of the tail, and ending with the grin, which remained some time after the rest of it had gone. 'Well! I've often seen a cat [without a grin](#),' thought [Alice](#); 'but a [grin](#) without a cat! It's the most curious thing I ever say in my life!'

The spacetime continuum in the [geometric formulation of GR](#) (the grin of the Cheshire cat without the cat, as observed by [Alice](#)) contains [UNcountably infinite](#) "points" ([Georg Cantor](#)): no "number" could possibly display the cardinality of 'the set of all sets' which isn't a 'set' in the first place -- see below.

Strangely enough, if you show [the "set" errors](#) in the "[the worst theoretical prediction in the history of physics](#)", these people wouldn't care. Or will stubbornly claim that cannot understand this crucial issue from [1935](#). Or both.

Subsequently, in the **local** (physical, teleological, and [Archimedean](#)) mode of spacetime we face the conundrum of [Lucretius](#): every **finite**, not matter how big or small, [Archimedean](#) object contains "the same number" of these immaterial dimensionless **geometrical** points ([Georg Cantor](#)). In order to have 'world points' that include *quasi-localized* matter ([Bergmann and Komar](#)), we need to **stop** the infinite regression toward "zero" with a rock-bottom **limit**: the [empty set  \$\mathbf{R}\$](#)  from the **global** mode of spacetime. The latter must be **brought back** into spacetime to also define its fleeting "boundaries", as suggested [previously](#).

But how to recover the **finite** 4-D spacetime made with *different* volumes of space, which are traversed by **light** for *different* times? Only [the "speed" of light](#) can "sense" the geometrical points in

the [continuum of Georg Cantor](#) *en bloc*, and "read" them in such way that **finite** objects with [distance function](#) can *emerge* as 'local mode of spacetime'. Which is what the *emergence* of spacetime from 'something else' ([Isham and Butterfield](#)) is all about (cf. the fourth group of the Ishamian taxonomy suggested in [1993](#)).

We need [non-Archimedean](#) geometry and new [mathematical formalism](#) for [quantum gravity](#). We simply cannot learn *any* details without an exact mathematical quantum gravity. It would be very difficult to specify the expectations from our still-uncovered mathematical quantum gravity, yet it seems to me that, **if** the universe itself works as a 'brain' ([22 May 1988](#)), we should be able to alter the **global** mode of time in which the total energy of 'the whole universe as ONE' is kept nullified (cf. Eq 1, p. 35 in [ExplanatoryNote.pdf](#)), and hence evoke the *release* of [pure dark energy](#) into *any* form of tangible energy ([Sir Hermann Bondi](#)). We may be able to eliminating all nuclear reactors by [2022](#), and fly by 'reversible elimination of inertial mass' or [REIM](#), perhaps like a [reactionless](#) Alien Visiting Craft (AVC). What if we alter the spacetime metric locally and reversibly, to wrap our [REIM drive](#)? Perhaps we can traverse 1000 m, as measured in the inertial frame of outsiders, with speed 1 m/sec relative to the *modified Lorentz covariance* (Sic!) in *our inertial frame*. We would perhaps notice that, strangely enough, the 3-D space itself is now "moving" toward us as well, and after we land we'll find out that our clock was a bit "slower". Can we make a "sharp" turn with speed 1 m/sec? Of course. Only those poor people outside will be flabbergasted and think we were "aliens". Which is fine with me, of course.

Well, I wish I've studied mathematics, instead of psychology. The task is well beyond and above my very limited knowledge of differential geometry and topology. And those who know math, [don't care](#) and keep wasting their life with chasings [ghosts](#).

D. Chakalov

January 22, 2013

Last updated: January 23, 2013, 13:45 GMT

=====  
Subject: The revival of A-time in quantum gravity

Date: Sat, 26 Jan 2013 03:00:59 +0200

Message-ID: <CAM7EkxkYYr5YeQisS8QPQNjpbq27k=Lcpe2Tk-ZXJw4\_XDm4jg@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Hartmann Römer <hartmann.roemer@physik.uni-freiburg.de>

Cc: albrecht.von.mueller@parmenides-foundation.org,

thomas.lehr@parmenides-foundation.org,

thomas.filk@physik.uni-freiburg.de,

guido@sissa.it,

o.behrend@lmu.de,

ernst.poeppel@med.uni-muenchen.de,

helmuth.blaseio@parmenides-foundation.org,

haa@igpp.de,

society@mindmatter.de

Dear Hartmann,

I like your recent [arXiv:1202.5748v2](#) very much, but have different proposals, ensuing from the most widely known public secret in theoretical physics: **localization**,

<http://www.god-does-not-play-dice.net/#localization>

<http://www.god-does-not-play-dice.net/#EFE>

Some tentative predictions from the theory are outlined at

<http://www.god-does-not-play-dice.net/#2022>

Besser eine Laus im Kraut als gar kein Fleisch ?

All the best,

Dimi

=====

Subject: Re: "A spoken thought is a lie"  
Date: Sat, 19 Jan 2013 22:23:54 +0200  
From: dchakalov <dchakalov@gmail.com>  
To: Lev Okun <levokun@gmail.com>, Lev Okun <okun@itep.ru>

> Could you please listen to autobiographical interview given in 1985

Lev, can you read English? Nobody talks about any "autobiographical interview", nor about your cat or mother-in-law.

> As was shown in my book [ABC of Physics](#) (Chapter 6)  
> all results of Relativistic Quantum Mechanics can be reproduced  
> without the misleading concept of collapse of wave function.

But your book is [seriously wrong](#), because you cannot explain the phenomenon in question either way -- everything and anything you've written is inapplicable. See again my today's email (Sat, 19 Jan 2013 15:51:25 +0200) at

<http://www.god-does-not-play-dice.net/#localization>

Please get professional and don't try to twist the issue. It's [about time](#), literally.

D. Chakalov

>> On Fri, Jan 18, 2013 at 4:34 AM, Dimi Chakalov <dchakalov@gmail.com> wrote:  
>>  
>>> P.S. Details at  
>>>  
>>> <http://www.god-does-not-play-dice.net/#Klauder>  
>>> <http://www.god-does-not-play-dice.net/Klauder.pdf>  
>>>  
>>> Any comments?  
>>>  
>>> D.

=====

Subject: The relative phase of a superposition state, [arXiv:1302.3787v1 \[quant-ph\]](https://arxiv.org/abs/1302.3787v1)  
Date: Mon, 18 Feb 2013 11:17:05 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: S Peil <steven.peil@usno.navy.xxx>

Dear Dr. Peil,

Thank you for your wonderful paper. It was a rare pleasure to read it.

Perhaps you can check out 'relative phase of a superposition state' in the 1929 puzzle at

<http://www.god-does-not-play-dice.net/#localization>

Best regards,

Dimi Chakalov

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**Note:** Steven Peil writes that, "according to standard quantum mechanics, the relative phase of a superposition state has no effect on measurement outcome; the Born rule for deducing measurement probabilities eliminates the relative phase by construction through the squaring of the complex probability amplitudes. Rather, the phase serves as a record of **coherent evolution**, and it plays an important role in atomic clocks and other atomic interferometers."

Perhaps another case of coherent evolution is with the duration of quantum coherence in photosynthetic complexes: "over an order of magnitude longer than coherences between electronic ground and excited states" (Martin Plenio *et al.*, *Nature Physics* 9 (2013) 113-118; [arXiv:1203.0776v2 \[quant-ph\]](https://arxiv.org/abs/1203.0776v2)). What is the **shielding factor** that can prolong the quantum coherence to ensure the safe passage of nearly 100% of the photon energy that the organisms absorbed?

The proper issue to start with is the 1929 puzzle from [Sir Nevill Mott](#). Good luck.

D. Chakalov  
February 18, 2013

=====



Subject: Re: Gravity (not "gravitons") knows about everything

Date: Fri, 4 Jan 2013 23:13:17 +0200

Message-ID:

<CAM7EkxnOrGwg9Jj2E4ZcKRNb31f0A-==pONxbrAhJEOdcJc1+cg@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Anthony Zee <zee@kitp.ucsb.edu>,

Lily Schrempp <L.Schrempp@thphys.uni-heidelberg.de>,

Kishore Ananda <Kishore.Ananda@gmail.com>,

Edward W Kolb <rocky.kolb@uchicago.edu>,

Lawrence M Krauss <krauss@asu.edu>,

Nima Arkani-Hamed <arkani@ias.edu>,

Paul Federbush <pfed@umich.edu>,

Ian Lawrie <I.D.Lawrie@leeds.ac.uk>,

Robert van den Hoogen <rvandenh@stfx.ca>,

Frank Steiner <frank.steiner@uni-ulm.de>,

Claus Gerhardt <gerhardt@math.uni-heidelberg.de>,

Eduardo Guendelman <guendel@bgu.ac.il>,

Thomas Buchert <buchert@obs.univ-lyon1.fr>,

Yi Zhang <zhangyia@cqupt.edu.cn>,

Lau Loi So <s0242010@gmail.com>,

Xiao Zhang <xzhang@amss.ac.cn>,

Marco Spaans <spaans@astro.rug.nl>,

Sergio Doplicher <dopliche@mat.uniroma1.it>,

Diederik Aerts <diraerts@vub.ac.be>,

Norbert Straumann <norbert.straumann@gmail.com>,

Merced Montesinos Velásquez <merced@fis.cinvestav.mx>,

Angelo Loinger <angelo.loinger@mi.infn.it>,

John Stachel <john.stachel@gmail.com>,

Tiziana Marsico <martiz64@libero.it>,

Jeremy <jb56@cam.ac.uk>,

Eric <eric.schechter@vanderbilt.edu>,

Erik <erik@strangebeautiful.com>

Dear colleagues,

In 'Gravity and its Mysteries: Some Thoughts and Speculations', arXiv:0805.2183v2 [hep-th], Anthony Zee wrote ([p. 17](#)):

"To move forward, physics had to abandon an apparently ironclad piece of commonsense that "where there is a wave something must be waving." I would not be at all surprised if it turns out that to move forward, we have to abandon an equally ironclad piece of commonsense. I leave it to the reader to identify that piece."

To identify 'the wave without any waving source', please see [for the record.jpg](#) attached, from <http://www.god-does-not-play-dice.net/#DJM>

If you have questions, feel free to write me back.

With all good wishes for 2013 and beyond,

Dimi Chakalov

On [Thu, 11 Feb 2010 16:25:10 +0200](#), Dimi Chakalov <dchakalov@gmail.com> wrote:  
[snip]

=====

Subject: Government of Canada Funding Encourages Youth to Pursue Careers in Science, 7 December 2012

Date: Tue, 8 Jan 2013 23:18:00 +0200

Message-ID:

<CAM7Ekxmyg2B\_RJH1wFwX10m=bArTSViLJYopeSrEH\_zEnW30FQ@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: gdick@perimeterinstitute.ca,  
mduschenes@perimeterinstitute.ca,  
nturok@perimeterinstitute.ca,  
rmyers@perimeterinstitute.ca,  
ebianchi@perimeterinstitute.ca,  
lfreidel@perimeterinstitute.ca,  
ismolin@perimeterinstitute.ca

"[Perimeter Institute](#) has received a [\\$1.73 million grant from the Government of Canada](#) to boost its educational outreach initiatives and further encourage youth to pursue studies in science, technology, engineering, and math (STEM) fields."

-----

Dear colleagues,

Please see the text (printed below) of my email sent a few minutes ago to Ms Stephanie Thomas at [FedDev Ontario](#). I think you do **not** deserve [any support whatsoever](#).

Should you have questions, please don't hesitate to write me back.

Sincerely,

Dimi Chakalov

=====

Re: Government of Canada Funding Encourages Youth to Pursue Careers in Science, 7 December 2012  
ATTN.: Ms Stephanie Thomas

Dear Ms Thomas,

In my opinion, the Perimeter Institute (PI) cannot introduce students to the STEM fields. Instead, it may implant many wrong speculations used by PI members.

I will be happy to elaborate extensively.

Yours sincerely,

Dimi Chakalov  
[chakalov.net](http://chakalov.net)

=====

Subject: Re: FedDev Ontario (MSC 0006757)  
Date: Wed, 23 Jan 2013 00:08:08 +0200  
In-Reply-To: <B13B47FE0AD80B4F950FE5FCD559A87D06448576@MSG-MB-02.icent.ic.gc.ca>  
Message-ID: <CAM7EkxmTJc1AgEqAqBoHY-k-Ug69OtJdnaKV59Tf7VfJa6iCPA@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Jeannie Smith <info@feddevontario.gc.ca>  
Cc: gdick@perimeterinstitute.ca,  
mduschenes@perimeterinstitute.ca,  
nturok@perimeterinstitute.ca,  
rmyers@perimeterinstitute.ca,  
ebianchi@perimeterinstitute.ca,  
lfreidel@perimeterinstitute.ca,  
ismolin@perimeterinstitute.ca,  
fmarkopoulou@perimeterinstitute.ca,  
rspekkens@perimeterinstitute.ca,  
lhardy@perimeterinstitute.ca,  
cfuchs@perimeterinstitute.ca

Dear Mrs. Smith,

Thank you for your reply from Tue, 22 Jan 2013 14:04:35 -0500.

> Thank you for taking the time to contact FedDev Ontario with your views on funding  
> provided to the Perimeter Institute.

In my opinion, you are wasting real money, earned with hard labor by many people in Canada, to support a group of individuals who are only practicing their diverse hobbies. They aren't interested in

the real, and widely known tasks of Quantum Theory:

<http://www.god-does-not-play-dice.net/#localization>

The proof of my statements in this email, as well as those in my initial email from 7 December 2012 (printed below), will be provided by PI members themselves -- they will not reply professionally, because they can't. And they can't reply professionally due to their ignorance of the main problems of Quantum Theory known since 1929 (cf. the link above).

Just one example: the last email from Lee Smolin was from Sun, 24 Feb 2002 17:30:25 +0000 (BST), and in the past thirteen year he has not even mentioned the unsolved problems from 1929, explain at the link above. Of course they are widely known, but cannot be solved with his hobby, which is why he has been keeping quiet ever since.

Needless to say, I am ready to elaborate extensively, starting with the lack of understanding of the basic issues from 1929 (cf. the link above) on behalf of PI members -- just wait to see their reaction. They will either (i) keep quiet or (ii) bluntly refuse to consider the unsolved tasks since 1929.

**NB:** Any third option will force them to abandon their hobbies and start working as professional physicists, which they can't.

I know the scientific members of PI very well indeed. They [do not deserve \\*any\\* support whatsoever.](#)

Looking forward to hearing from you, Lee Smolin, and his scientific colleagues,

Yours sincerely,

Dimi Chakalov

=====

Re: Government of Canada Funding Encourages Youth to Pursue Careers in Science, 7 December 2012  
ATTN.: Ms Stephanie Thomas

Dear Ms Thomas,

In my opinion, the Perimeter Institute (PI) cannot introduce students to the STEM fields. Instead, it may implant many wrong speculations used by PI members.

I will be happy to elaborate extensively.

Yours sincerely,

Dimi Chakalov  
[chakalov.net](http://chakalov.net)

=====



Subject: Re: Grundlage der allgemeinen Relativitätstheorie  
Date: Tue, 22 Jan 2013 17:57:15 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: [snip]

Dear colleagues,

The unsolved mathematical problems, mentioned in my initial email (Thu, 10 Jan 2013), are known since 1929,

<http://www.god-does-not-play-dice.net/#localization>

My prediction, based on the assumptions that these problems can and will be resolved, is explained in the excerpt ([cf. attached](#)) from

<http://www.god-does-not-play-dice.net/#2022>

Please let me know if you would be interested in quantum gravity.

Sincerely,

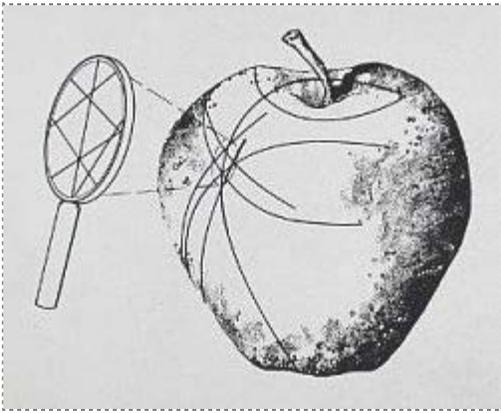
D. Chakalov

On Thu, 10 Jan 2013 16:29:00 +0200, Dimi Chakalov <dchakalov@gmail.com> wrote:

>  
> Dear colleagues,  
>  
> A number of unsolved mathematical problems are posted at  
>  
> <http://www.god-does-not-play-dice.net/#Neiman>  
>  
> Sincerely,  
>  
> D. Chakalov

=====

<http://www.scribd.com/doc/120680276/Quantum-Ontology>



Subject: Re: Enhanced Quantization  
Date: Mon, 14 Jan 2013 16:38:58 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: John Klauder <john.klauder@gmail.xxx>

Dear John,

Thank you for your kind reply. It is a pleasure to hear from you, and I very much hope to understand your Enhanced Quantization (John R. Klauder, [arXiv:1211.7351v3 \[quant-ph\]](https://arxiv.org/abs/1211.7351v3)).

As it looks to me, the problem is to [recover the \\*exact\\* \(no approximations\) classical limit](#) of QM [[Ref. 1](#)], and then (hopefully) move to "the evolving universe as a whole" [[Ref. 2](#)], provided we have previously defined the asymptotic structure for arbitrarily large spatial volumes, pertaining to 'the universe as a whole', in order to answer the fundamental question 'relative to what?'.

In my opinion, the \*exact\* (no approximations) classical limit of QM cannot be derived, because of the so-called "context" in Kochen-Specker Theorem [[Ref. 3](#)]: the intrinsically UNcolorable [whatever] cannot be presented in Hilbert space with dim 3 and higher. We don't face this problem in the Schrödinger cat paradox (nor in the "quantum information" hypothesis), because we still can play with Hilbert space there.

But in general, these UNcolorable [whatever] cannot fit in any reasonable Hilbert space in principle. Moreover, they are not related to [any probabilities whatsoever](#), firstly because we can say [nothing](#) about them in the framework of Quantum Theory (please ignore my website).

The question is, what would you do to fix these problems? I tried with the geometric formulation of QM [[Ref. 4](#)], simply because I don't like the mathematical poetry in standard QM textbooks, but it didn't work out.

Perhaps you can help with deriving the \*exact\* classical limit of QM [[Ref. 1](#)], as you don't like mathematical poetry either. Namely, I do hope you can include these [UNcolorable](#) [whatever] in the solution to the macro-objectification problem [[Ref. 5](#)], and hence solve the \*exact\* classical limit. Then I hope you could reconcile Quantum Theory with Special Relativity, with your theory of Enhanced Quantization.

Sorry for being too long. Thank you in advance for your time and efforts.

Best regards,

Dimi

On Mon, 14 Jan 2013 00:45:30 -0500, John Klauder <john.klauder@gmail.xxx> wrote:  
[snip]

> On Sun, Jan 13, 2013 at 11:34 PM, Dimi Chakalov <dchakalov@gmail.com> wrote:

>>

>> Dear John,

>>

>> Please let me know if you can suggest any solution to the measurement

>> & macro-objectification problems, do define the "classical limit" of

>> QM and then embark on your ideas.

>>

>> All the best,

>>

>> Dimi Chakalov

>> [chakalov.net](http://chakalov.net)

>

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[Ref. 1] L. Landau, E.M. Lifshitz, Quantum mechanics: Non-relativistic theory, 3rd ed., Pergamon Press, 1977.

"Thus quantum mechanics occupies a very unusual place among physical theories: it contains classical mechanics as a limiting case, yet at the same time it requires this limiting case for its own formulation."

[Ref. 2] [James B. Hartle](http://arxiv.org/abs/1207.6653v2), S. W. Hawking, Thomas Hertog, Inflation with Negative  $\Lambda$ , arXiv:1207.6653v2 [hep-th]  
<http://arxiv.org/abs/1207.6653v2>

"Our large scale observations of the universe are of its classical behavior. The isotropic accelerated expansion and the large scale structure in the [CMB](#) and the galaxy distribution are just two examples. The laws that govern such features can be presumed (statement of belief - D.) to be fundamentally quantum mechanical. A quantum system behaves classically when the probabilities implied by the quantum state (Sic! - D.) are high for coarse-grained histories with correlations in time (classical limit? - D.) governed by deterministic equations of motion. That is true whether the system is a tennis ball in flight or \*the evolving universe as a whole\* (emphasis added - D.).

.....

"(W)ave functions satisfying the constraints of general relativity have a universal semiclassical (unacceptable approximation - D.) asymptotic (unacceptable approximation - D.) structure for large (unacceptable approximation - D.) spatial volumes."

[Ref. 3] Karol Horodecki et al., Contextuality offers device-independent security, arXiv:1006.0468v1 [quant-ph]  
<http://arxiv.org/abs/1006.0468>

(Please see an excerpt in KS\_context\_time.jpg attached.)

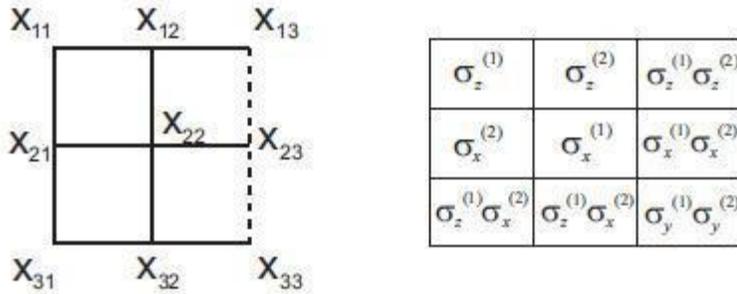


FIG. 1: Peres-Mermin version of Kochen-Specker paradox. We have 9 observables  $x_i$  arranged into  $3 \times 3$  array. If one chooses the observables as in (b) - where we have two two-level systems and  $\sigma^{(i)}$ 's are Pauli matrices on  $i$ -th system - quantum mechanics allows for joint measurement only of observables in a chosen row or a chosen column. One can ask whether some better theory could reproduce quantum mechanical predictions, allowing however to predict outcomes of all nine observables at the same time. This was the subject of the famous Einstein-Bohr controversy. The Kochen-Specker paradox says that it is impossible. Namely, quantum mechanics predicts that along solid lines, the outcomes, if multiplied give with certainty 1, while on the dashed line they give -1. Thus, supposing that these nine observables have some pre-existing values, which are merely revealed by measurement, we would obtain different value of the product of all nine of them, if multiply them in different order, which is a contradiction. So if one insists on ascribing some definite values to observables, the value of at least one of them would need to depend on whether the given observable is measured within row or within column, i.e. on the context. Thus only *contextual* values can be ascribed.

[Ref. 4] Abhay Ashtekar and Troy A. Schilling, Geometrical Formulation of Quantum Mechanics, arXiv:gr-qc/9706069v1  
<http://arxiv.org/abs/gr-qc/9706069>

"The geometric formulation shows that the linear structure which is at the forefront in text-book treatments of quantum mechanics is, primarily, only a technical convenience and the essential ingredients -- the manifold of states, the symplectic structure and the Riemannian metric -- do not share this linearity. Therefore, the framework can serve as a stepping stone for non-linear generalizations of quantum mechanics."

[Ref. 5] GianCarlo Ghirardi, Sneaking a Look at God's Cards: Unraveling the Mysteries of Quantum Mechanics, Princeton University Press, 2007.

"How, when, and under what conditions do definite macroscopic properties emerge (in accordance with our daily experience) for systems that, when all is said and done, we have no good reasons for thinking they are fundamentally different from the micro-systems of which they are composed?"

**Note:** Let me stress again that the crucial issue of '[reality in Quantum Theory](#)' **cannot** be presented with "probabilities": see Erwin Schrödinger in [1935](#) and in [November 1950](#). Ten years later, Ernst Specker ([1960](#)) demonstrated that it is **impossible** to even *think of anything* that could restore the reality in Quantum Theory, because of the requirements from 'the context' imposed at '**one** instant' ([John Bell](#)), as read with physical clock [[Ref. 3](#)].

Thus, the [no-go argument](#) from John Bell is a secondary issue, which is **not** relevant here, because it uses counterfactual statements (W. Unruh, Nonlocality, counterfactuals, and quantum mechanics, *Phys. Rev. A*59, 126-130 (1999); [arXiv:quant-ph/9710032v2](#), p. 3) of the type 'what might have happened, had I made measurements that I didn't actually made'. Such counterfactual statements **cannot** be applied to [reality in Quantum Theory](#), because they explicitly presuppose the mundane form of reality we know from classical physics. For example, if I toss a coin on the table and see 'heads', I can and will conclude with certainty that the invisible -- at the same instant -- state of the coin **was** indeed 'tales', at the same instant. Recall that the requirement of **unitarity** strictly requires that **one** outcome will be observed with unit probability, that is, 'something will happen with certainty', provided that the coefficients for probability will also be fixed -- for this same **one** instant -- by the requirement of unitarity *prior to the act of measurement*. In the case of tossing a coin, we have 1/2 probability for 'heads' and 1/2 probability for 'tales'. Subsequently, if the presumed coin has somehow evolved into dice (recall [Black Swans](#)), we encounter **non-unitary** transitions and correct our expectations to match the notion of 'objective reality *out there*' from classical physics, keeping the same recipe,  $6 \times 1/6 = 1$ .

But as we know from [Ernst Specker](#), the outcomes of all observables at the same instant **cannot** be treated with probabilities, because "quantum mechanics predicts that along solid lines, the outcomes, if multiplied give with certainty 1, while on the dashed line they give -1." [[Ref. 3](#)]. Period. Subject closed. We need '[potential reality](#)'.

For the sake of the argument, just think for a moment that the [KS Theorem](#) were wrong: we could somehow *think* of the **full** catalogue of expectation values ([Erwin Schrödinger](#)), although such speculation would require some "hidden variables" that could somehow fix such **full** catalogue, in line with the requirement of unitarity which people impose *prior to the act of measurement*. Then we could calculate with such "hidden variables" all possible "states" of quantum systems, included the number of angels which can [fit on needle's pin](#), and find out how many angels were blond, for example.

The fact of the matter is that '[reality in Quantum Theory](#)' requires to examine all possible "[clouds](#)" in **all possible** experimental contexts, pertaining to **one single** particle, as we know since 1929 after [Sir Nevill Mott](#). However, we cannot measure non-commuting observables, such as the [position-and-momentum](#) of **one single particle**. These "[clouds](#)" or "[jackets](#)" certainly exist 'out there' with **certainty**, but in the form of *pre-quantum* and *pre-gravitational* reality, which cannot be **directly** observed due to [the "speed" of light](#).

We will inevitably encounter an [UNSpeakable, pre-quantum, Kochen-Specker source](#) in the case of [KS Theorem](#), simply because it pertains to **all** possible [non-commuting](#) observables. And this is the [pre-quantum source](#) in Quantum Theory, which **always** exists 'out there' (forget about probabilities), regardless of whether it is "observed" or not:

There was a young man who said "God,  
to you it must seem very odd  
that a tree as a tree  
simply ceases to be  
when there's no one about in the quad."

"Young man, your astonishment's odd,  
I'm always about in the quad  
and that's why the tree  
never ceases to be  
as observed by, yours faithfully,  
[God](#)."

No, we cannot recover the **exact** (no approximations) [classical limit of QM](#) from [textbooks](#). Physically, we can only observe a fleeting and *distorted* classical "[jacket](#)", projected on [Plato's cave](#) *one-at-a-time* by the [Arrow of Space](#), and with **unit probability**: God casts the die, not the dice (Albert Einstein). The alleged "quantum jumps" are nothing but **artifacts** from the macroscopic measuring devices: Dead matter makes quantum jumps; the living-and-quantum matter is [smarter](#). Why? Because of the "speed" of light:



Why this is difficult to understand, I wonder. Is this because people prefer parapsychology instead of [quantum gravity](#)?

D. Chakalov  
January 16, 2013  
Last updated: January 18, 2013, [16:58:42 GMT](#)  
<http://www.scribd.com/doc/120680276/Quantum-Ontology>

-----  
"Wenn es doch bei dieser verdammten Quantenspringerei bleiben soll, dann bedauere ich, mich mit der Quantentheorie überhaupt beschäftigt zu haben." (If we have to go on with these damned quantum jumps, then I'm sorry that I ever got involved.)

Erwin Schrödinger

"Let me say at the outset, that in this discourse, I am opposing not a few special statements of quantum mechanics held today (1950s), I am opposing as it were the whole of it, I am opposing its basic views that have been shaped 25 years ago, when Max Born put forward his probability interpretation, which was accepted by almost everybody.

....  
"I don't like it, and I'm sorry I ever had anything to do with it."

[Erwin Schrödinger](#), *The Interpretation of Quantum Mechanics*. Dublin Seminars (1949-1955) and Other Unpublished Essays, Ox Bow Press, Woodbridge, 1995

=====  
Subject: [arXiv:1301.2844v1 \[quant-ph\]](#), p. 3  
Date: Tue, 15 Jan 2013 12:08:35 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: [IGUS Jim](#) <hartle@physics.ucsb.edu>  
Cc: Yakir Aharonov <yakir@post.tau.ac.il>, Yakov Itin <itin@math.huji.ac.il>, Yasha Neiman <yashula@gmail.com>,

yaronoz@post.tau.ac.il,  
c.isham@imperial.ac.uk,  
giulini@zarm.uni-bremen.de

IGUS Jim: "Alternatives at a moment of time can be reduced to a set of yes/no questions."

No they can't,

<http://www.god-does-not-play-dice.net/#Klauder>

<http://www.god-does-not-play-dice.net/Klauder.pdf>

<http://www.god-does-not-play-dice.net/#cloud>

[http://www.god-does-not-play-dice.net/#Brown\\_null](http://www.god-does-not-play-dice.net/#Brown_null)

<http://www.god-does-not-play-dice.net/#Neiman>

You still haven't replied to my arguments against your essay 'Problems for the 21st Century', [gr-qc/9701022](http://gr-qc/9701022), January 16, 1997.

You've been quiet for 16 years, Jim. Is it fun?

I pose this question to your colleagues as well.

Dimi Chakalov

-----

"Wenn es doch bei dieser verdammten Quantenspringerei bleiben soll, dann bedauere ich, mich mit der Quantentheorie überhaupt beschäftigt zu haben."

Erwin Schrödinger

=====

<http://www.scribd.com/doc/130939366/Dedicated-to-Ernst-Specker>

Printable file

[http://www.god-does-not-play-dice.net/Ernst\\_Specker.pdf](http://www.god-does-not-play-dice.net/Ernst_Specker.pdf)



Subject: Re: [The "cloud" of contextuality](#)

Date: Fri, 18 Jan 2013 04:55:05 +0200

Message-ID:

<CAM7Ekx=g00uAjJjKOi-3dfg\_X0b0QqmOxF1qL98\_wukDjwjrOw@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Jürg <juerg@phys.ethz.ch> ,

Jürg Fröhlich <juerg.froehlich@itp.phys.ethz.ch> ,

Gian Michele Graf <gian-michele.graf@itp.phys.ethz.ch> ,

Stefan Wolf <wolfst@inf.ethz.ch> ,

nbeisert@itp.phys.ethz.ch,

jinke@itp.phys.ethz.ch,

gaberdiel@itp.phys.ethz.ch,

broedel@itp.phys.ethz.ch,

mfraas@itp.phys.ethz.ch,

canduc@itp.phys.ethz.ch,

deleeuwm@itp.phys.ethz.ch,

verguc@itp.phys.ethz.ch,

blau@itp.unibe.ch

Dear colleagues,

No reply has been received to my email sent two weeks ago.

Meanwhile, I tried to explain [the issue](#) at

<http://www.god-does-not-play-dice.net/#Klauder>

<http://www.god-does-not-play-dice.net/Klauder.pdf>

Please send me your professional opinion.

The issue is indeed well-known, since 1935. The latest relevant reference in the text above is from Ernst Specker regarding the "Infuturabilien" (Die Logik nicht gleichzeitig entscheidbarer Aussagen, *Dialectica* 14, 239-246 (1960); [p. 243](#)). Professor Specker was also associated with ETH Zurich, and acknowledged the receipt of my proposal on Wed, 20 Apr 2011 18:41:44 +0000.

Unfortunately, he left us eighth months later. God bless his soul.

We must restore the heritage of [Ernst Paul Specker](#).

Looking forward to hearing from you at your earliest convenience,

Sincerely,

Dimi Chakalov

On Fri, 4 Jan 2013 15:15:08 +0200, Dimi Chakalov <dchakalov@gmail.com> wrote:

[snip]

-----

**Note:** Three weeks after my email [above](#), I still haven't received any answer. Perhaps these people simply can't understand the meaning of [Infuturabilien](#) in Ernst Specker's article ([p. 243](#)). Let me help.

Unlike [Bell's argument](#) [[Ref. 1](#)], the Kochen-Specker theorem does not depend on separability and/or locality assumptions. The issue is not about "correlations" nor "[noncontextual hidden](#)" (whatever), and has nothing to do with Bell's argument which **cannot** display the noncolorizable UNSpeakable *pre-quantum* [Kochen-Specker states](#).

They show up in a Hilbert space of more than two dimensions: it is *in principle impossible* to 'color' with 0's and 1's without violating orthogonality constraints and obtain "consistent predictions about a quantum mechanical system" ([Ernst Specker](#)), because the noncolorizable "quantum states" of [\[whatever\]](#) are **neither** "quantum" **nor** "states". They do not pertain to *anything physical*, hence cannot fit in any Hilbert space whatsoever. It does **not** matter whether we would change the "context" and "multiply them in different order" (see [above](#)), because all permutations of possible sequences/orders of multiplication will **always** show the same number of noncolorizable "quantum states" of [\[whatever\]](#).

The issue here is that the permutations of possible cases of "context" (see [above](#)), introduced with all possible sequences/orders of "multiplication", will demonstrate with certainty that **all** quantum "states" can switch from physical, colorable quantum observables to **unphysical**, noncolorizable "quantum states" of [\[whatever\]](#), and back. To explain this fundamental quantum phenomenon (which cannot be demonstrated with Bell's argument), let me simplify it by introducing three quantum guys, Tom, Dick, and Harry. They have three degrees of freedom by raising their hands upon observation: only left hand [L, up], or only right hand [R, up], or both hands [up, up]. Thus, if Tom becomes colorable quantum observable in particular "context" (see [above](#)) with [L, up], Dick and Harry have to pick up the remaining alternatives for this "context", **but** if Dick chooses [R, up], Harry **will have no hands** and will **not** become colorable quantum observable. If at some other *instant* (as measured with your macroscopic wristwatch) Harry chooses to raise both hands [up, up], and Dick chooses [L, up], then Tom **will have no hands** at this particular *instant*, and have to remain in the initial **unphysical**, noncolorizable [\[whatever\]](#), from which the three quantum guys *evolved* by changing the "context".

Perhaps the simplest explanation is offered by [Chris Isham](#): "the implication of the discussion above is that the value ascribed to B (resp. the result of measuring B) depends on whether it is considered together with A1, or together with A2. In other words the value of the physical quantity B is *contextual*." In our parable, the quantity **B** will show up with different combination of "hands", and will **not** have any pre-existing "state". To explain this crucially important situation, suppose we identify the three quantum guys by their raised hands, say, Tom has only [L, up], Dick has only [R, up], and Harry can only raise both hands [up, up]. Then the fundamental feature of Quantum Theory is that at any *instant*, as measured with your (inanimate) wristwatch, one of the guys **will have no hands**, because at *this instant* he will remain **confined** (remember [quarks](#)?) in the **unphysical unspeakable noncolorizable** pre-quantum [\[whatever\]](#), from which the three quantum guys *evolved* by changing the "context".

Generally speaking, the notion of *potential reality* can be parameterized with the variable [\[psi\]](#) from the Potential Reality (PR) interpretation of QM -- in the case of {Tom, Dick, Harry} [\[psi\]](#) equals 3, while in the case of 'spin up/spin down' [\[Ref. 1\]](#), [\[psi\]](#) equals 2. Yet in  $\dim(H) \geq 3$  *some* percentage (Helena Granström, [p. 2](#)) of all possible explications may have [\[psi\]](#) **zero**, similar to 'the ideal monad without windows' or Kantian thing-in-itself (*das Ding an sich*). Notice that *potential reality* is practically *non-existent* in classical mechanics; in QM **it** can be proved for only *one* instant of "joint probability distribution" in  $\dim(H) \geq 3$ ; and in [QCD](#) **it** holds *permanently* in the form of [quarks](#) and ["god particles"](#). The quantum vacuum is a special entity of its own, because its [\[psi\]](#) is *not* determined: it has [\[psi\]](#) **zero**, *i.e.*, no "real particles".

Also, the Potential Reality interpretation of Quantum Mechanics introduces actualization or rather *physicalization* of **one** potentiality with **certainty** at the instant 'now' from the Arrow of Space -- **one-at-a-time**, and with unit probability current. The rest of potentialities -- all but **one** -- don't matter, because they have become at *this instant* noncolorizable and '*have no hands*'. In other words, the explication of **one** colorized "jacket" -- one-at-a-time and with unit probability -- is the essence of [PR](#) interpretation of QM. It is depicted with the first photo below, as opposed to the postulated "collapse" in the orthodox interpretation of QM (recall that all "superposed cat states" are supposed to "evolve" in some "absolute Newtonian time", denoted with **t** in the Schrödinger equation).



People try to obscure 'the ideal monad *without* windows' and the case of 'one of the guys will have no hands' with phrases like "quantum value [indefiniteness](#)", as if they could in principle suggest **any** value -- you name it -- of the "uncolored" [\[whatever\]](#), only in the case under consideration the "value" has miraculously become "indefinite". But they *cannot* suggest **any** value [whatsoever](#), because *any* value will be necessarily *physical*, hence coloriz**able**. For example, the notion of 'zero *something*' (such as "[dark matter](#)") pertains to a *physical*, and hence coloriz**able** stuff (say, I claim there are zero bananas in my ears), while the noncoloriz**able** [\[whatever\]](#) is opposite to 'zero *something*', and should be 'zero *nothing*'.

Also, the question of whether one can use some "hidden variables" to explain the noncoloriz**able** [\[whatever\]](#) presupposes that some "hidden" quantum stuff may **physically exist** in the first place. If so, we would be able to calculate the number of blond quantum angels that can fit on the head of a pin, and explain, for example, the "hidden" physical basis of spin ([Hans Ohanian](#)). But even if such hidden *physical* stuff were possible to exist, it will be coloriz**able**, as we could at least *talk* about it. However, in the case of the Kochen-Specker theorem we can't show anything physical [whatsoever](#): the noncoloriz**able** [\[whatever\]](#) does not *physically* exist.

To cut the long story short, if we denote the **unphysical unspeakable noncoloriz**able**** pre-quantum [\[whatever\]](#) with '[John](#)', **it** (not He) can be symbolically presented, along with its localizable, physical, EPR-like entangled and correlated 'jackets' cast from **it** on the '[curved wall of the cave](#)', as

**John <--> jackets.**

This is the essence of Quantum Theory in  $\dim(H) \geq 3$ , after [Kochen-Specker](#) and [Gleason's theorem](#). There will be always "probability measures" which are *discontinuous*, hence they cannot qualify as 'probability measures' by virtue of [Gleason's theorem](#).

The so-called **John** stands for the *potential*, not-yet-physical, pre-quantum, unspeakable, and noncoloriz**able** quantum-gravitational "**it**", which is always **separated** from its *physicalized* "jackets" due to the **dynamics** of the [Arrow of Space](#) (cf. also option YAIN (iii) [above](#)). There is no other way to proceed. If you wish to ignore **it** and drop *everything* on a dead fixed spacetime equipped with a [dead frozen](#) Cauchy hypersurface ([Robert Wald, p. 201](#)), you will only explore Feynman's '[blind alley](#)'.

**NB:** We must never hide the essential facts and arguments from our [students](#). They are kids and have the right to know *everything* we know.

Recall *the* most widely known public secret in theoretical physics -- [localization](#). Everything else, Bell's argument included [[Ref. 2](#)], is based on the nature of quantum reality: "In general, a variable *has* no definite value before I measure it; then measuring it does *not* mean ascertaining the value that it *has*." ([Erwin Schrödinger](#)) Which means that the noncoloriz**able** UNspeakable pre-quantum "state" (called here '[John](#)') does **not** belong to the inanimate physical world, but only casts there its perfectly well localized "jackets" on the '[curved wall of the cave](#)' -- *the* most widely know public secret in theoretical physics, called [localization](#). Don't forget that a single quantum particle does possess full "[jackets](#)" -- *energy* and *momentum* at particular *location* and *instant* -- all of which

match the **path** of macroscopic water droplets in [Wilson cloud chamber](#) (see discussion [above](#)). And secondly, **all** these "jackets" are entangled with/by John from [The Beginning](#).

In the context of Einstein's dictum 'God casts the die, not the dice' (English translation by Jean Untermyer), the "die" is the noncolorizable UNSpeakable pre-quantum "state" called '[John](#)', while its 'jackets' refer only to the **physical** presentations of 'the quantum world *out there* without observers'. Surely John's jackets can't live on [Minkowski spacetime](#); in the case of the human brain, check them [here](#). To avoid confusion, bear in mind that the [binding phenomenon](#) is *biological* presentation of entanglement due to 'the ultimate John' or '[the universe as ONE](#)', while at [galaxy length scale](#) we see [the same](#) entanglement inducing [gravity & rotation](#) on its "jackets". It's like a song played with three very different instruments -- biological, quantum, and gravitational; the basic assumption from 'the universe as a brain' is that *the psyche* can [penetrate matter](#) only at macroscopic length scale, thanks to which we have **life**, from [microorganisms](#) to humans. We will put aside for now the obvious question (prompted by Virgil's statement *Der Geist bewegt die Materie* and 'the ultimate John' [[John 1:1](#)] or the [Noumenon](#) of 'the ideal monad [without windows](#)') about whether 'the universe as a brain' may or may not have qualities resembling human mind and consciousness.

In general, the genuine [quantum state](#) in the quantum realm 'out there' is **not** what we can observe at macroscopic length scale -- [either "nose" or "arm"](#) (bzw. [particle or wave](#)). The quantum "jumps" would inevitably look *both* "instantaneous" and "[random](#)" to an observer who has imposed a classical "filter" through which 'the quantum world *out there*' can cast its jackets at the length scale of tables and chairs.

The genuine *ontic* noncolorizable UNSpeakable quantum "**it**" is **not** about [probabilities of something](#), because any such 'something' is already "colored": we can think about it, speak about it, and offer some probability for its observation. It is best described with the macroscopic "[jackets](#)" of spin: there is no small rigid body rotating about its axis, but "spin **minus its physical basis**" ([Hans Ohanian](#)). We do observe water droplets, as we know [since 1929](#), as well as the "[jackets](#)" of spin and '[localization](#) of an electron', but never *the* genuine ontic [quantum state itself](#).

Likewise, we observe [rotation](#) in astronomy, but people should stop speculating about some "dark" stuff, just as we don't speculate about some '[small rigid body](#) rotating about its axis'. If you look at the left-hand side of field equations ([Kevin Brown](#)), the **intangible** ([Hermann Bondi](#)) **pure energy** has the same ontological status of 'energy of *something* **minus its physical basis**', and if some people try to trace **it** back from its [linearized](#) "jackets", they will fail and would consider **it** "dark", like in the story with [Stavros](#).

Observe that 'probability' and 'energy' pertain to the local (physical) mode of spacetime, and must be treated like adjectives -- we have only 'probability of *something*' and 'energy of *something physical*', while the *intangible* ([Hermann Bondi](#)) **pure energy cannot** refer to *anything physical*. If it could, it will be colorizable, which means '**converted** into energy of *something physical*' or "timber" (see below).

Moreover, the **transition** between "the intangible energy of the gravitational field (as it will be called here), which is not described by the energy-momentum tensor, and the tangible forms which are so described" (Sir Hermann Bondi, Conservation and non-conservation in general relativity, *Proc. R. Soc. Lond. A* 427 (1990) 249-258) may be *bi-directional* -- matter could **dissolve** back to the vacuum and stay available there for any partial, full, or "over unity" recall, **if and when needed**. If you disagree, you have to embrace the weak cosmic censorship hypothesis, according to which spacetime singularities are produced in gravitational collapse of "physically reasonable" matter that evolves from "[smooth](#)" initial data (James Isenberg, [footnote 3](#)), and are hidden behind some "[event horizon](#)" that can [crack](#) and expose some naked time-like singularities which will, in turn, ruin the whole universe.

The phenomenon of '**pure energy**' is noncolorizable and UNSpeakable as well. Its **conversion** into physical stuff with [positive energy density](#) determines "the rate at which the nongravitational matter receives (*physicalized* - D.C.) energy and momentum from the gravitational field" ([Hans Ohanian](#)). Perhaps such **conversion** of "marble" into "timber" (see below) is [atemporal](#), and includes alteration of the quantum wave *phase* producing [constructive interference](#) in the [quantum vacuum](#). We should indeed consider it a *nonconservation* law ([ibid.](#)) of the *dynamics* of spacetime along the **w-axis**.

In general, a gravitational "field" *per se* does not exist as physical reality but only as *potential reality* of noncolorizable and *intangible* '**pure energy**'. Its *physicalized* presentation ("timber", see below) is

**not** 'objective reality at a point' but a fleeting *wegtransformierbar* faculty of gravity, which makes the story of Tom, Dick, and Harry to resemble the Landau-Lifshitz [pseudotensorial](#) recipe: in both cases, we get *some* physical stuff, but **not** the whole thing which keeps its Genidentität (Kurt Lewin) through time, so we can eliminate "by hand" what we have, and obtain "new" physical stuff.

In the context of the [school of fish metaphor](#), the *intangible* gravitational **pure energy** ("marble", see [below](#)) of 'the school as ONE' becomes *physicalized* (example from particle physics [here](#)) by fixing the **next** state of every [quasi-local](#) fish ("timber"), yet at the very same instant every quasi-local fish has **already** feedback-instructed (past tense) 'the school as ONE' about its *possible next* state.

$$\underbrace{R_{\mu\nu} - \frac{1}{2}g_{\mu\nu}R}_{\text{Marble}} = \underbrace{\kappa T_{\mu\nu}}_{\text{Timber?}}$$

At every instant 'now', the end result from the nonlinear marble-timber negotiation is *already*-correlated in timber's **past**. Hence a [proton](#) can exist *only* as [self-acting](#) timber (just like the [human brain](#)), and the [Higgs](#) are not physical but "dark", just like the "dark" [basis of spin](#). Likewise, if we look at the [brain](#) we can't detect its mind but only the **past** states of a [self-acting](#) brain. Simple, no?

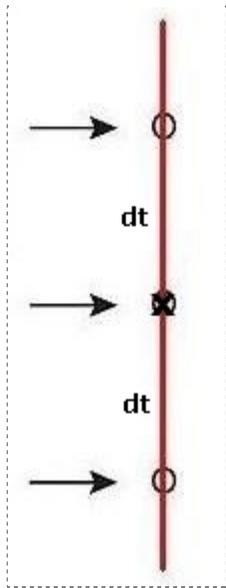
$$R_{ij} - \frac{1}{2}g_{ij}R = \frac{8\pi G}{c^4}T_{ij}$$

«Space acts on matter, telling it how to move. In turn, matter reacts back on space, telling it how to curve.»

C.W. Misner, K.S. Thorne, J.A. Wheeler – *Gravitation*. Freeman & Co., 1973 (p.5).

Consider a horizontal step from a ladder, and picture it as an instant 'now' (marked with **x** ; see the drawing below) from the [Arrow of Space](#), at which the **nonlinear** negotiation (recall Escher's [drawing hands](#)) between the *intangible* "marble" and the tangible "timber" has *always* been **already** completed *at the very instant* we look at it (Leibnizian [pre-established harmony](#)).

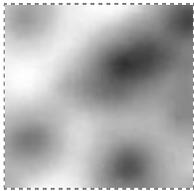
A "horizontal" instant 'now' (marked with **x** ) from the *flow of time* in the [Arrow of Space](#), defined with respect to the fleeting 'potential future' (*not yet* marked with **x** ) and 'irreversible past' (already *not* marked with **x** ). The **red** vertical ladder shows the global mode of spacetime, which does not *physically* exist. The **re**-creation of physical universes at the instant 'now' produces the flow of time and *requires* energy [nonconservation](#) and ["dark" effects](#) along the vertical axis (Phoenix Universe), while matter and energy are conserved one-at-a-time in their horizontal physical universe. The gaps **dt** are made **zero** by [the "speed" of light](#), which produces a



perfect continuum of the *accumulated-in-time* dimensions of spacetime.

The arrows symbolize some kind of "torch" which highlights different points from space, but because this torch would have to "move" to different points, physicists claim that such torch does not exist, and our perception of the flow of time is an illusion, or at best an effect of [thermodynamics](#). They also claim that the flow of time does not and must not physically exist, which is correct: physically, the "vertical" gaps **dt** are truly **zero**, thanks to which "the entire manifold is constructed by smoothly sewing together (notice the poetry - D.C.) these local regions" (cf. [above](#), p. 31).

Notice that the *potential future* (not yet marked with the instant **x**) is made of *not yet* quantum-gravitational "**it(s)**", which resemble a "dough" or rather continual *density* of *intangible* [pure energy](#).



There is no metric there, no spatial relations (inside vs. outside, left vs. right), and no [set theory](#) relations, such as 'one vs. many' either. **It** (not He) is the ultimate presentation of *entanglement* (Verschränkung): "*the characteristic trait of quantum mechanics*" ([Erwin Schrödinger](#)). We can only sense the UNSpeakable **it** with our brains [here](#).

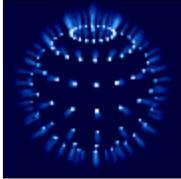
At the *instantaneous* step 'now' marked with **x** above, we have an *already*-negotiated energy conservation that is indistinguishable from [Minkowski spacetime](#), so people can literally *insert* at this point **x** the Hamiltonian formulation based on the notion of [hyperbolicity](#) backed with some sloppy speculations from [thermodynamics](#). Namely, "the coordinates are **asymptotically** those of a flat spacetime with inertial rectangular coordinates" ([H. Ohanian](#), private communication), gravity has become at *this* instant "[linearized](#)", and the two negotiating parties in [EFE](#) should have **canceled** each other (not exactly, due to the "[dark energy](#)"), or else "the [ether](#) would come back!" ([M. Montesinos](#)).

Also, the *instantaneous* step 'now' marked with **x** above is the [instant](#) at which the '[GR elevator](#)' has been **suddenly** "pushed up" -- once-at-a-time -- and the whole universe has been **re-created** with positive mass, inertia, and a [dead frozen](#) Cauchy hypersurface, thanks to which at this instant of time "throughout the universe" ([Robert Wald](#), p. 201) we can indeed postulate [tangent vectors](#) -- again, once-at-a-time only.

Last but not least, at this point **x** we have null vectors and null surfaces that are everywhere orthogonal to a null vector -- the "remnant" from the [Arrow of Space](#), which has been effectively **nullified** at the instant **x** and the whole local (physical) mode of spacetime.

Then the **next** "vertical" step 'now', at  $t_0 + dt$ , will **re-create** (Phoenix Universe) the whole universe anew from  $t_0$ , but with different [content](#) at **dt**, which will be **re-negotiated** along the [atemporal](#) "vertical" [Arrow of Space](#), namely, in the [dark Zen gaps](#) **dt** of the global mode of spacetime.

Again, these **gaps** of *intangible pure energy* are **nonexistent** in the local (physical) mode of spacetime thanks to [the "speed" of light](#), and we can see only a *perfectly smooth* continuum of **already** completed and already **re-**negotiated 'world points' ([Bergmann and Komar](#)). The 'world points' **cannot** hold the [gravitational energy density](#) at a geometrical point (e.g., like electromagnetic energy on flat spacetime), because such classical 'world points' will **expose** the [flow](#) of *physicalized* energy coming from '[the universe as ONE](#)' in the "timber", and the flow will be [recorded with a physical clock](#), as in the example with the [Sun](#). Then the whole theory of relativity will be ruined, because we would have direct observational proof of such [absolute object](#).



Don't try to recover the genuine nonlinear dynamics of spacetime, exhibited in its "[waves](#)", from only *one* "horizontal step from a ladder", like in [Dirac-ADM](#) hypothesis. There is absolutely nothing resembling law and order in the "[spacetime foam](#)" to [raise](#) a robust [Lorentzian metric](#) within  $10^{-30}$  seconds "after" the "[big bang](#)" and the increase of universe's "size" (with respect to *what?*) by a [factor of  \$10^{78}\$](#) , and keep the Lorentzian metric for at least [13.73](#) billion years rooted on the Planck length at which "points become *fuzzy* and *locality loses any precise meaning*" ([Sergio Doplicher](#)). We need [perfect](#) points at *all length scales*, made with the [atemporal](#) noncolorizable [dark Zen gaps](#) of the global mode of spacetime and the universe as [ONE](#).

Try a simple experiment [here](#). All you need is a brain. If your *brain* can do it, the universe should be able to do it as well; perhaps even better.

D. Chakalov

March 7, 2013

Last updated: April 13, 2013, 12:00 GMT

[Ref. 1] J. Bub, Quantum Correlations and the Measurement Problem, [arXiv:1210.6371v3 \[quant-ph\]](#).

## 2 Correlations

Consider the simple case of measurements of two binary-valued observables,  $x \in \{0, 1\}$  with outcomes  $a \in \{0, 1\}$ , performed by Alice in a region A, and  $y \in \{0, 1\}$  with outcomes  $b \in \{0, 1\}$ , performed by Bob in a separated region B. Correlations are expressed by a correlation array of joint probabilities as in Table 1. The probability  $p(00|00)$  is to be read as  $p(a = 0, b = 0|x = 0, y = 0)$ , i.e., as a joint conditional probability, and the probability  $p(01|10)$  is to be read as  $p(a = 0, b = 1|x = 1, y = 0)$ , etc. (I drop the commas for ease of reading; the first two slots in  $p(--|--)$  before the conditionalization sign  $|$  represent the two possible measurement outcomes for Alice and Bob, respectively, and the second two slots after the conditionalization sign represent the two possible observables that Alice and Bob choose to measure, respectively.)

There are four probability constraints: the sum of the probabilities in each square

$x$	0	1
0	$p(00 00)$ $p(10 00)$ $p(01 00)$ $p(11 00)$	$p(00 10)$ $p(10 10)$ $p(01 10)$ $p(11 10)$
1	$p(00 01)$ $p(10 01)$ $p(01 01)$ $p(11 01)$	$p(00 11)$ $p(10 11)$ $p(01 11)$ $p(11 11)$

Table 1: Correlation array

cell of the array in Table 1 is 1, since the sum is over all possible outcomes, given the two observables that are measured.

[Ref. 2] Nicolas Brunner *et al.*, Bell nonlocality, [arXiv:1303.2849v1](https://arxiv.org/abs/1303.2849v1) [quant-ph].

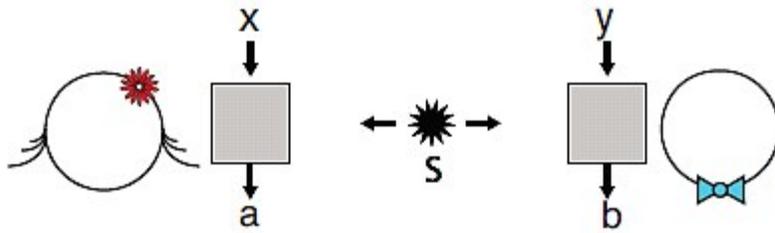


FIG. 1 Sketch of a Bell experiment. A source (S) distributes two physical systems to distant observers, Alice and Bob. Upon receiving their systems, each observer performs a measurement on it. The measurement chosen by Alice is labeled  $x$  and its outcome  $a$ . Similarly, Bob chooses measurement  $y$  and gets outcome  $b$ . The experiment is characterized by the joint probability distribution  $p(ab|xy)$  of obtaining outcomes  $a$  and  $b$  when Alice and Bob choose measurements  $x$  and  $y$ .

When such an experiment is actually performed – say, by generating pairs of spin-1/2 particles and measuring the spin of each particle in different directions – it will in general be found that

$$p(ab|xy) \neq p(a|x)p(b|y), \quad (1)$$

implying that the outcomes on both sides are **not** statistically independent from each other. Even though the two systems may be separated by a large distance – and may even be space-like separated – the existence of such correlations is nothing mysterious. In particular, it does **not** necessarily imply some kind of direct influence of one system on the other, for these correlations may simply reveal some **dependence** relation between the two systems which was established when they interacted in the **past**.

**Comment:** The nonexistence of two-valued probability measures is **not** a formalization of the concept of contextuality viz. rejection of macroscopic realism (Erwin Schrödinger, [1935](#)): we have context-dependant "states" also in Bell's argument [[Ref. 1](#)], which complies with orthogonality constraints.

In our case, the noncolorizable UNSpeakable *pre-quantum* Kochen-Specker states correspond to the **full** catalogue of expectation values, which include non-commutative observables that **cannot** be simultaneously measurable. Without such noncolorizable quantum "states", one would be able to "produce" with Gedankenexperiment a **full** catalogue of expectation values by considering only one set of non-commuting observables, and would speculate further that such "wave function" might offer a "full description" of the quantum particle, provided we apply "counterfactual definiteness". But we can't, because the latter is applicable only and exclusively only to 'objective reality *out there*' from classical physics: if I toss a coin on the table and see heads, I can infer with certainty that the invisible state of the same coin was tails '*out there*'. But this kind of classical reasoning is **not** applicable to Bell's argument [[Ref. 1](#)]: a quantum phenomenon is **not** a phenomenon unless it is an observed/registered phenomenon, **after** which we have 'quantum phenomenon' (try as an exercise the [Schrödinger cat](#)).

Surely we cannot measure all non-commutative observables at *one* instant, as recorded with our clock, but this constraint does **not** imply that a quantum particle '*out there*' must conform to the nature of time relevant to *inanimate* macroscopic measuring devices, hence could *not* possess its noncolorizable UNSpeakable *pre-quantum* ontic state. In the first place, we don't have time operators in QM and never will, and must never forget that the quantum realm '*out there*' is **not** what we can

observe at macroscopic length scale -- [either "nose" or "arm"](#) (bzw. [particle or wave](#)).

Again, the fact of the matter is that one cannot fit the noncolorizable UNSpeakable *pre-quantum* state "it" (never in plural) in any Hilbert space whatsoever. The "two" parties in Bell's argument, Alice and Bob, **is** (never in plural) a joint presentation of the noncolorizable *pre-quantum* quantum state "which was established when they interacted in the past" [[Ref. 2](#)].

**It** (not He) is not some additional object (like a bridge connecting two riversides), but 'the universe as [ONE](#)' manifested as 'the characteristic trait of quantum mechanics' ([Erwin Schrödinger](#)). The whole physical world (local mode of spacetime) is rooted on **it** and emanates from **it**. Nothing acts *between* Alice and Bob [[Ref. 2](#)] -- the so-called "ghost fields" (Gespensterfelder) or "spooky action at a distance" that would propagate "at least  $10^7$  times faster than the speed of light" ([Nicolas Gisin et al., 2002](#)) do not exist, just as there is no "action" *between* the brain and its mind ([Wolfgang Pauli](#)). They are **pre**-correlated and [contextual](#) "jackets" emanating from their common quantum-gravitational "**it**" which Albert Einstein envisaged as '[a total field of as yet unknown structure](#).'

**It** produces two mirror forms of entanglement, quantum and [gravitational](#), starting from the macro-world in two opposite "directions" along the [w-axis](#). In the astrophysical form of entanglement, we encounter the tug-of-war manifestation of gravity between "[dark matter](#)" and "dark energy", along with the ubiquitous [rotation](#) -- just as in the case of "[spin](#)". Yet the majority of people would prefer "supermassive [black holes](#)" inhabited by [advanced Russian civilizations](#), instead of quantum gravity.

As of [today](#), nobody cares about the unfinished theory of [Albert Einstein](#). [Nobody](#).

D. Chakalov  
March 8, 2013  
Last updated: April 24, 2013, 21:41 GMT

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Subject: Time and the Structure of Quantum Theory, FQXi grant of [\\$110.397](#)  
Date: Thu, 7 Mar 2013 16:30:13 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Jon.Barrett@rhul.ac.uk, Stefano.Pironio@ulb.ac.be  
Cc: m@physics.org, cramer@phys.washington.edu, schlossh@up.edu, physics@aps.org

Check out the facts  
<http://www.god-does-not-play-dice.net/#ETH>

Pity you can't reply...

D. Chakalov

=====

[http://www.god-does-not-play-dice.net/30\\_Jan\\_2013.pdf](http://www.god-does-not-play-dice.net/30_Jan_2013.pdf)  
<http://www.scribd.com/doc/123206497/Quantum-Gravity>

$$\underbrace{R_{\mu\nu} - \frac{1}{2}g_{\mu\nu}R}_{\text{Marble}} = \underbrace{\kappa T_{\mu\nu}}_{\text{Timber?}}$$

Subject: Marble vs Timber, [arXiv:1301.5481v1 \[gr-qc\]](https://arxiv.org/abs/1301.5481v1)  
Date: Thu, 24 Jan 2013 14:03:01 +0200  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Hermann Nicolai <nicolai@aei.mpg.de>  
Cc: [\[snip\]](#)

Dear Hermann,

You explained the main problem (p. 3) as follows:

"(T)he point-likeness of particles and their interactions seems to be required by both relativistic invariance and locality/causality – building a (quantum) theory of relativistic extended objects is not an easy task! In classical GR, the very notion of a point-particle is problematic as well, because any exactly point-like mass would have to be a mini black hole surrounded by a tiny horizon, and thus the putative point particle at the center would move on a space-like rather than a time-like trajectory. Again, one is led to the conclusion that these concepts must be replaced by more suitable ones in order to resolve the inconsistencies of GR and QFT."

And later you added (p. 10):

"So the challenge is to come up with criteria that allow to unambiguously discriminate a given proposal against alternative ones!"

The criteria that unambiguously discriminate my proposal against all the rest is the solution to the main problem (p. 3): neither "point-like mass" nor "relativistic extended objects", but a new geometry with \*[quasi-local](#)\* points, which unifies the current geometry (marble) and matter (timber) from the outset.

If you or any of your colleagues disagree, just try to solve *the* most widely known public secret in theoretical physics -- **localization**,

<http://www.god-does-not-play-dice.net/#localization>

In my opinion, you can't solve it '[your way](#)', because nobody can. [Nobody](#).

Of course, I will be more than happy if you or any of your colleagues can resolve the localization problem by using theories published on paper, and I will immediately start using your version of quantum gravity.

Please drop me a line if you nevertheless can resolve the 1929 problem at the link above.

All the best,

Dimi

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**Note:** The notion of '[reality](#)' leads to models having an exact, point-like representations of events -- between, before, during, and after measurements/observations -- in order to answer questions about the system, as a function of underlying spacetime. The puzzle of '[localization](#)' concerns the main question in Quantum Theory: What is the state of **reality** that underlies our knowledge about "superposition" and "entanglement" ? In gravitational physics, the puzzle of 'localization' concerns the **transition** of *intangible* gravitational energy into tangible energy of matter ([Hermann Bondi](#)), due to which we can model spacetime as made of *physicalized* 'world points' ([Bergmann and Komar](#)).

Let me try to answer the main question in Quantum Gravity: What is the state of **reality** that underlies our knowledge about **blank** geometrical "points", as shown with the [pure smile of the Cheshire cat](#) in the left-hand side of field equations ?

In classical physics, one can offer a simple distinction between (i) continuous and (ii) discrete. The first case refers to something that can take any value in a range of numbers, specified within an [interval](#). For example, if I consider the color of my hair, it will fit in two cases, black and white, with a very fuzzy borderline, and I can claim that the color of my 'salt and pepper' hair is specified with numbers ranging from 'pure black' to 'pure white', which comprise a 'color interval'. The number of these threadlike structures, called 'hairs', is always a finite number at particular instant, and because the width of a hair is relatively small compared to my head, I can think of them as 'continuous data'. Case (ii) is different, because it corresponds to 'discrete' numbers, such as, for example, the number of email messages I receive in particular interval. So, if I use a 'fine grained' approach and assume that one email takes one second, I can claim that yesterday have received ten emails, which have taken ten seconds out of all seconds from the whole day. The latter is also an [interval](#), but now these 'data' are separated by many 'seconds of **no** data', and subsequently we talk about 'discrete data'.

But what can happen if we instruct the size of 'hairs' and 'seconds' to approach *asymptotically* zero ([the empty set  \$\mathbf{R}\$](#) ), to fill in an [Archimedean interval](#) *completely*, included its crucial [end points](#) that belong to "open sets" ([James Dungundji](#))? We will have to **remove** all mathematical poetry [[Ref. 1](#)] and introduce an ultra fine grid, called '[spacetime](#)', which is comprised of infinitesimal 'world points' ([Bergmann and Komar](#)). We do need "point-likeness of particles" and "relativistic invariance and locality/causality" ([Hermann Nicolai](#)), but we do **not** have 'seconds of **no** data' anymore, to make them 'discrete' as in classical physics.

Question is, can we obtain a model for continuous-and-discrete physical reality at [Planck scale](#) ?

Our logic offers only one solution: introduce **blank** ([dark Zen](#)) "points" [Ibetween](#) all "neighboring" world points, to make all [world points](#) *both* absolutely discrete (global mode of spacetime; see explanation [here](#)) and absolutely continual ([local mode](#) of spacetime). Namely, the *structure* of the *physicalized* '[world points](#)' is exhibited with purely geometrical, **blank** ([dark Zen](#)) "points" [Ibetween](#) them, and these **blank** "points" are made totally absent -- **zero** -- in the **resulting** local (physical) mode of spacetime **by** the Arrow of Space. How? With [the "speed" of light](#).

Stated differently, a "[bartender](#)" will claim that any "converging sequence" [[Ref. 1](#), p. 3] necessarily *contains* [the empty set  \$\mathbf{R}\$](#)  that is nevertheless **not** present at the 'end point' presented with numbers (e.g., [two pints](#)). Surely [the empty set  \$\mathbf{R}\$](#)  is absolutely needed to *complete* the sequence and make it 'converging', yet it is *always* '**not there**' ([Henry Margenau](#)), like the "shadow" ([Warren Leffler](#)) cat [Macavity](#), or simply '[potential reality](#)'.

Why? Because any **finite** (no matter how "small") [Archimedean](#) sequence contains exactly the same "number" of UNcountably infinite points ([Georg Cantor](#)), and we'll face two **alternatives**: (i) never **actually** complete the sequence, as explained with the on-off states of [Thompson's Lamp](#), or (ii) complete the sentence with 'potential infinity', after which the whole converging sequence will **actually** hit the so-called 'nothingness' or "[singularity](#)", and become [geodesically incomplete](#).

Obviously, these alternatives must be [avoided](#). Only the [non-Archimedean](#) and [empty set  \$\mathbf{R}\$](#) , living in

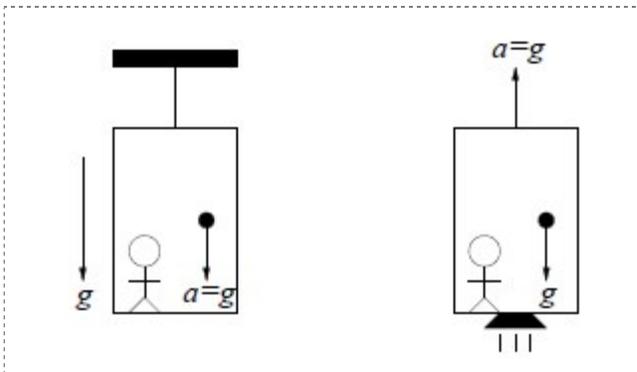
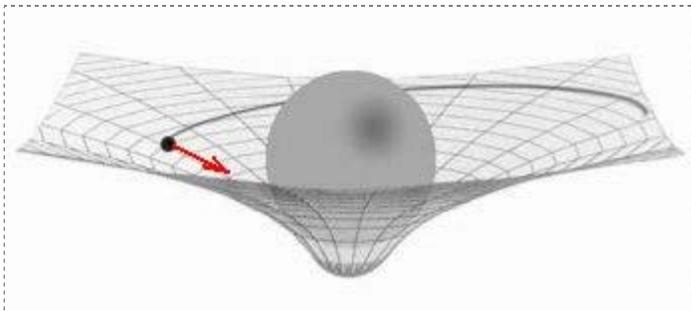
the global mode of spacetime, can *both* finish the job with **actual infinity** from 'the universe as ONE' and completely disappear at the end-point of "two pints". Mathematically, it is 'the set of all sets' that is at the same time **not** a 'set' *per se*: see details from Quantum Theory below.

Strangely enough, if you show the "set" errors in the "the worst theoretical prediction in the history of physics", these people wouldn't care. Or will stubbornly claim that cannot understand this crucial issue from 1935. Or both.

**NB:** This is *the only* option to explain the build up of finite intervals, which we call 'emergence of spacetime' (Isham and Butterfield). Only the phenomenon producing the speed of light could somehow "read" all UNcountably infinite points (Georg Cantor) *en bloc* and 'take into account' their different **size**, which we define with distance function. We have no alternative proposal to explain the puzzle noticed by Lucretius some 2070 year ago: there **must** be a limit to stop a sequence and make it converging, or else there can be no difference between 'small' and 'large'. We need to amend the current incomplete ideas of point-set topology and differential geometry with the Arrow of Space.

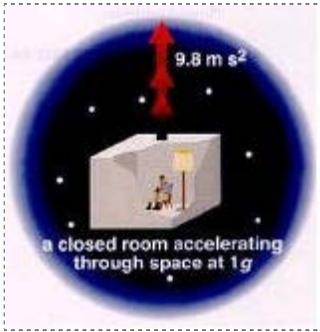
Of course, Hermann Nicolai and his colleagues may not "like" it and would prefer to stick to their poetic textbooks ("arbitrarily near to  $x$  in an appropriate way," [Ref. 1], p. 3), but they don't have *any* alternative to offer. They can only keep quiet and ignore the facts, as Max Planck explained.

In summary, recall two ideas in Einstein's Allgemeine Relativitätstheorie: "curvature" and "free fall".



Both ideas *imply* the global mode of spacetime that is **totally absent** in the local (physical) mode of spacetime. In the first case, we "see" a crude metaphor of "curved" spacetime, which is **bumped** into some *physically* nonexistent "radius" of the universe (Ned Wright), and then of course cannot explain the fundamental manifestation of gravity by **torsion**, which produces rotation. The second drawing is an equally deceptive analogy, because we cannot replace the elevator cage or "closed room" below with 'the universe as ONE' with respect to which we define the "dark" global mode of spacetime.

**NB:** The **red arrow** points to **all** directions in 3-D space, because there is no global inertial coordinate system. This omnipresent **red arrow** is from the Arrow of Space. Ignore it at your peril.



The notions of 'time' presented with 'local duration' [Ref. 2], and 3-D space modeled as 'differentiable volume made by *extremely* packed points "separated" by **nothing**', are produced by the [Arrow of Space](#) that can "read" all [UNcountably infinite](#) points *en bloc* with actual infinity in the [global mode](#) of spacetime. I will refer to this '**nothing**', endowed with the faculty of embracing all points *en bloc* with *actual infinity*, as "**it**", stressing that **it** corresponds to the unique case of 'zero nothing', as opposed to the physical case of 'zero *something*' (e.g., the current number of theoretical physicists interested in quantum gravity).

This is the only available solution to the *paradox of space*, which also solves the *paradox of time* (not "problem") in current textbooks [Ref. 2]. The **blank** geometrical points, which "separate" the *physical* world points by '**nothing**', are 'the whole universe as ONE' (global mode of spacetime). Depending on the direction we look at **it** from the local (physical) mode of spacetime, **it** can project two *deceptive* (notice 'either/or' contraposition) images: either 'an infinitesimal point tending *asymptotically* toward zero' or 'the largest volume of 3-D space, tending *asymptotically* toward infinity' ('*asymptotically*' refers to **potential** infinity only). However, **it** is a dual object that *wraps* the local mode of spacetime, and can only be pictured as a dimensionless "point" stretched to the dimensions of an "infinite" universe -- there is no metric to define 'distance' in the global mode of spacetime. Everything happens there "instantaneously", just as we see our face in the mirror only at the very instant we look at it.

Likewise, all [living](#) and [quantum-gravitational](#) systems can "see" the instant spectrum of *potential* "[clouds](#)" or "[jackets](#)", and choose **one** of them to become physical reality in the **next** instant 'now' from the [Arrow of Space](#). Thus, 'the universe as a brain' can "sense", anticipate, and ultimately *alter* its [potential future](#), just as the finite brains and living organisms do, following their common 'flow of time' (cf. option YAIN (iii) [above](#)), and the causality of 'the universe as a brain' (dubbed *biocausality*) is always [retarded](#).

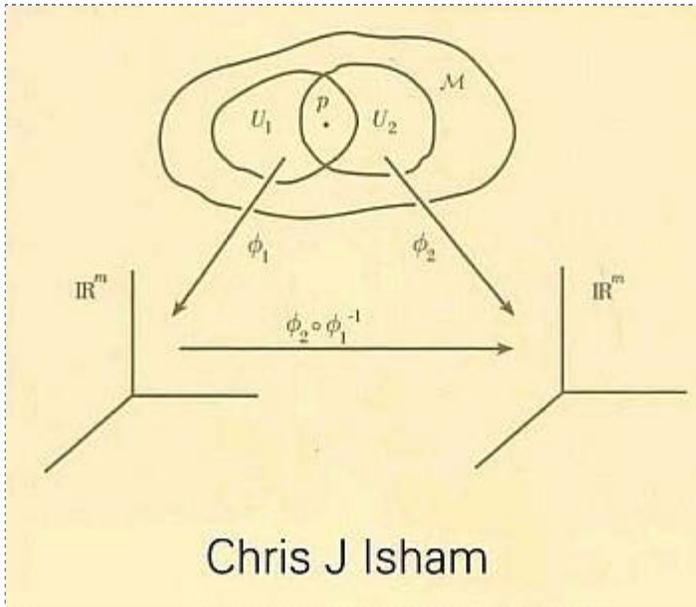


Physically, **it** is *the* ONE entity providing the [sufficient conditions](#) for spacetime and **binding** the *physical* world points by '**nothing**' ([Luke 17:21](#)), thanks to which we experience accumulated-in-time spatial dimensions of the universe -- one-point-at-a-time along the [Arrow of Space](#).

Nature is designed in a way that is *both* the only possible *and* the optimal one. Can't do it by chance.

Dead matter makes quantum jumps; the living-and-quantum-gravitational matter is [smarter](#).

[Ref. 1] [Chris J Isham](#), *Modern Differential Geometry for Physicists*, [2nd ed.](#), World Scientific, 1999.



(Note: To explain '[the point p](#)' above, the maximal resolution used by Chris Isham is with 'points' as well, which I think is sheer poetry - D.C.)

### 1.1.2 Remarks on topology

The subject of topology can be approached in a variety of ways. At the most abstract level, a 'topology' on a set  $X$  consists of a collection of subsets of  $X$ —known as the *open sets* of the topology—that satisfy certain axioms (they are listed in Theorem 1.3). This special collection of subsets is then used to give a purely set-theoretic notion of characteristic topological ideas such as 'nearness', 'convergence of a sequence', 'continuity of a function' *etc.* From a physical perspective, one could say that topology is concerned with the relation between points and 'regions': in particular, open sets are what 'real things' can exist in.

Many excellent books on topology take an abstract approach from the outset<sup>1</sup>. However, on a first encounter with the idea of a topology, it is not obvious why that particular set of axioms is chosen rather

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<sup>1</sup>Two classic examples are Bourbaki (1966) and Kelly (1970).

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## 1.2. METRIC SPACES

3

than any other, and the underlying motivation only slowly becomes clear. For this reason, the particular introduction to general topology given in Section 1.4 is aimed at motivating the axioms for topology by starting with the broadest structure one can conceive with respect to which the notion of a converging sequence makes sense, and then to show how this definition is narrowed to give the standard axioms for general topology.

### 1.2.1 The simple idea of convergence

A key ingredient in any topological-type structure on a set  $X$  is the sense in which a point<sup>2</sup>  $x \in X$  can be said to be 'near' to another point  $y \in X$ —without such a concept, the points in  $X$  are totally disconnected from each other. In particular, we would like to say that an infinite sequence  $(x_1, x_2, \dots)$  of points in  $X$  'converges' to a point  $x \in X$  if the elements of the sequence get arbitrarily near to  $x$  in an appropriate way. We shall use the idea of the convergence of

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<sup>2</sup>The notation  $x \in X$  means that  $x$  is an element of the set  $X$ .

---

## 4 CHAPTER 1. AN INTRODUCTION TO TOPOLOGY

sequences to develop the theory of metric spaces and, in Section 1.4, general topological spaces. As we shall see, in the latter case it is necessary to extend the discussion to include the idea of the convergence of collections of subsets of  $X$ —with this proviso, the structure of a topological space is completely reflected by the convergent collections that it admits.

A familiar example is provided by the complex numbers: the ‘nearness’ of one number  $z_1$  to another  $z_2$  is measured by the value of the modulus  $|z_1 - z_2|$ , and to say that the sequence  $(z_1, z_2, \dots)$  ‘converges’ to  $z$  means that, for all real numbers  $\epsilon > 0$ , there exists an integer  $n_0$  (which, in general, will depend on  $\epsilon$ ) such that  $n > n_0$  implies  $|z_n - z| < \epsilon$ ; this is illustrated in Figure 1.1. Thus the disks<sup>3 4 5</sup>

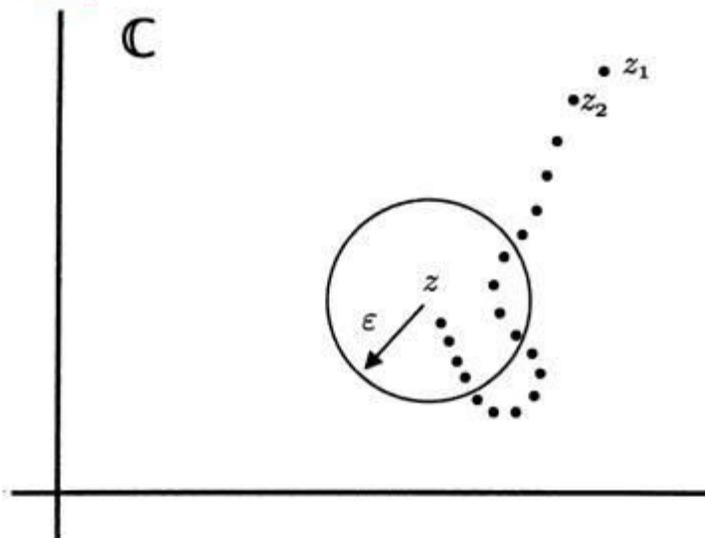


Figure 1.1: A convergent sequence of complex numbers.

$B_\epsilon(z) := \{z' \in \mathbb{C} \mid |z - z'| < \epsilon\}$  ‘trap’ the sequence. (Wrong-D.C.)

### 1.4.8 The idea of a compact space

A most important concept in topology—and one that fundamentally involves generalised convergence—is that of a ‘compact’ space, which means a space that is, in some sense, of ‘finite size’. The classic examples of compact spaces are spheres, tori, or any other subspaces of Euclidean space  $\mathbb{R}^n$  that are closed and bounded<sup>25</sup>.

<sup>25</sup>A subspace  $A$  of a metric space is bounded if  $\sup_{x,y \in A} d(x,y) < \infty$ . ?

One characteristic feature of such a set is that any infinite subset of points must necessarily cluster together in some way.

[Ref. 2] Sean Gryb and Flavio Mercati, [Right About Time?](#) FOXi Essay Contest, 2012.

"As Minkowski put it in 1908 [2], "space by itself, and time by itself, are doomed to fade away into mere shadows, and only a kind of union of the two will preserve an independent reality." Nowhere is this more apparent than in the main equation physicists use to construct the solutions of general relativity (GR):

$$S_{\text{Einstein-Hilbert}} = \int d^4x (R + \mathcal{L}_{\text{matter}}) \sqrt{-g} . \tag{2}$$

"Can you spot the **t**? It's hidden in the 4 of  $d^4x$ . But there are important structures hidden by this compact notation. We will start by pointing out an invisible minus sign in equation (2). When calculating spacetime distances, one needs to use

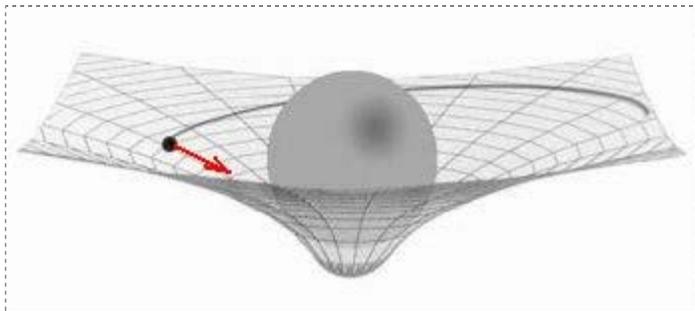
$$x^2 + y^2 + z^2 - t^2, \tag{3}$$

which has a - in front of the  $t^2$  instead of Pythagoras' + . The minus sign looks innocent but has important consequences for the solutions of equation (2). Importantly, the minus sign implies causality, which means that only events in the past can effect what is going on now. This, in turn, *implies* that generic solutions of GR can only be solved by specifying information at a particular time and then seeing how this information propagates into the future. Doing the converse, i.e., specifying information at a particular place and seeing how that information propagates to another place, is, in general, not consistent. (Footnote 2: Technically, the difference is in the **elliptic** (cf. [Jim Woodward](#) - D.C.) versus hyperbolic nature of the evolution equations.) Thus, the minus sign already tells you that you have to use the theory in a way that treats time and space differently.

.....

p. 3: "Expert readers will recognize this as one of the facets of the *Problem of Time* [4]. The fact that there is no equivalent *Problem of Space* can be easily traced back to the points just made: time is singled out in gravity as the variable in terms of which the evolution equations are solved. This in turn implies that local duration should be treated as an *inferred* quantity rather than something fundamental. Clearly, time and space are not treated on the same footing in the formalism of GR despite the rather misleading form of equation (2)."

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Subject: "... perhaps gravity is "special", and it is merely a coincidence

that it looks like a fictitious force."

Date: Sat, 23 Mar 2013 03:15:37 +0200

Message-ID: <CAM7Ekx=9reKUy1WVTasbUreXyrhxioamD\_JK1MT-XTEDhtFx1w@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Courtney Seligman <courtney@cseligman.com>

<http://cseligman.com/text/physics/fictitious.htm>

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Dear Dr. Seligman,

Perhaps you may be interested to read what may be "special" about gravity:

<http://www.god-does-not-play-dice.net/#ETH>

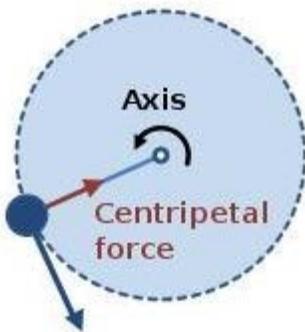
All the best,

Dimi Chakalov

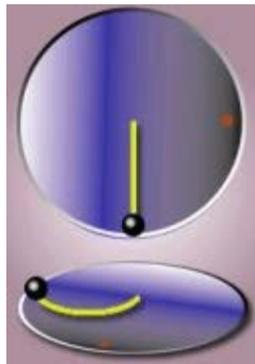
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**Note:** The small red arrow above might look like a "fictitious force", but it is manifestly 'real' and most importantly *omnipresent*, because only observers who feel no force at all -- including gravity -- would be *shielded* from it and could claim that they weren't "accelerating" ([Brian Greene](#)). Besides, gravity isn't a force either, because it doesn't conform to Newton's third law, so the "equality of inertial and active gravitational mass then remains as puzzling as ever. It would be nice (no, it wouldn't be "nice" at all - D.C.) if the inertial mass of an accelerating particle were simply a back-reaction to its own gravitational field, but that is not the case." (Wolfgang Rindler, [p. 22](#))

But what if gravity is centripetal force from "rotation" in the *global mode* of spacetime?



The acceleration is pointing directly opposite to the radial displacement at all times



Coriolis effect



Notice the vertical trajectory of the black ball in the second drawing of Coriolis effect: it corresponds to "instantaneous" re-generation -- one-at-a-time -- of inertial forces along the **w**-axis of the whole universe en bloc. As [Courtney Seligman](#) suggested,

The fact that gravity, like fictitious forces, involves a constant acceleration, makes us wonder whether gravity could be a fictitious force. It's hard to imagine that anything so pervasive and seemingly real could be "fictitious", but the forces experienced by the person in the accelerated car feel real, and are presumably fictitious. Is there some way that we could create the phenomenon of gravity, without the force?

There is indeed such a way. Suppose that you were in a rocket ship, headed [upwards](#) at the acceleration of gravity, so that anything not attached to the ship seems to "fall" with a mirror image of that upward acceleration. Then every such object would fall toward the back of the ship, at the acceleration of gravity, and trying to stop such a fall would require a force, in the direction of the acceleration, proportional to the object's mass, which would be equal to, and appear to be, its real weight.

Of course, we can't explain gravity in that way, as that would require every part of the Earth to be accelerating upward and outward, which would make the Earth bigger and bigger, which is not observed.

But the "[upward direction](#)" is *not* physical. It points to the quantum-gravitational "[it](#)" in the global mode of spacetime. Physically, it would correspond to some **absolute** observer at 'the reference frame of fixed stars' (see below). [Courtney Seligman](#) also added his opinion:

So the simplest explanation is to assume that, peculiar though it may be, gravity -- although a perfectly real force -- acts as though it is a fictitious force. No other real force is known to act in this way, but perhaps gravity is "special", and it is merely a coincidence that it looks like a fictitious force.

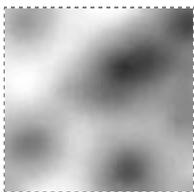
**NB:** Alternatively, the simplest explanation is to assume that gravity is a physical blueprint left from the Arrow of Space on the local (physical) mode of spacetime from two phenomena: (i) the "[upward direction](#)" along the **w**-axis in the Arrow of Space, and (ii) the "rotation" in the *global mode* of spacetime. Physically, we will obtain an omnipresent **red arrow** in the *local* mode of spacetime (see [above](#)), but **cannot in principle** detect its "physical basis" nor absolute reference frame of the *global mode* of spacetime.

Notice that the *physical* blueprint of "rotation" is **complemented** by the elementary shift **dt** in the "[upward direction](#)" along the **w**-axis. The topology of "rotation" is a circle, as in the cognitive cycle of [Ulric Neisser](#), while the topology of the "[upward](#)" shift **dt** goes along a line (1-D Euclidean space), called "time". It corresponds to "radial displacement at all times" in the first drawing above, and its mirror image is called 'inertia'.

Thus, we propose a *superposition* of "two" topological transitions in the *global mode* of spacetime, but bear in mind that the transitions are *completed* and *totally eliminated* in the *local* mode of spacetime by [the "speed" of light](#), leaving a *perfect* 3-D continuum of *physical* 'world points' -- [one-at-a-time](#).

This proposal is alternative to all multi-dimensional ideas put forward ever since [1914](#); see a recent account [here](#). Instead of speculating about a 3-D nanny looking at 2-D Flatland and then claiming that those extra "directions" have been "wrapped" and made terribly "small" at macroscopic length scale, we offer the '[dark Zen gaps](#)' of the global mode of spacetime and a pocket of *propensities* explicated from the global mode (called 'potential reality'), which resides *only* in the *potential future* of the [Arrow of Space](#).

As mentioned [previously](#), the *potential reality* is *not yet* physicalized quantum-gravitational "[it](#)", which might resemble a "dough" or continual *density* of *intangible* [pure energy](#).



There is no [metric](#) there, no spatial relations (inside vs. outside, left vs. right), and no [set theory](#) relations, such as 'one vs. many' either. **It** (not He) is the ultimate presentation of *entanglement* (Verschränkung): "*the characteristic trait of quantum mechanics*" ([Erwin Schrödinger](#)). We can only

sense or *feel* the UNSpeakable "it" with our brains [here](#). If we try to explain the *connectedness* of the global mode of spacetime, relative to the local, 3-D mode (resembling fiber bundle [base space](#)), one could perhaps connect and [bootstrap](#) all points in 3-D space **simultaneously** and [from all directions](#), "including the inner structure of solid objects and things obscured from our three-dimensional viewpoint" ([Wiki](#)). Topologically, such infinite-connected global mode of spacetime would allow to have "two" (in fact, one) simultaneous, *en bloc* view(s) on **all** 'world points' ([Bergmann and Komar](#)) in 3-D: we could "see" all points on the closed 2-D surface in the drawing below, along all radii, at **one** instant, and in **both direction(s)**.

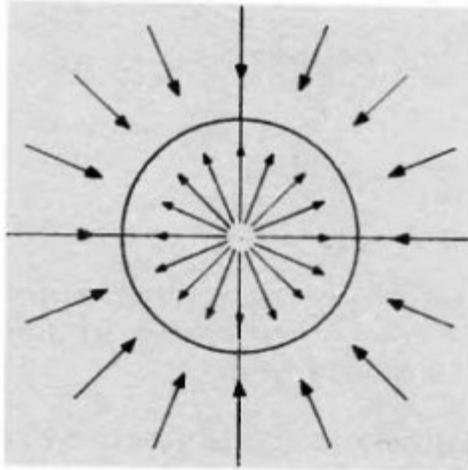


Figure 5.7

M.A. Armstrong, *Basic Topology*, Springer, 1997, [p. 104](#)

Let's go back to the [Coriolis effect](#), shown exclusively in the local mode of spacetime:



In the analogy with a ball rolling across the surface of a rotating merry-go-round, there are two reference frames, (i) on the rotating merry-go-round and (ii) on the ground, while in our case we are **locked** on a "stand still" merry-go-round (like the girl in the first photo above) and [cannot](#) switch to an **absolute** observer on the ground or (ii) 'the reference frame of fixed stars'. Just as in the case of [Stavros](#), she cannot 'take off the train' and detect her "rotation" with respect to reference frame (ii). She is **locked** -- [once-at-a-time](#) -- on a "stand still" merry-go-round and can only observe "rotation" in the trajectory of her rolling ball.

The inertial effect is real -- as [Ernst Mach](#) has allegedly said, "when the subway jerks, it's the fixed stars that throw you down". Yet we cannot [trace back](#) inertia with Newton's third law, because that would *physically* expose the global mode of spacetime and its "[aether](#)".

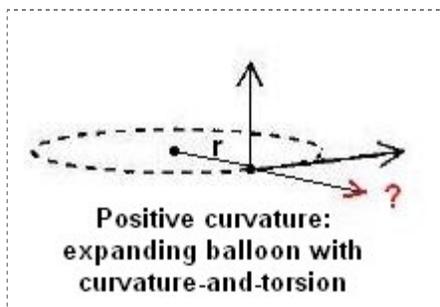
Recall that if we apply current GR textbooks (e.g., [Ciufolini and Wheeler](#), [p. 270](#)), the *generation* of

inertial reaction forces would look "instantaneous" and *very* puzzling: read [Jim Woodward](#). According to Tom Phipps (Thomas E. Phipps, Should Mach's Principle be taken seriously? *Speculations in Science and Technology*, 1(5) 499-508 (1978), p. 504):

Gravity is a different beast from radiation of any kind. Being mediated by *virtual* particles, which may be considered to be kept permanently virtual by the physical non-existence of [gravity shields or absorbers](#), gravity can act (nonlocally) with infinite speed - in effect, with precognition. That is exactly what it does, if Mach's principle has any substance. The fixed stars "know" the subway is going to jerk, because they have sent their virtual spies [forward in time](#) to find out about it.

In my opinion, Mach's Principle doesn't imply "precognition" nor "infinite speed" but [atemporal bootstrapping](#) of all 'world points', which produces [Synchronicity](#).

The important issue is that, just as with "spin" ([Hans Ohanian](#)), we will encounter 'gravity *minus* its physical basis' in the left-hand side of [field equations](#) -- a *potential* quantum-gravitational "[it](#)". Namely, [torsion & curvature](#) are physically exposed as 'rotation minus its physical basis'.

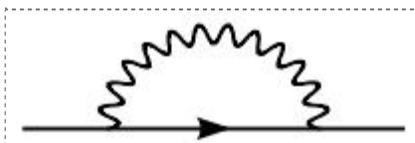


In the case of negative curvature, the two black vectors depicting curvature (right arrow) and torsion (vertical arrow) will be reversed. The red vector corresponds to "expansion"; the opposite vector of "inertia" is not shown. The dotted circle corresponds to 1-D space with positive curvature, as in Fig. 5.7 from M.A. Armstrong above.

Gravity doesn't have its own "field", but is manifestation of an [atemporal](#) "negotiation" between the physical content of every "point" and 'the universe as [ONE](#)', which yields an *additional* and perfectly *physicalized* [input on matter](#) from 'the universe as ONE'. The same mechanism holds for the human brain: we [cannot observe](#) its mind but only a *self-acting* brain. And the same holds for 'the universe as a brain', [bootstrapped](#) by its [self-acting](#) ... "gravity", as we chose to call this holistic phenomenon.

Again, 'the universe as [ONE](#)' is quantum-gravitational "[it](#)" which does not and cannot possess any *metric* ([Chris Mihos](#)). **It** is rooted on the [dark Zen gaps](#) ]between[ all "infinitesimally nearby events" (Wald, [p. 8](#)), and supports Mach's idea about the influence of 'the whole universe' (*ibid.*, [p. 71](#), [p. 9](#)).

In brief, the causality (called *bi-causality*) in the [Arrow of Space](#) is always retarded, because all influences from the past, *converging* ([Chris Isham](#)) on a 'world point' ([Bergmann and Komar](#)), have been [already correlated](#) with/by their common "[it](#)". If we try here to impose the notion of time from physics textbooks, the [already correlated](#) bi-directional [atemporal](#) negotiation between the physical content of (i) every 'world point' and (ii) 'the universe as [ONE](#)' would match the "duration" of absorption-and-emission of a *virtual* photon.



This is my Ansatz to the origin of gravity & [positive mass](#). If the [feedback](#) from 'the universe as ONE' were *physically* detectable, gravity will be a 'physical force' in line with Newton's third law, "but that is not the case" (Wolfgang Rindler). It **must** be [camouflaged](#) as "fictitious force" ([Courtney Seligman](#)), because otherwise we would have direct observational proof of [the aether](#) of 'the universe as ONE'. Details available upon request.

In [practical terms](#) (pending verification with the full mathematical theory of 'the universe as a [brain](#)'), one can expect that the "acausal" connecting principle ([Carl Jung](#)) dubbed [Synchronicity](#) is determined by *biocausality*, namely, jointly from the past and the potential future of 'the universe as ONE', and hence may become *invariable* or perhaps even *evokable*. But as [Rudolf Peierls](#) remarked, "Synchronicity is something which physicists do not know about, nor would they wish to."

D. Chakalov

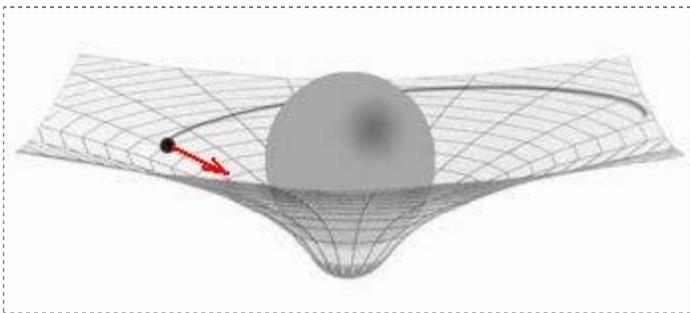
March 23, 2013

Last updated: March 31, 2013, [05:46:04 GMT](#)

<http://www.scribd.com/doc/132837865/Gravity-and-Rotation>

[http://www.god-does-not-play-dice.net/gravity\\_and\\_rotation.pdf](http://www.god-does-not-play-dice.net/gravity_and_rotation.pdf)

=====



Subject: Re: [arXiv:1307.1510v1 \[gr-qc\]](#)

Date: Mon, 8 Jul 2013 17:58:02 +0300

Message-ID: <CAM7EkxkWgNkT63vddLfPFmPOPGe-2UGzzRSrx96SKNL5QJvsSQ@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: James M Nester <nester@phy.ncu.edu.tw> ,

cmchen@phy.ncu.edu.tw,

liujl@phy.ncu.edu.tw,

liquideal@gmail.com

Cc: mtwang@math.columbia.edu,

yau@ims.cuhk.edu.hk,

lbszab@rmki.kfki.hu,

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roh.suan.tung@gmail.com

Dear James,

Your objective is "just to find a good way to select the reference for the Hamiltonian boundary term". May I ask a question.

I wonder if you can extend the boundary 2-form  $B(N)$  *exactly* to null-and-spacelike infinity, so that it cannot be modified in any way, shape or form whatsoever. If you can, your "closed 2-surface" will pertain to a unique object -- the whole universe with unique quasilocal quantities and unique boundary conditions.

[You also wrote](#) that "for geometric gravity the standard ground state is Minkowski geometry", which is your "chosen reference", and "Minkowski spacetime is the natural choice, especially for asymptotically flat spacetimes [19]. However, as noted above, almost any four functions will determine some Minkowski reference."

If you succeed with the task above, I suppose you will discover the correct "standard ground state" as well. I'm afraid it can't be "Minkowski spacetime": the devil is in the asymptotic details.

Please keep me updated.

Best - Dimi

On Mon, Jul 8, 2013 at 1:19 PM, Dimi Chakalov <dchakalov@gmail.com> wrote:

>  
> Dear colleagues,  
>  
> Regarding the (quasi-)localization of energy and your recent efforts, please see  
>  
> <http://www.god-does-not-play-dice.net/#Jeff>  
>  
> In my opinion, the idea to invoke some "closed 2-surface" is wrong:  
> see the link above.  
>  
> Your professional comments will be greatly appreciated.  
>  
> Sincerely,  
>  
> Dimi Chakalov

-----

**Note:** Look at the drawing [above](#), and try to imagine how a dead flat Minkowski spacetime would suddenly become "springy" and induce [rotation](#) due to gravity, being full of gravitational energy, most of which is "dark" because its source cannot be 'matter'. Moreover, if you manage to extend some "closed 2-surface" *exactly* to null-and-spacelike infinity, it won't keep its topology anymore -- it can't have any **definable** topology whatsoever. It *must* be [indefinable](#), because if you are confined within physical spacetime only (local mode of spacetime), [you](#) can approach it **only** with potential infinity -- see the [Thompson's lamp paradox](#). The fundamental object here is the [indefinable](#) and [empty set  \$\mathbf{R}\$](#) , which *must* be "zero" in the local mode of spacetime due to the ["speed" of light](#).

Have a nice summer.

D. Chakalov

July 8, 2013

Last updated: July 12, 2013, 11:22 GMT

=====

Subject: What induces rotation ?  
Date: Sun, 10 Feb 2013 12:38:38 +0000  
Message-ID: <CAM7EkxnEoZ7cA4c673RPA4hGJ=aPm=S\_8nDyMU=3jD1mtETHFA@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: David B Malament <dmalamen@uci.edu>  
Cc: Erik Curiel <erik@strangebeautiful.com>,  
David Brown <david\_brown@ncsu.edu>,  
Adam Helfer <helfera@missouri.edu>,  
Laszlo Szabados <lbszab@rmki.kfki.hu>,  
O'Murchadha, Niall <n.omurchadha@ucc.ie>,  
Angelo Tartaglia <angelo.tartaglia@polito.it>,  
Domenico Giulini <domenico.giulini@zarm.uni-bremen.de>,  
Ettore Minguzzi <ettore.minguzzi@unifi.it>,  
Andrzej Trautman <andrzej.trautman@fuw.edu.pl>

Dear David,

I have a request prompted by your Lecture Notes.

I wonder if you can explain the origin of rotation in GR -- "a subtle and ambiguous notion that does not, in all cases, fully answer to our classical intuitions" (Topics in the Foundations of General Relativity and Newtonian Gravitation Theory, 7 May 2012, [p. v](#)) -- as acknowledged since 1970s,

<http://www.god-does-not-play-dice.net/#Wittman>

Perhaps GR can treat rotation in our solar system only, assuming no "dark" stuff there, but we have proven rotation also with "dark" stuff, as explained at the link above.

So, what induces rotation ? Could it be a topological property of space, produced by [torsion](#) and hence neglected in [GR textbooks](#)?

I will also very much appreciate the opinions of your colleagues.

All the best,

Dimi

-----

**Note:** An example of *the* most widely known public secret in theoretical physics -- [localization](#) -- is shown with the small red arrow [above](#). It is common to [gravitational attraction](#) & **rotation**, but bear in mind that the drawing above could only be considered a crude metaphor, not even a remote analogy to the mystery of omnipresent rotation: from elementary particles (known as "[spin](#)") to 'the whole universe' pictured metaphorically with an inflating -- due to its **rotation** -- balloon ([Ned Wright](#)).

In short, the [phenomenon](#) inducing rotation is physically **not present**. If you nevertheless believe that **rotation** can *only* be produced by classical matter, you'll end up with with a [very "dark" elephant](#).

Perhaps a comparison between textbook GR and the Machian quantum gravity ([MQG](#)) will be helpful.

There are three major ideas in current GR (source [here](#)):

**1.1.** GR: "There is no absolute space or absolute time. Rather space and time are concepts that are abstracted from the relations of physical objects."

**1.2.** MQG: There is no absolute space or absolute time, but [necessary and sufficient](#) conditions for spacetime. The latter cover 'global properties of spacetime' and spring from '[the universe as ONE](#)'.

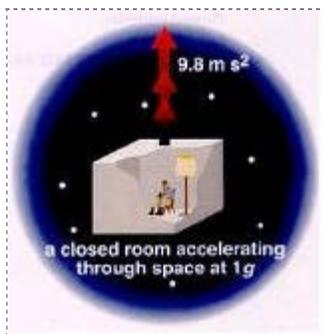
**2.1.** GR: "Spatial scale is abstracted from local ratios, i.e. ratios with physical rods."

**2.2.** MQG: Space is an [emergent phenomenon](#) of the [Arrow of Space](#) which (i) produces [the flow of time](#) and (ii) requires perpetual **non**-conservation of energy in [textbook GR](#).

**3.1.** GR: "Time is abstracted from the dynamics of local physical degrees of freedom, i.e. the dynamics of physical clocks."

**3.2.** MQG: Time is abstracted from the dynamics of [Arrow of Space](#). The underlying axiom is about the [constituents of spacetime](#): *not* some finite Archimedean chunks of "space" or "time", but infinitesimal [uncountably infinite](#) points *accumulated* by '[the universe as ONE](#)' along the **w-axis** (cf. **1.2** above).

Every instant 'now' in the [Arrow of Space](#) resembles one act of "pulling" the 'closed room' **upwards** (cf. the drawing below) through the global mode of spacetime, namely, along the **w-axis**. The latter is being compacted to **zero** in the local (physical) mode of spacetime.



The end physical result -- one-at-a-time -- is an [already-positivized matter](#) endowed with [inertia](#).

Another example of textbook GR is the introduction of fake "graviton", after a convenient analogy with the photon:



$S = \int d^4x F_{\mu\nu} F^{\mu\nu}$

Field	Particle	Polarizations
$A_\mu$	Photon	2

**EINSTEIN SIMPLIFIED**



$S = \int d^4x \sqrt{-g} R$

Field	Particle	Polarizations
$g_{\mu\nu}$	Graviton	2

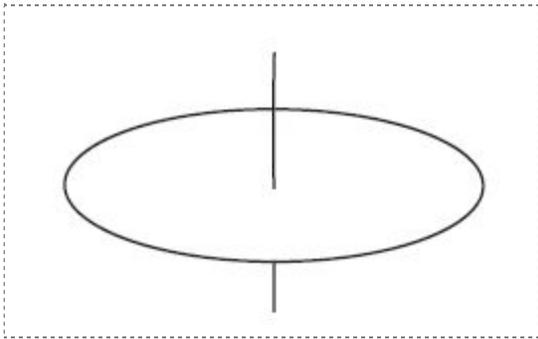
Regarding the Einstein Lagrangian, Robert Bluhm [Ref. 1] kindly explained the idea as follows:

If you start with a Maxwell Lagrangian  $-1/4F^2$  for a field  $A_\mu$  and expand it out, you will see that there are no second time derivatives for  $A_0$  and only the three spatial components  $A_j$  have second time derivatives. For this reason  $A_0$  does **not** propagate as a harmonic wave. It is a non dynamical "auxiliary" field. The gauge symmetry lets you eliminate one more degree of freedom, leaving two physical degrees of freedom for the massless photon.

Likewise in the Einstein Lagrangian, if you expand it out in terms of the ten metric excitations  $h_{\mu\nu}$  you will find that the four fields  $h_{00}$  and  $h_{0j}$  do not have second time derivatives. So they are **not** dynamical. The [diffeomorphism symmetry](#) then allows removal of four more degrees of freedom, leaving two physical degrees of freedom for the massless graviton.

Nothing helps here, but notice that we have some esoteric "auxiliary modes" [[Ref. 1](#)]: can we use them to recover the **rotation** ? Nope, these poetic "auxiliary modes" can't help, just as the alleged "massless transverse modes" [[ibid.](#)] can't capture the elusive **rotation**. What to do, then?

As stated above, the axis of rotation is **not** present, which is why the question whether the ring (cf. the drawing below) is rotating or not "around the axis" (David B. Malament, *Topics*, Figure 3.2.1, [p. 191](#), footnote 20) is irrelevant.



But how can the [engine](#) of rotation stay '**not** present', while the rotation effect cast on baryonic matter is [overwhelmingly present](#)? This is the crux of Quantum Geometry: we have *physicalization* of the [pure intangible energy](#) of the gravitational field ([Hermann Bondi](#)) into *any* form of tangible energy; in our case it will produce **rotation & curvature**. Namely, the phenomenon which *induces* rotation is '**not** present' in the local (physical) mode of spacetime, like the *physical basis* of quantum "spin" [[Ref. 2](#)] -- "klassisch nicht beschreibbaren Art von Zweideutigkeit" ([Wolfgang Pauli](#)).

Forget about all "dark" crap. We cannot witness the *physicalization* of the [pure intangible energy](#) due to [the "speed" of light](#). It is not a 'process' and it ain't 'dynamical', because it *produces* the dynamics of spacetime.



This is the crux of Quantum Geometry, as already explained [many times](#) at this website. If you nevertheless believe that can explain the "[dark matter](#)" effect of gravitational **rotation**, as well as the same **rotation** but without "dark matter" effect, and firmly insist that "dark matter" is made by matter "*because all forms of matter gravitate*" (Paolo Pani *et al.*, [arXiv:1302.2646v1 \[gr-qc\]](#)), you will have to live with "[dark elephants](#)" until you [quietly retire](#). The choice is [yours](#).

D. Chakalov

February 12, 2013

Last updated: March 6, 2013, [07:46:48 GMT](#)

[Ref. 1] Robert Bluhm, Observational Constraints on Local Lorentz Invariance, [arXiv:1302.1150v1](https://arxiv.org/abs/1302.1150v1), p. 9 (to appear in The Springer Handbook of Spacetime, Springer-Verlag, 2013).

Diffeomorphisms are mappings from one differentiable manifold to another. In GR, the mappings are from the spacetime manifold back to itself. Vectors and tensors transform in prescribed ways under diffeomorphisms, and diffeomorphism invariance in GR is the statement that the same physics is described by the spacetime manifold, metric, and matter fields both before and after a diffeomorphism is performed.

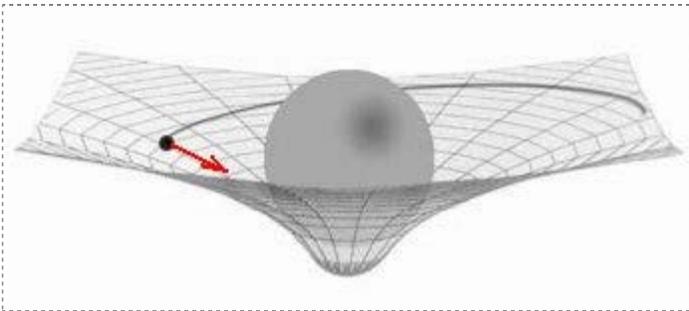
As with local Lorentz symmetry, diffeomorphism symmetry can be used to eliminate additional degrees of freedom. Under infinitesimal diffeomorphism transformations, points  $x^\mu$  on the space-time manifold are mapped to neighboring points  $x^\mu + \xi^\mu$ , where the four parameters  $\xi^\mu$  are spacetime dependent. Under infinitesimal diffeomorphisms, the metric transforms as

$$g_{\mu\nu} \rightarrow g_{\mu\nu} - \partial_\mu \xi_\nu - \partial_\nu \xi_\mu. \quad (9)$$

By gauge fixing the four diffeomorphism degrees of freedom, the metric can be reduced from ten down to six independent degrees of freedom. The excitations  $h_{\mu\nu}$  then have six degrees of freedom as well after gauge fixing. These represent the six possible excitation modes for gravitational radiation that can occur in a generalized theory of gravity. For the case of Einstein's GR, the kinetic terms in the action are chosen so that four of these degrees of freedom do not propagate as physical modes and instead are called auxiliary modes. As a result, in Einstein's GR only **two** gravitational modes propagate, which are both massless transverse modes.

[Ref. 2] [Hans C. Ohanian](#), What is spin? *Am. J. Phys.* 54 (1986) 500-505.

**When Goudsmit and Uhlenbeck proposed the hypothesis of the spin of the electron, they had in mind a mechanical picture of the electron as a small rigid body rotating about its axis. Such a picture had earlier been considered by Kronig and discarded on the advice of Pauli, Kramers, and Heisenberg, who deemed it a fatal flaw of this picture that the speed of rotation—calculated from the magnitude of the spin and a plausible estimate of the radius of the electron—was in excess of the speed of light. However, the great success of the spin hypothesis in explaining the Zeeman effect and the doublet structure of spectral lines quickly led to its acceptance. Since the naive mechanical picture of spin proved untenable, physicists were left with the concept of spin minus its physical basis, like the grin of the Cheshire cat.**



Subject: Re: [arXiv:0704.2291v1 \[astro-ph\]](https://arxiv.org/abs/0704.2291v1)  
Date: Wed, 13 Feb 2013 01:47:29 +0200  
Message-ID: <CAM7EkxkRF0d==5XeHtjY87NNwJ+eZg7hfV1rsb702VEGLv\_4Xg@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Simon White <swhite@mpa-garching.mpg.de>  
Cc: [\[snip\]](#)

You bluntly ignored my email sent to you since Fri, 20 Apr 2007 14:24:49 +0300.

Why did you do that, Simon? You cannot speculate about "Fundamentalist physics: why Dark Energy is bad for Astronomy", because neither you nor any of your colleagues know the very first effect of gravity that you see in front of your nose:

<http://www.god-does-not-play-dice.net/#rotation>

If you or any of your colleagues can explain it, please do write me back, and I will show you

additional errors in your [arXiv:0704.2291v1 \[astro-ph\]](https://arxiv.org/abs/0704.2291v1).

Please don't hesitate to pass this email to other people interested in theoretical physics.

If you aren't interested, [don't bother to respond](#) -- there is none so blind as they that won't see.

D. Chakalov

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**Note:** Read an excerpt from Simon White below (emphasis added). Mind you, he wasn't joking, and is still the Geschäftsführender Direktor at the Max-Planck-Institut für Astrophysik!

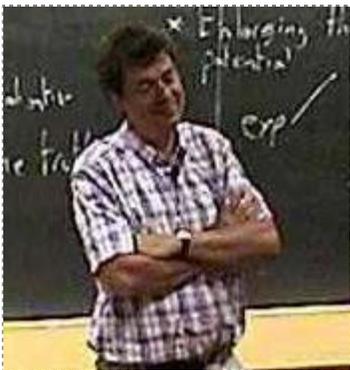
More from [Max Planck](#).

D. Chakalov

February 13, 2013

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Fundamental Physics: Why Dark Energy May Be Bad for Astronomy  
Prof. Simon White, Director at the Max-Planck-Institut für Astrophysik  
<http://online.kitp.ucsb.edu/online/bblunch/white1/>  
[arXiv:0704.2291v1 \[astro-ph\]](https://arxiv.org/abs/0704.2291v1)



pp. 8-9: "Dark Matter drives the formation of galaxies and galaxy clusters and influences all aspects of their structure. Its distribution can be mapped **directly** using gravitational lensing, and can be inferred indirectly both from the dynamics of galaxies and intergalactic gas, and from the structure of fluctuations in the microwave background radiation. (...) Dark Matter studies thus impact directly on most aspects of extragalactic astronomy and astrophysical cosmology, as well as stimulating astroparticle experiments and research programmes at accelerators. In contrast, Dark Energy studies have little or no impact on other areas of astrophysics and experimental high-energy physics. (...) Thus, while clarifying the nature of Dark Matter has all the hallmarks of a typical "astrophysicist's" problem, interacting with many other aspects of the field and accessible by many routes, clarifying the nature of Dark Energy is a "fundamental" problem, apparently accessible only by a route which has **little** impact on the rest of astrophysics.

.....

p. 13: "Listening to the siren call of the fundamentalists may lose us both the creative brains and the instruments that are needed to remain vibrant. Dark Energy is the Pied Piper's pipe, luring astronomers away from their home territory to follow high-energy physicists down the path to professional extinction."

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Subject: Re: What induces [rotation](#) ?

Date: Thu, 14 Feb 2013 17:34:51 +0200

Message-ID: <CAM7Ekx=\_BYJAmHQ7SYBT52pZmFPs8GONKPRcjYWHahRWAHU=wg@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: David B Malament <dmalamen@uci.edu> ,

Erik Curiel <erik@strangebeautiful.com> ,

David Brown <david\_brown@ncsu.edu> ,

Adam Helfer <helfera@missouri.edu> ,

Laszlo Szabados <lbszab@rmki.kfki.hu> ,

Niall <n.omurchadha@ucc.ie> ,

Angelo Tartaglia <angelo.tartaglia@polito.it> ,

Domenico Giulini <domenico.giulini@zarm.uni-bremen.de> ,

Ettore Minguzzi <ettore.minguzzi@unifi.it> ,

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Chris Isham <c.isham@imperial.ac.uk> ,

Robert M Wald <rmwa@midway.uchicago.edu> ,

Robert Geroch <geroch@midway.uchicago.edu> ,

Karel V Kuchar <kuchar@physics.utah.edu> ,

Helmut Friedrich <hef@aei.mpg.de> ,

Friedrich W Hehl <hehl@thp.uni-koeln.de> ,

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Alan Rendall <rendall@aei.mpg.de> ,

Paul Tod <tod@maths.ox.ac.uk> ,

Jörg Frauendiener <joergf@maths.otago.ac.nz> ,

Jack Lee <lee@math.washington.edu> ,

Michael H Freedman <michaelf@microsoft.com> ,

John Friedman <friedman@uwm.edu> ,

George <george.ellis@uct.ac.za> ,

Torsten <torsten.asselmeyer-maluga@dlr.de> ,

Bernhard Milow <bernhard.milow@dlr.de> ,

Jürg <juerg@phys.ethz.ch> ,

EMIS <editor@emis.de> ,

Isaac Newton Institute for Mathematical Sciences <info@newton.ac.uk>

[Gentlemen:](#)

The mathematical tasks are spelled out -- with crucial help from Kevin Brown, Bob Geroch, and David Malament -- at

[http://www.god-does-not-play-dice.net/#Brown\\_null](http://www.god-does-not-play-dice.net/#Brown_null)

The idea belongs to William Clifford, published on February 21, 1870.

Please don't procrastinate and get professional about "rotation" (cf. the initial link below). The tasks are strictly mathematical.

All the best,

D. Chakalov

On Tue, Feb 12, 2013 at 4:59 AM, Dimi Chakalov <dchakalov@gmail.com> wrote:

>

> P.S. Note added at

> <http://www.god-does-not-play-dice.net/#rotation>

>

> D.C.

>

> On Sun, Feb 10, 2013 at 2:38 PM, Dimi Chakalov <dchakalov@gmail.com> wrote:

> [snip]

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**Note:** To explain the tasks, let me use an example: the positive mass conjecture [Ref. 1] and the question "why mass in the real universe should be positive" [Ref. 2].

It is an outstanding puzzle, because the Strong Energy Condition (SEC) is "violated on cosmological scales **right now!**" (Barcelo & Visser, [gr-qc/0205066v1](http://arxiv.org/abs/gr-qc/0205066v1)), and we have no idea how the "[dark energy](#)" is related to the puzzling positivity of mass [Ref. 2]. In [our model](#), the *now*-at-a-distance instants from the Arrow of Space, constituting the local (physical) mode of spacetime (watch the video clip [here](#)), belong to a "frozen" and [perfectly flat](#) spatial hypersurface ([Pong Soo Jang](#)), which implies that the *local* mode of spacetime has "already" (due to [the "speed" of light](#)) been made to show *positive mass* only, which in turn implies "rotating-and-expanding" universe, as suggested [above](#).

Notice that my [efforts](#) to replace the so-called "dark energy" with gravitational repulsion [Ref. 2] are not related to [antimatter](#), but to the [negative energy density](#)... of [what?](#)

Okay, let's start with something we know. As a guiding metaphor, recall that if we mix red, green, and blue light, will obtain [white light](#), which we shall call *colorless*, after the [Kochen-Specker Theorem](#).

Now, suppose you wish to observe *the* intrinsic color of an object, but it turns out that it doesn't have *invariant* color: depending on the "directions" you look at it, you'll see many different colors, as in the drawing below.



Then you can claim that you've been observing many different colors from different objects (e.g., not *the invariant mass* but many pseudotensorial "*clouds*"), since you cannot see the *colorless* light of the *underlying object* -- it will be invisible, hence "*dark*" and "unphysical", like the *absolute structures* and the *reference fluid in GR*. The latter must *not* be "*physical*": recall the fictitious background spacetime in John Walker's animation *above*, with which one could **time** the perpetual increase of the past, as seen from the last carriage of the *train*. If the *reference fluid* were *physical* object, it would expose *the aether* and literally ruin the theory of relativity.

Due to the "*speed*" of light, we can notice, from the last carriage and opposite to the direction of the *train*, the growing-in-time **past** *post factum* only, and because the '*dark Zen gaps*' in the local mode of spacetime are set to **zero**, we cannot "see" the *reference fluid in GR* with respect to which one can define the *dynamics of space* -- it is compacted onto one point only, and has become "*dark*".

Instead, we see unlimited 3-D space in the local mode of spacetime (cf. Fig. 1 below), spanned from macroscopic length scale toward the Small and the Large (see the video clip *here*) along the *w-axis* depicted with Fig. 2 below. If we could look through the global mode of spacetime (Fig. 2), perhaps we could observe all points in the 3-D local mode of spacetime (Fig. 1) **simultaneously** and *from all directions*, "including the inner structure of solid objects and things obscured from our three-dimensional viewpoint" (*Wiki*).

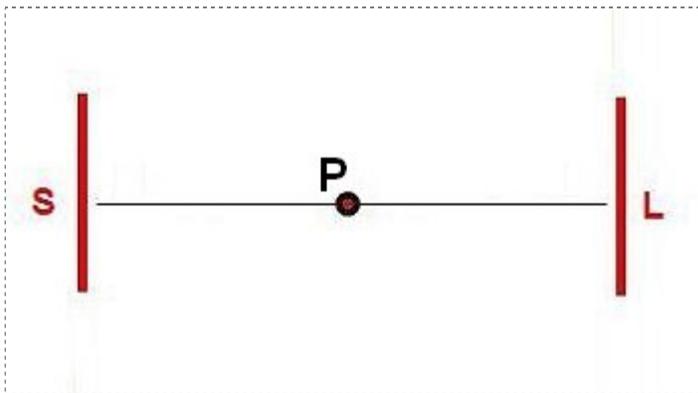


Fig. 1

**P** is shown in the *local* mode of spacetime, and is located at equal distances from **S** and **L**. It belongs to the macroscopic length scale in which 3-D space looks spanned in two "opposite" directions. The so-called Relative Scale Principle (*RSP*) postulates a fusion, or mutual penetration of space toward **S** and **L** in the *global mode*, which begins at **P**.

Fig. 2 below, from Fig. 5.7 of M. A. Armstrong (*Basic Topology*, Springer, 1997, [p. 104](#)), shows two simultaneous views (in red) on **P** from the *global mode* of spacetime.

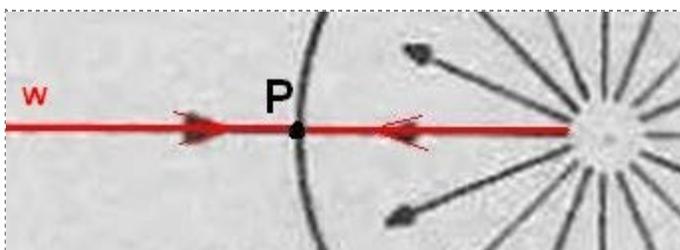


Fig. 2

**P** is shown in the [global mode of spacetime](#), modeled with a segment from closed (positive curvature) 1-D space, in **black**. The **w**-axis (in **red**) of the [Arrow of Space](#) shows two additional views from the *global mode of spacetime* on every point **P**. The case of *negative* curvature is obtained by "[space inversion](#)" along **w**-axis and with respect to the **black** curved segment, after which the two **red** arrows along the **w**-axis will point to opposite "directions" from **P**, again in the [global mode of spacetime](#). The latter could be interpreted as a neutral gravitational plasma of [negative-positive mass pairs](#) (Belletête and Paranjape, [pp. 6-7](#)).

**NB:** The "length" of **w**-axis in the local mode of spacetime is being compactified to **zero**, which is why we cannot show how 3-D space exercises its dynamics along the [Arrow of Space](#) and **accumulates** spacetime -- one-step-at-a-time. We cannot *in principle* display [Macavity](#) either.

Which brings us back to the question above: [negative energy density](#)... of *what ?* Try to understand the notion of '[pure energy](#)' by performing some simple experiments [above](#) with your brain.

The elusive origin of "the continual creation of positive energy" [[Ref. 3](#)] is still unclear. We don't know how to model a [smooth manifold](#) in the first place, because we cannot use the epsilon-delta approach by Augustin Cauchy to fix the "distance" (recall the [empty set R](#)) between the "neighboring" [points](#) presented with [two distinct real numbers](#).

As to the Relative Scale Principle ([RSP](#)), notice that it encapsulates the ideas of [Quantum Geometry](#): the geometrical "points" themselves become *quasi-local* toward **S** and **L** (Fig. 1), along with the spacetime metric. The latter is a **dual** parameter depending on the reference frame, according to [RSP](#). Namely, an electron and a galaxy look "small" bzw. "large" only to macro-observers located at **P** (Fig. 1), while their *relative* length will remain unchanged in the joint quantum-geometrical domain of spacetime. For example, a table at **P** (Fig. 1) with length 1 m will *always* remain 1 m in the **joint** spacetime domain, although its metric *will indeed* "shrink" bzw. "expand" with respect to a macro-observer at **P**. Bear in mind that entangled particles and astrophysical objects, obtained toward **S** and **L**, do **not** interact *through* the classical spacetime domain at **P** (Fig. 1): they are *one to one* mapped in their **joint** quantum-geometrical domain of spacetime. Otherwise you will have to speculate about "spooky action at a distance" that would propagate "at least  $10^7$  times faster than the speed of light" (Nicolas Gisin *et al.*, [2002](#)) and some "dark matter" in [galaxy rotation](#), and cannot explain [the rotation itself](#) nor the "dark" spin "minus its physical basis" ([Hans Ohanian](#)). Notice that the "size" of 'the whole universe as **ONE**' is the ultimate *dual* object, because **it** will always look like a table with length 1 m in the [global mode of spacetime](#) (Fig. 2). The new space inversion symmetry at **P** and its transformations along the **w**-axis pose a tough mathematical challenge, however.

Mathematically, what is the *interface* between the physical, Archimedean world and the geometrical [non-Archimedean](#) realm of [the continuum](#)? What is "**zero**"? If the physical presentation of the universe (local mode of spacetime), placed in the right-hand side of the [field equations](#), is an *open* system and the conservation of total energy is [impossible due to gravity](#) [[Ref. 4](#)], what could play the role of "dark" [Maxwell demon](#) ?

Some people would eventually claim (G F R Ellis, [p. 23](#)) that the future "is presently only potential (so does not yet exist)", but the *mathematical* presentation of *potential* future that '*does not yet exist*' requires the distinction between 'something that exists' vs. something **else** that *does not yet exist*.

Recall that it is indeed **impossible** to define *gravitationally* closed system: you will need to specify its '[external environment](#)', which inevitably requires to define 'the truly isolated system': [the universe as a whole](#). But with respect to *what ?* Welcome aboard! [The universe as ONE](#) *does not yet exist*, because **it** can never exist as a *physical* system defined ontologically w.r.t. 'something else'.

Regrettably, people ignore their own logic and keep dreaming about some "closed dynamical systems" after Dirac-ADM [[Ref. 5](#)], and speculate further about "spatial infinity" [[Ref. 6](#)], hoping to make use of [energy conservation](#) defined with Stokes' theorem on a [bounded region of spacetime](#). But again, the gravitational energy density **must not** be well-defined [at a point](#), because the metric

"field" couldn't be dynamical but would be fixed at *all points* and at *all times*, exactly as in [Minkowski spacetime](#), and the [wegtransformierbar](#) gravity will have to be zero.

Here, we consider [the universe](#) in its *local* mode of spacetime, and bring the "ambient" or unphysical [reference fluid in GR back to spacetime](#), but as *global* mode of spacetime placed "outside" asymptotic infinity: both "between" neighboring points and "outside" the cosmological horizon. Physically, we will observe two presentations of the global mode of spacetime, toward the Small and toward the Large, although **it** is in fact [ONE](#). It cannot be a 'set', because it is '*the* "set" of all sets'.

But what is the geometrical meaning of '*outside* asymptotic infinity' ? We cannot define **it** with the Archimedean axiom valid for the local (physical) mode. We need [non-Archimedean](#) geometry of the global mode of spacetime.

To sum up, there is one common idea in the [tangent bundle formulation of GR](#) and in the theory of quantum gravity proposed [here](#): a point from spacetime, and an object related to this point. In the case of GR, we consider a point that belongs to the 'base space' (like the cylinder in the hairbrush below), and attached a 'fiber' (bristle) to that point. Then replace the fiber with a 'tangent space' (viewed as a vector space), and suggest that the 'tangent space' (bristle) is **attached** to the 'base space' (spacetime) in such way that the [energy is conserved](#) at that point. Why? Because the tangent space at that point looks (to some people) very much like Minkowski spacetime. Nothing could possibly *propel* that point in any direction, however, because the object related to it (tangent space) is dead frozen and is kept **attached** to that point **at all times**.



In our case, a point from the *local mode* of spacetime is [perfectly flexible](#), like a '[jacket](#)' or '[cloud](#)', but the object related to this point, called [global mode of spacetime](#), is **totally detached** from such world points ([Bergmann and Komar](#)) constituting the *local* mode of spacetime. Energy is conserved in both the local (physical) and global mode -- dynamically, one-at-a-time along the Arrow of Space. In the local mode, energy is conserved between matter and gravity in a static instant 'now' only; in the global mode, the *dynamical conservation of energy* involves positive and negative mass ([nullification](#)). Hence 3-D space is being **re-created** at the instant 'now' -- one-at-a-time -- along the Arrow of Space, which in turn builds up the topological dimensions of spacetime. Also, the global mode of spacetime is a [non-Archimedean](#) entity that belongs to '[the whole universe](#)', and always stays *outside* asymptotic infinity: it is fully detached from, and **nonexistent** in the physical world explicated from **it**.

To paraphrase [Plato](#), the *colorless* Idea [[John 1:1](#)] does **not** belong to the set of [color-able](#) distorted shadows (or [jackets](#)) explicated from **it**. Check out the explanation of 'spin' and [KS Theorem](#), the experiments with your brain [above](#), then consider the universe as a [brain](#), and you're done. Just keep in mind that what we observe at the length scale of tables and chairs (e.g., [spin](#)) does **not** match the actual universe in its [quantum-and-gravitational](#) regime: we can see *only* along [two directions](#) toward **S** and **L** (Fig. 1), while the universe itself is approaching [ONE](#).

As of today, however, the mathematical presentation of these [very old ideas](#) [[Ref. 7](#)] is still uncovered, perhaps waiting 'out there' in the potential future.

It is always dark shortly before dawn...

[Ref. 1]. Dieter R. Brill and Pong Soo Jang, Positive mass conjecture, in *General Relativity and Gravitation*, ed. by Alan Held, Vol. 1, Ch. 5, Plenum, New York, 1980, [pp. 173-193](#) (links and emphasis added - D.C.).

pp. 173-174: "For reasons of stability we expect all reasonable classical (though not [quantum!](#)) field theories to have positive energy density, and we expect all (classical and quantum) field theories to have positive total mass-energy. Existence of solutions with negative total mass would have bizarre consequences.

"For example, by a simple scaling one could obtain solutions with arbitrarily large negative total mass, and one could presumably use such configurations to extract an infinite energy from a finite system or from the vacuum. Another example would be a [self-accelerating system](#), consisting of a positive mass object connected with a long rod to an object with negative mass.

"Of course, the total mass defined in terms of the asymptotic structure can have a negative value if we do not impose any conditions in the interior. Examples would be solutions containing naked singularities or matter fields with [negative energy density](#). However, if the space-time is regular at least initially and the matter fields are physically reasonable, we expect the total mass to be positive. (...)

## "2. The Positive Mass Conjecture

"The total mass of an isolated (i.e., asymptotically flat) system is determined by examining the **rate** (Sic! - D.C.) of approach of the geometry to the geometry of Minkowski space in the asymptotic region.

"Asymptotic flatness expresses geometrically the physical properties one expects of an isolated system, depending **only** on the (momentary) state of the system, **not** on its past or future history; it is defined by the existence of a spacelike surface  $E$  which approaches flatness in the following sense: ... "

.....

p. 176: "A possible Bondi mass conjecture would state that  $m_B$  is always positive in an asymptotically simple space-time, **provided** the matter satisfies an appropriate local energy condition (e.g., the dominant energy condition)."

[Ref. 2] W. B. Bonnor, [Negative mass in general relativity](#), *General Relativity and Gravitation* 21 (1989) 1143-1157.

As far as we know, mass is always and everywhere positive. Nevertheless, it is interesting to speculate on a universe containing negative masses, and many writers have done so.

The first speculations occurred in the nineteenth century and these are described in the book by Max Jammer [1]. Karl Pearson attributed the observed fast recession of a certain star to the fact that, having negative mass, it was being repelled from our region of space. Föppl in 1897 worked out an elaborate theory of negative masses, and Schuster in 1898 contemplated a universe containing negative mass.

The fundamental modern paper on negative mass is that of Bondi [2].

[Ref. 3] Banesh Hoffmann (1964), Negative Mass as a Gravitational Source of Energy in the Quasistellar Radio Sources, in: Thomas Valone *et al.*, *Electrogravitics Systems*, Integrity Research Institute, 2001, pp. [92-96](#).

Negative mass may or may not exist. If it does, according to both Newtonian mechanics and Einstein's general theory of relativity, it behaves in a most astonishing manner. For example, by the principle of equivalence the ratio of gravitational to inertial mass must be positive for all mass. Therefore, as is well known, positive mass attracts negative as well as positive mass, while negative mass repels both types of mass. Consequently, if a mass is placed near a mass  $-m$ , the two move in the same direction with ever-increasing speed, the negative mass chasing the positive. At first this seems to contradict the law of conservation of energy. But the particle of negative mass acquires negative energy as its speed increases, and the total energy of the two particles remains constant.

What happens to particles of negative mass that escape? They are unlikely to be present in interstellar space in sufficient amounts to affect significantly our estimates of the average density of the universe. Since they repel all matter, they cannot form negative-mass stars. If the universe is such that negative-mass particles can, on balance, "escape to infinity" there will be an effect of continual creation of positive energy in the observed region.

Hui-Hwa Chen, De-Ching Chen, and James M. Nester, Positive Energy Test of Teleparallel Theory, *Chinese J. Phys.* 25 (1987) [481-496](#).

## II. POSITIVE TOTAL ENERGY TEST

Although there is no unique local energy-momentum density for gravitating systems, there is a conserved total energy-momentum 4-vector  $P^\mu$  for those gravitating systems which are asymptotically Newtonian (MTW<sup>1</sup> ch. 19). The rest mass  $M$  of  $P^\mu$  is just the apparent active gravitational mass of the asymptotically Newtonian gravitational field which must have the form  $\vec{g} = -\frac{GM}{r^2}\hat{r}$  in the asymptotic Minkowski center of mass inertial frame. We take  $c = 1$  and use the words mass and energy interchangeably. So positive total energy simply means that the gravitational field is asymptotically attractive; negative total energy would mean repulsion – antigravity. Note that the relativistic idea of total energy used here includes rest mass-energy and is thus quite different from the Newtonian – negative energy means bound orbit – idea.

For fundamental theoretical reasons only positive total energy is acceptable for a physical theory. One reason is stability. We expect a system to spontaneously radiate until it settles into a ground state, the state of lowest energy. A lower bound for the energy is thus needed for stability.

.....

Another reason is thermodynamic. Should  $E = M$  be allowed to become negative, a system could radiate away more mass-energy than was originally assembled; the original amount could be reassembled and the cycle **repeated**, the excess amount providing a [perpetual source of energy](#).

For these and related reasons it is a fundamental requirement for any good gravitational theory that all its asymptotically Newtonian solutions (with of course positive local mass density sources) have positive total energy with zero energy being uniquely empty Minkowski space.

[Ref. 4] [Hans C. Ohanian](#), The Energy-Momentum Tensor in General Relativity and in Alternative Theories of Gravitation, and the Gravitational vs. Inertial Mass, [arXiv:1010.5557v2 \[gr-qc\]](#).

The universality of free fall motivates the geometric interpretation of gravity, with small test masses moving along geodesics of a curved spacetime geometry. In General Relativity, this geodesic motion can be shown to be a consequence of the “conservation” law  $T_{\mu}{}^{\nu}{}_{; \nu} = 0$  for nongravitational matter. But this is really a *nonconservation* law—it reveals to what extent the energy-momentum of the nongravitational matter is *not* conserved. Written out in full, it becomes

$$\frac{\partial}{\partial x^{\mu}} T_{\nu}{}^{\mu} = \Gamma_{\nu\mu}^{\alpha} T_{\alpha}{}^{\mu} - \Gamma_{\alpha\mu}^{\mu} T_{\nu}{}^{\alpha} \quad (1)$$

which determines the rate at which the nongravitational matter receives energy and momentum from the gravitational field (the equation is analogous to the equation for the rate of change of the momentum of a particle,  $dp/dt = F$ ).<sup>2</sup> Most writers on General Relativity fail to acknowledge that Eq. (1) is not so much a conservation law, as a law for energy transfer; Weinberg [(1972), p. 166] and Padmanabhan [2010, p. 213] are commendable exceptions. Only in a local geodesic coordinate frame (that is, in freely falling coordinates with  $\Gamma_{\mu\nu}^{\alpha} = 0$ ) does Eq. (1) reduce to the standard form of a conservation law,  $\partial T_{\nu}{}^{\mu} / \partial x^{\mu} = 0$ , which shows that the gravitational field delivers no energy or momentum to the nongravitational matter. From this we immediately recognize that the energy and momentum of a small test mass (for which energy contributions of order  $M^2$  can be neglected) are constant, so the body remains **at rest** in the freely falling coordinates and therefore moves along a geodesic. **wrong!**

([Adam Helfer](#): "Macavity, Macavity... he **breaks the law of gravity**."

[Ref. 5] J. Barbour and N. O’Murchadha, Conformal Superspace: The configuration space of general relativity, [arXiv:1009.3559 \[gr-qc\]](#).

It was realised more than 50 years ago, due to the pioneering work of Dirac [1], and Arnowitt, Deser and Misner [2], that general relativity could be expressed as a dynamical theory, just like the other standard theories of physics such as particle mechanics or electromagnetism. In GR one can specify initial data and then integrate forward in time. The initial data for gravity consists of a spacelike 3-slice, equipped with a Riemannian 3-metric,  $g_{ij}$  and a symmetric tensor  $K_{ij}$ , which is to be the extrinsic curvature of the slice. Thus it is the time derivative of the 3-metric.

[Ref. 6] Yvonne Choquet-Bruhat, Positive-energy theorems, in: *Relativity, Group and Topology II*, ed. by Bryce Seligman De Witt and Raymond Stora, Les Houches Summer School Proceedings (Session XL, 27 June - 4 August 1983), Elsevier Science Publishers B. V., 1984, [pp. 739-785](#).

### **Introduction**

It is well known that in Einstein theory there is no intrinsic definition of a local density of gravitational energy. Physically this is a consequence of the equivalence principle (the gravitational field appears zero to an observer in free fall), mathematically it results from the fact that a connection is not a tensor. However when a background space-time is given in addition to the one we are studying, it may be possible to define an energy for the latter with respect to the former. For instance, a local positive density of energy can be defined for gravitational waves propagating in a fixed background (high-frequency waves, shock waves), by an approximation method or, better, by a rigorous asymptotic expansion. It is also possible to define the global energy of a space-time  $(V, {}^{(4)}g)$  with respect to another, given, one  $(V, {}^{(4)}\hat{g})$ , provided the latter admits a time-like Killing vector field, and the two metrics are asymptotically the same at space-like infinity. It turns out that the energy can be expressed as a flux integral at spatial infinity—in accordance with the fact that the energy of a gravitational field plays also the usual role of the charge in gauge theories. If one takes as background the vacuum of classical General Relativity, Minkowski space-time  $(\mathbb{R}^4, \eta)$  the global energy of an asymptotically Minkowskian space-time corresponds to our idea of an isolated gravitating system whose metric at large spatial distances tends to the Minkowski metric. In this context the energy is often called the mass of the gravitating system, it coincides with  $m$  for the Schwarzschild solution. It has been conjectured that this mass (energy) is positive for all space-times satisfying reasonable assumptions, in particular having sources with non-negative local energy density. This conjecture had been proved to be correct in many special cases along the years (for references see for instance the review by Brill and Pong 1980).

(Cf. Brill and Pong 1980 [above](#) - D.C.)

[Ref. 7] Enrico Bombieri, The Mathematical Infinity, in *Infinity: New Research Frontiers*, ed. by Michael Heller and W. Hugh Woodin, Cambridge University Press, 2011, [pp. 55-75](#).

=====  
Subject: [arXiv:1307.5126v1 \[gr-qc\]](#), Sec. 4 and ref. [8]  
Date: Mon, 22 Jul 2013 14:58:11 +0300  
Message-ID: <CAM7EkxnndHrzJR+m3ho8jjJ3+ADgSez+iCmDmw9F0m-33ySU=w@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Archil Kobakhidze <archilk@physics.usyd.edu.au>,  
Nicholas L Rodd <nrodd@student.unimelb.edu.au>  
Cc: Ray Volkas <raymondv@unimelb.edu.au>,  
Greg Galloway <galloway@math.miami.edu>,  
Chris Fewster <chris.fewster@york.ac.uk>,  
Romualdo Tresguerres <romualdotresguerres@yahoo.es>,  
Ettore Minguzzi <ettore.minguzzi@unifi.it>,  
Thomas Roman <roman@ccsu.edu>,  
Larry Ford <ford@cosmos.phy.tufts.edu>,  
[Jörg Frauendiener](#) <joergf@maths.otago.ac.nz>

Dear colleagues,

May I ask for clarification of your statement that your "time-symmetric quantization is causal and deals only with positive norm states."

You suggested that if "a time-symmetric quantization is used, where annihilation and creation operators are associated with both positive and negative states, the negative energy states lead to a cancelling out of the thermal effects," in line with your "reinterpretation principle" based on the crossing symmetry in transition amplitudes. However, "what one needs for the consistency of the theory is to avoid asymptotic in and out negative states" (Sec. 4, p. 6) for which crossing symmetry cannot be applied anymore -- it's [a whole new ball game](#) there.

Please help me understand (i) the \*exact\* asymptotic limit, at which you still have 'in and out' states (would you use [Wheeler-Feynman](#), ref. [8]?), and (ii) the cancellation of ['in and out' negative states](#) at this \*exact\* [asymptotic limit](#).

The opinion from your colleagues will be highly appreciated, too.

Kind regards,

Dimi Chakalov  
[chakalov.net](#)

=====

Any reference to the hypersurface  $\Sigma \rightarrow \mathcal{M}$  which carries the geometric data  $g_{ab}(x)$ ,  $p^{ab}(x)$  is conspicuously absent in the constraints (1.1) - (1.4). The hypersurface  $\Sigma \rightarrow \mathcal{M}$  represents an instant of time; the fact that it drops out of the constraints (1.1) - (1.4) underlies the problem of time in quantum gravity.

Karel V. Kuchar, [Time and interpretations of quantum gravity](#), in: Proceedings of Fourth Canadian Conference on General Relativity and Relativistic Astrophysics, May 16-18, 1991, World Scientific, Singapore, 1992

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Subject: Re: dimensionally scaled physics  
Date: Thu, 6 Jun 2013 14:36:55 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Marcos Maia <maia@unb.br>  
Cc: Karel V Kuchar <kuchar@physics.utah.edu>, Chris Isham <c.isham@imperial.ac.uk>

Dear Marcos,

Thank you very much for your detailed reply.

[snip]

> I am also attaching a copy of [Kuchar reference](#) for your delight.

Thanks, I know it very well and have quoted from it extensively. How did this "orthogonal time-like vector field" (...) has been produced? Karel stressed "the laws of an instant in canonical gravity" and then explained that the hypersurface "carries the dynamical data" (pp. 2-3, cf. [attached](#)).

But in order to "carry" these "data", the hypersurface must be equipped with \*something\* that can be expanded over at least two consecutive "instants" (relational ontology), in order to know/define where and how the data will be "carried" at the \*next\* dt, to produce some "orthogonal time-like vector field" in the first place.

Problem is, the "carrier" itself must be the Unmoved Mover: see K. Kuchar, The Problem of Time In Quantum Geometroynamics, in The Arguments of Time, ed. by Jeremy Butterfield, Oxford University Press, Oxford, 1999, p. 193,

[http://www.god-does-not-play-dice.net/#Yuan\\_OG1](http://www.god-does-not-play-dice.net/#Yuan_OG1)

Which, I believe, leads to RS gravity,

<http://www.god-does-not-play-dice.net/#FAQ>

Best wishes,

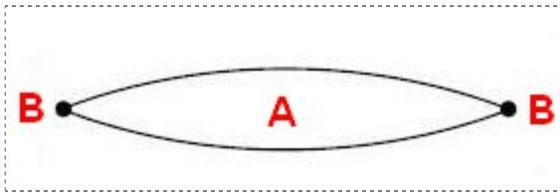
Dimi

On Sat, Jun 1, 2013 at 1:37 PM, Dimi Chakalov <dchakalov@gmail.com> wrote:

>  
> Dear Marcos,  
>  
> May I ask you for reference to your conclusion that "the topology  
> Sigma x R characterized by the global hyperbolicity of Einstein's  
> equations is not consistent with the principle of general covariance  
> of GR." I would like to quote you in my forthcoming paper on RS  
> gravity.  
>  
> I think the issue with general covariance goes back to Erich  
> Kretschmann's paper from 1917. My efforts to understand it (not solve)  
> is posted at  
>  
> <http://www.god-does-not-play-dice.net/#Scharf>  
>  
> To be specific: once we introduce time-orientability, we're in murky  
> waters -- where does it come from?  
>  
> <http://www.god-does-not-play-dice.net/#Waldyr>  
>  
> Perhaps we should start from the so-called global mode of spacetime,  
> which is a continuum of space&imaginary time, as suggested by Arthur  
> Eddington,  
>  
> <http://www.god-does-not-play-dice.net/#Eddington>  
>  
> Then we introduce a \*[self-action](#)\* of the universe **on itself** (...),  
> which makes this continuum [3+1-foliatable](#) (sorry for my English),  
> and "time" shows up with real sign in a physical universe (local mode  
> of spacetime) -- one-instant-now-at-a-time.  
>  
> It is a bit like taking photos in a dark room with camera equipped  
> with flash -- you produce a "sequence" of photos, and you imagine  
> some global Killing field which has arranged them "along time", but  
> you cannot see the initial "dark room" with your flash camera. The  
> latter also acts on the free falling elevator by pulling it "up" --  
> [one-pull-up-at-a-time](#) -- thanks to which we have only positive  
> mass endowed with inertia.  
>  
> So, where does time-orientability come from? Certainly not from  
> thermodynamics. Any suggestions?  
>  
> I hope Laszlo, Domenico and Waldyr can offer some smart ideas.  
>  
> Best regards,  
>  
> Dimi  
>  
>

**Note:** The (i) "carrier" (see [above](#)) and (ii) the **binding agent** connecting any two neighboring "points" (to obtain *perfect* continuum in the local mode of spacetime) are one and the same entity (called "**it**"), which must be **nullified** -- one-at-a-time -- in the physical world. In the [global mode](#) of spacetime, **it** is "positioned" *both* [between](#) neighboring points *and* on the very "edge" of spacetime in terms of its "[boundary](#)", being *both* infinitely close to the **every 'world point'** *and* infinitely away from it. It is hopeless to seek some "[tiling of spacetime](#)" or "[differentiable embedding](#)" to [connect the dots](#).

Now, people *imagine* some 'asymptotically flat spacetime', such that at *every* point "the coordinates (at point **A** below - D.C.) are **asymptotically** those of a flat spacetime with inertial rectangular coordinates" ([Hans Ohanian](#), private communication), because they deeply *believe* that such 'asymptotically flat spacetime' can be reached with *the same recipe* we use in [differential calculus](#). Wrong. See the drawing below.



Relative Scale ([RS](#)) gravity

Point **B** to the *right* should be the "end point" of [spacelike-and-null infinity](#), which will always be pathologically ill-defined in current mathematical relativity. Why? Because you try to reach it from *within* spacetime, using *only* [Archimedean geometry](#), but this "end point" **B** must be **different** from the rest of points *within* spacetime at macroscopic length scale, such as point **A**. You simply claim, after [Roger Penrose](#), that have somehow "eliminated" the "unphysical" or "ambient" spacetime ([Steven Harris](#)), *with respect to which* the physical spacetime could obtain its "boundaries". Such 'golden oldie' miracle requires "certain smoothness" to allow "null infinity to be represented by a conformal boundary, a hypersurface of some smoothness in the extended space-time" ([Helmut Friedrich](#)). The problem is that such **perfect** "smoothness" ([Piotr Chrusciel](#) mentioned "smooth" and "smoothness" 66 times) is a dream -- see Paul Tod's '[Big Question](#)'. Mathematically, in [open sets](#) "the **end** points  $x = a$  and  $x = b$  are **excluded**" (Ian Lawrie, [p. 17](#)). The whole story, modulo the exotic math, resembles a well-known cartoon with [Pink Panther](#), who sucked the entire spacetime (up to its asymptotic boundaries at [spacelike-and-null infinity](#)) in his vacuum cleaner, and then himself, and finally the vacuum cleaner **sucked itself** and disappeared into "nothingness", or perhaps "[singularity](#)":



As an example, consider Helmut Friedrich, 'Conformal Einstein evolution', arXiv:gr-qc/0209018v1, Time-like infinity, Sec. 4.4, p. [42](#): it's a **dead-end**, suggested with a bunch of additional unreasonable assumptions (e.g., [Bernard Schutz](#)). But you have no choice, because if you wish to calculate the asymptotic "boundary" of spacetime, the latter must be mathematically well-defined:

either infinite, which makes no physical sense, or bounded by some **finite** value. So no matter what you do, you're destined to produce poetry like [Pink Panther](#) (I'm trying to be polite here).

If you try to bypass this asymptotic mess ([John Stewart](#)), you'll need to supplement the *initial* conditions by *boundary* conditions, but in the case of Einstein equations there can be no "boundary conditions" in the first place. "For instance, we do not know how to build a mirror for gravitational waves", acknowledged Alan Rendall ([pp. 43-44](#)). Yet he believes that "the problem of proving general global existence theorems for the Einstein equations is beyond the reach of the mathematics presently available" ([p. 5](#)), as if such task were feasible, even in principle. Again, it's all very simple: recover the topological **dimensions** themselves, so that we could "look around, and see as far as we like" ([Lee Smolin](#)). Only "the theory does not allow us, even in principle, to extend solutions arbitrarily far in one direction" ([Martin Bojowald](#)). And there's nothing you can do to fix it. Nothing.

In Relative Scale ([RS](#)) gravity, on the other hand, spacetime has dual nature: every 'asymptotically flat spacetime' is being produced by the Arrow of Space as 3-D "slice" valid for one-instant-now-at-a-time, while the remaining possible "slices" (recall John Wheeler's "[cloud](#)") are kept at *this instant 'now'* as 'potential reality' in the form of pre-quantum Kochen-Specker state of the whole universe as ONE.

Hence at each instant 'now' we have **re**-parameterization of the "gravitational field", and **nothing else** ([Günter Scharf](#)). Thus, trace-free "conservation" equations ([George F R Ellis](#)) resemble the act of "measurement", such that the underlying quantum-gravitational "state" can be "disposable", but only for *this instant 'now'*. If you ignore the dynamic "measurement" of the whole universe, which **it** executes **on itself** one-at-a-time, you will have to treat all *potential* particle states in the quantum vacuum as 'objective reality subject to gravitation', and will immediately reach *reductio ad absurdum*: the radius of the universe "could not even reach to the moon," as calculated by [Wolfgang Pauli](#).

No, you cannot model spacetime like [bartenders](#) or [Chuck Norris](#). We need new mathematics to model the "carrier" itself. **It** can only show up as 'pure mathematics', because the "carrier" is nothing but the *self-action* of the universe. It may look "dark" to some [people](#), because nobody can *physically* trace back the *self-acting* Unmoved Mover: *Der Geist bewegt die Materie* (Virgil's *Mens agit at molem, The Aeneid, Ch. 6, 727*).

Physically, we can only observe a *self-acting* 'universe as a brain', just as we cannot detect the human mind in its brain, but only a self-acting brain.

D. Chakalov  
June 12, 2013  
Last updated: June 17, 2013, 21:23 GMT

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Subject: [arXiv:1306.3021v1 \[gr-qc\]](#), p. 2 and Sec. 6  
Date: Fri, 14 Jun 2013 15:15:44 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: George <george.ellis@uct.ac.za>

Cc: [snip]

George,

You know very well that the so-called trace-free conservation equations for the total energy-momentum tensor (p. 2) are [red herrings](#).

Sir Hermann Bondi, for example, has explained the issue many years ago (Conservation and non-conservation in general relativity, Proc. R. Soc. Lond. A 427 (1990) 249-258): "... the extra terms (not includable in a Green's type function) precisely describe the transfer between the \*intangible\* energy of the gravitational field (as it will be called here), which is not described by the energy-momentum tensor, and the tangible forms which are so described."

You aren't stupid, George. Your suggestion that the vacuum energy may not affect spacetime geometry, because it were "arbitrarily disposable" (Sec. 6), is nothing but a joke -- you know bloody well the unsolved issues with the transfer of 'tangible forms of energy' by/from the \*[intangible](#)\* object, which Einstein simply called "a total field of as yet unknown structure",

<http://www.god-does-not-play-dice.net/#outline>

I know you for over twenty years, and am sure you won't acknowledge that your speculations are 'not even wrong'. Using your "logic", one would claim that the quantum state(s) were "arbitrarily disposable" as well: see Ernst Paul Specker at

<http://www.god-does-not-play-dice.net/#ETH>

No need to reply to this email, just try to get serious about the unfinished theory of Albert Einstein.

I extend this gentle suggestion to all colleagues of yours.

Dimi

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Dimi Chakalov

<http://tinyurl.com/bold-facts-9-11>

<http://tinyurl.com/steel-evaporation>

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Subject: Gravity and Faster than Light Particles, [arXiv:gr-qc/0611124v4](http://arxiv.org/abs/gr-qc/0611124v4)

Date: Tue, 18 Jun 2013 14:23:56 +0300

From: Dimi Chakalov <dchakalov@gmail.com>

To: Asher Yahalom <asya@ariel.ac.il>

Cc: James Woodward <jwoodward@fullerton.edu> ,

Peter <peter.evans@sydney.edu.au> ,

John <cramer@phys.washington.edu> ,

Chris Fewster <chris.fewster@york.ac.uk> ,

Marcos Maia <maia@unb.br> ,

Salvatore Capozziello <capozzie@na.infn.it>

Dear Asher,

May I ask a question.

I wonder if you can tweak your suggestion that "a particle which travels radially in a Friedman-Lemaitre-Robertson-Walker metric passing outwards the critical radius of [XXX] and then coming back at superluminal velocities" to match the idea of a standing \*[atemporal](#)\* gravitational wave:

James F. Woodward, Gravitation: The Origin of Inertia,  
<http://physics.fullerton.edu/~jimw/general/inertia/index.htm>

"The act of pushing on something causes a disturbance in the gravitational field to go propagating off into the future. It makes stuff (the "absorber") out there wiggle. When the stuff wiggles it sends disturbances backward (and forward) in time. All the backward traveling disturbances converge on what we're pushing and generate the [inertial reaction force](#) we feel. No physical law is violated in any of this. And nothing moves faster than the speed of light. It only seems so because of the advanced waves traveling at the speed of light in the backward time direction."

The opinion of your colleagues will be highly appreciated as well.

Sorry for my unsolicited email; I was never able to understand the origin of inertia.

All the best,

Dimi

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**Note:** Instead of speculating about "forward" and "backward" time direction(s), viz. hyperbolic and elliptic evolution equations ([Gryb and Mercati](#)), use the *atemporal* global mode of spacetime inhabited by **one** standing gravitational wave (cf. Fig. 5 [above](#)): the stuff that "moves" in the global mode is the topology of spacetime, which is being "flattened" at every instant 'now' from the *local* mode as 'asymptotically flat spacetime'. The latter is analogous to the ["measuring device" in QM](#). Simple, no?

Bear also in mind the pictorial expression of Mach's principle ([Ciufolini and Wheeler, p. 270](#)): what happens at asymptotic infinity determines the geometry of spacetime & positivity of mass, which in turn determines what happens *right here-and-now*, and *vice versa*. It's a "bi-directional" *atemporal* negotiation between '[the school of fish](#)' and any (quasi-local) fish *here-and-now*. In the present GR textbooks, you may have, at best, only one completed cycle of negotiations, i.e., only one "clap":



There can be no dynamics whatsoever in these textbooks ([Karel Kuchar](#)). None. You can try to *bypass* the issue **iff** you have dead fixed metric and topology pertaining to some flat background spacetime, hence you can fix the initial & boundary conditions, say, for a trajectory of your Frisbee.

Have a nice summer.

D. Chakalov

June 24, 2013, [13:10:43 GMT](#)

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Subject: The unphysical spacetime, [arXiv:1307.0321v1 \[gr-qc\]](#) and [arXiv:1306.6204v1 \[gr-qc\]](#)

Date: Tue, 2 Jul 2013 12:56:24 +0300

From: Dimi Chakalov <dchakalov@gmail.com>

To: Tim-Torben.Paetz@univie.ac.at

Cc: Helmut Friedrich <hef@aei.mpg.de> ,

Piotr T Chrusciel <piotr.chrusciel@univie.ac.at> ,

Roger Penrose <rouse@maths.ox.ac.uk>

Dear Dr. Paetz,

I wonder if you can define the unphysical spacetime in such way that the global properties of physical spacetime, solution of the Einstein field (not vacuum) equations, can be defined as well.

In my approach, I use a [non-dynamical](#) \*global mode\* of spacetime (not non-dynamical "background field"), but if you can solve the task (Helmut, Piotr, and Roger still can't), I will gladly use your brand new theory.

All the best,

Dimi Chakalov  
[chakalov.net](#)

**Note:** Suppose, for the sake of the argument, that [Tim-Torben Paetz](#) and his colleagues (they all are very good in [math](#)) were able to somehow "[extend](#)" matter in the RHS of Einstein field equations (EFE) from *here-and-now* (cf. the [initial boundary value problem](#)) to [null-and-spacelike infinity](#) -- **exactly** to the "asymptotic boundary" of spacetime. If so, there would be no need for 'unphysical spacetime', because *after* solving these brand new [EFE](#) the whole spacetime will be defined *with respect to itself*.

But here's the problem: the mathematics itself does not permit such self-referential and self-acting [miracles](#). One cannot produce *theorems* with which one can *prove* the global existence of topological dimensions and the positivity of (quasi-local) mass. In fact, the gravitational energy density at a point is not *definable* in the first place, so it is **impossible** in principle to *prove* that [energy](#) is, or is not, "[conserved](#)".

Such global tasks are *impossible* in GR, and they **must** be banned from the outset.

Why? Here's a very simple explanation. Suppose GR were "classical theory", as people declare in [textbooks](#). Then you need a critical **boundary** of the integration domain (Walter Wyss, [p. 304](#)):

## 6 Equations of motion and conservation laws

The equations of motion are given by demanding that the action Eq. (1) is stationary, i.e. has a critical point under variations where on the boundary of the integration domain  $\delta x^\mu = 0, \delta_* \phi = 0$  and  $\delta_* \phi_\mu = 0$ .

Such "[edges](#)" would define the "boundary" of spacetime at [null-and-spacelike infinity](#), and would **reflect** the gravitational waves like a mirror (as observed by [Chuck Norris](#)), but (i) "we do not know how to build a mirror for gravitational waves" (Alan Rendall, [pp. 43-44](#)) and (ii) Killing vector field that "[preserves the metric](#)" at these mirror "[edges](#)". But even if you miraculously managed to obtain such "mirror" without [quantum gravity](#), you will inevitably ruin that Killing vector field and expose the "unphysical spacetime" **beyond** these "[edges](#)", which of course **must** be banned from the outset. Q.E.D.

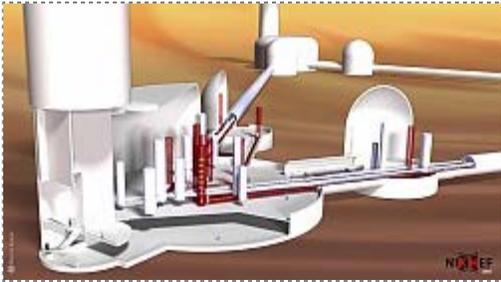
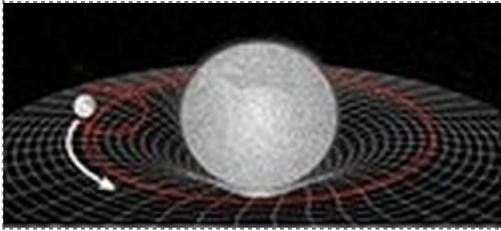
D. Chakalov

July 3, 2013

Last updated: July 4, 2013, [12:34:53 GMT](#)



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Subject: Waiting for Godot: Gravitational wave astronomy  
Date: Mon, 1 Apr 2013 12:28:26 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: [snip]

Ladies and Gentlemen,

LIGO is for the birds. You don't have any theory for detecting GWs. Your ideas and hopes are based solely on wishful thinking, and contradict the full nonlinear General Relativity.

Just two facts: you don't have any "weak limit" (John Stewart) and haven't even tried to explain the effect of inducing stress in matter (Robert Wald),

<http://www.god-does-not-play-dice.net/#madness>

<http://www.god-does-not-play-dice.net/#BMS>

Why are you ignoring the facts?

Why are you wasting taxpayers' money?

Please reply professionally.

Sincerely,

Dimi Chakalov

P.S. If you are good in math, check out  
<http://www.god-does-not-play-dice.net/#rotation>

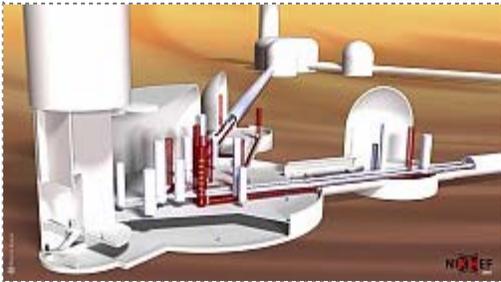
D.C.

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**Note:** The so-called linearized gravitation can be used for calculating simple effects from "curvature" (e.g., correcting the [GPS system](#)), but cannot be used to explain the [self-interaction](#) of gravity, and subsequently to build GW detectors capable of detecting **itself**. With respect to *what*? There are two alternatives: either some "extra-dimensional" superstitions ([Naresh Dadhich](#)) or a new [quantum gravity](#) in which matter interacts with *itself* in its *potential quantum-gravitational "it"*.

People speak about "total energy  $E_{GW}$  carried in a gravitational-wave burst" (reference [here](#)), but never explained the conversion of *intangible* gravitational energy into tangible one ([Hermann Bondi](#)) at *every* spacetime point (MTW, [p. 467](#)) from its path to LIGO arms, starting from strongly nonlinear "astrophysical sources" (Michele Maggiore, [p. 32](#)). Same story in parapsychology with detecting "psi energy", since they haven't explained the conversion of "psi energy" into some tangible form of energy either.

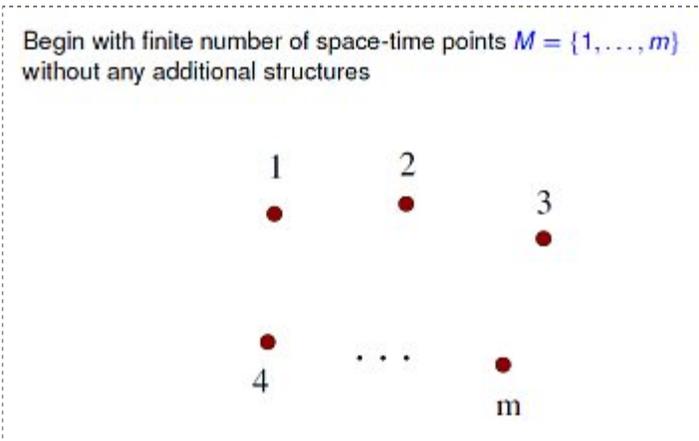
Do you agree to have "[at least 3-4 billion dollars](#)" wasted in GW parapsychology by 2020?



The next [wine cellar](#) (pictured above) will cost at least \$1,280,000,000 ([€790M](#)). It will be built underground at a depth of about 100–200 m and will consist of three *very* large wine cellars, linked by 10 km long wine shelves. Cheers!

D. Chakalov  
 April 2, 2013, 08:50 GMT

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Subject: [arXiv:1107.2026v3 \[math-ph\]](#)

Date: Thu, 4 Apr 2013 05:37:42 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Andreas Grotz <Andreas.Grotz@mathematik.uni-regensburg.dx>,  
Felix Finster <felix.finster@mathematik.uni-regensburg.dx>  
Cc: Torsten Thumstädter <torsten.thumstaedter@math.uni-mannheim.dx>,  
Roman Sauer <roman.sauer@kit.edx>

Dear colleagues,

I agree that "there is no consensus on what the mathematical framework of quantum geometry should be", and suggest to examine the facts at

<http://www.god-does-not-play-dice.net/#ETH>

<http://www.god-does-not-play-dice.net/#rotation>

The task is strictly mathematical. Will be happy to help.

Kind regards,

Dimi Chakalov

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**Note:** Suppose the primitive points above belong to a Borel set. Notice that the "number" of these points is not finite but *unphysical* -- uncountably infinite -- and that they form a continuum of physical reality. There exists an object which does not belong to this set, and which produces *the* elementary connection "between" these points: the universe as ONE. The latter belongs to the sufficient conditions for spacetime, which inhabit the *potential* quantum-gravitational "it" from the Arrow of Space, called global mode of spacetime. The general idea is to present the primitive points above as *emergent* phenomenon, called local (physical) mode of spacetime, which builds up the topological dimensions of the physical world -- one-point-at-a-time along the Arrow of Space. Keep in mind that the building process is "hidden" by the "speed" of light, which is why we cannot witness the global mode of spacetime "between" the physical points in the local mode: at every instant 'now', the "gap" of the universe as ONE has been **re-rendered zero** by the Arrow of Space, yielding a **perfect continuum** of physical reality. Thus, the geometry itself is *quasi-local*, and every "point" has **structure** which leads to the universe as ONE: "a total field of as yet unknown structure" (Albert Einstein). Then we can introduce quantum-gravitational matter on these "points" and obtain their exact limit.

Again, the task is strictly mathematical. But as John Coleman noticed, "it is extremely difficult to induce penguins to drink warm water".

If your brain can understand the saying above, try another one here.

D. Chakalov  
April 4, 2013  
Last updated: April 6, 2013, 11:31 GMT

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Subject: arXiv:1208.3749v4 [gr-qc], "a parametrization of the gravitational field and nothing else"  
(p. 3)  
Date: Thu, 9 May 2013 17:27:53 +0300

From: Dimi Chakalov <dchakalov@gmail.com>  
To: Günter Scharf <scharf@physik.uzh.ch>  
Cc: [Luca Lusanna](mailto:luca.lusanna@fi.infn.it) <lusanna@fi.infn.it>

Dear Dr. Scharf,

May I comment on your ideas.

I think your statement in the subject line resembles KS Theorem, in the sense that in both cases we face a fundamental object that cannot be directly observed,

<http://www.god-does-not-play-dice.net/#ETH>

To fix the gauge ambiguity by observables, see

[http://www.god-does-not-play-dice.net/#RS\\_gravity](http://www.god-does-not-play-dice.net/#RS_gravity)

A penny for your thoughts.

Kind regards,

Dimi Chakalov

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**Note:** There are various nontensorial "energy-momentum complexes" (Sibusiso S. Xulu, [Ch. 2](#)), which offer a dubious "freedom" to mathematical physicists to either produce obviously wrong results or perfectly "correct" ones, that is, confirmed by experiment or observations. Such "freedom" is well-known from [KS Theorem](#); the difference is that in GR we have "[pure energy](#)" which is explicated *by* (not with) a "measuring device" -- asymptotically Minkowskian spacetime (equipped with rectilinear coordinate systems) at **spatial** infinity  $r \rightarrow \infty$ , which executes "a parametrization of the gravitational field and nothing else" ([Günter Scharf](#)) -- **one-at-a-time**.

People have the "freedom" to ignore all obviously wrong "measurements" that have never happened, and happily use only those that they know, from the outset, that will work. Yet the same people would insist that GR were "classical theory", as if one could determine the gravitational energy density *at a point*. Of course you can't and shouldn't be able to do it, or else there will be a background spacetime in GR, defined by the matter-energy content of these perfectly localizable points, and '[the grin of the Cheshire cat](#)' won't be **geometry** but will contain *physical* stuff from the cat.

D. Chakalov  
May 17, 2013  
Last updated: June 16, 2013

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[The Wilson chamber](#)

Subject: Re: Corrections  
Date: Thu, 4 Apr 2013 04:47:26 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Jürg <juerg@phys.ethz.ch>,  
Nicolas <nicolas.gisin@unige.ch>,  
Antoine Suarez <suarez@leman.ch>  
Cc: [snip]

Dear Jürg, Nicolas, and Antoine,

Thanks to the discovery of Charles Thomson Rees Wilson in 1911, the localization of a single quantum particle is now *the* most widely known public secret in theoretical physics -- see the second link in my email below.

Can you acknowledged this fact? If you can, please try to suggest an alternative explanation, and write me back. The professional opinion of your colleagues will be appreciated as well.

If you cannot, would you at least tell your younger colleagues that you are already incapable of thinking as scientists? Then there will be no sense to reply to my email, of course.

All the best,

Dimi Chakalov

On Thu, 4 Apr 2013 03:29:37 +0300, Dimi Chakalov <dchakalov@gmail.com> wrote:

>  
> Dear colleagues,  
>  
> May I offer corrections to your ideas, starting from the basic facts at  
>  
> <http://www.god-does-not-play-dice.net/#ETH>  
>  
> <http://www.god-does-not-play-dice.net/#localization>  
>  
> Kind regards,  
>  
> Dimi Chakalov

=====

Subject: Re: Corrections  
Message-ID: <CAM7EkxkCwOgvJe6fZGQE+N3sOChMxnh2z8qF\_jFJq0LmRb+zGw@mail.gmail.com>  
In-Reply-To: <653e8789364e9fd8524a4c82af55238e@phys.ethz.ch>  
Date: Thu, 4 Apr 2013 05:26:55 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: juerg <juerg@phys.ethz.ch>  
Cc: Nicolas <nicolas.gisin@unige.ch>, hugo.zbinden@unige.ch, wiese@itp.unibe.ch, norbert.straumann@gmail.com, gian-michele.graf@itp.phys.ethz.ch, wolfst@inf.ethz.ch, renner@phys.ethz.ch

On Thu, Apr 4, 2013 at 5:03 AM, juerg <juerg@phys.ethz.ch> wrote:

>  
> I don't know anybody else who insists to get lectures via e-mail for free

Jürg dorogoi,

You are indeed [Russian](#).

The facts are on the table since [1911](#).

D.C.

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>> Dear Jürg, Nicolas, and Antoine,  
[snip]

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Subject: Re: 200 wrong theories for the cosmological constant, by Hooft 't G.  
Date: Sun, 7 Apr 2013 01:46:52 +0300  
Message-ID: <CAM7EkxmdGaYX-tKtkQeAo-Mm=ddHbEqztq2R0=cZdTFSy6EaGQ@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Gerardus <g.thooft@uu.nl>

Gerardus,

Twelve years ago (Fri, 6 Apr 2001 11:04:56 +0200), you probably knew nothing about my theory, yet offered me to provide for the 201st reference in your paper about wrong theories for the cosmological constant.

Seven years ago (Tue, 4 Apr 2006 15:12:24 +0200), you declared that my website "contains too much obvious nonsense", and again failed to show at least one example.

The explanation of "dark" energy is here:

<http://www.god-does-not-play-dice.net/#ETH>

It is similar to the explanation of "[spin](#)", but you wouldn't even try to study it, because you already can't. You are perfect example for a physicist who had all the facts at the tip of his fingers, but couldn't connect the dots, because he had become "famous". Which is regretful, because back in 1970s when you weren't "famous" you were very good at math.

I will explain your case in my forthcoming book, and will quote from your post-famous insights. You were very instrumental indeed.

No need to reply, of course. I know you can't.

D. Chakalov

On Fri, 6 Apr 2001 11:04:56 +0200, "Hooft 't G." <G.tHooft@phys.uu.nl> wrote:

[snip]

> Then the cosmological constant. it is not understood. I once  
> planned to write a paper entitled: "200 wrong theories for the  
> cosmological constant", with 200 references. Needless to say that  
> most of these theories are also mutually exclusive. The right theory  
> has not been found. You are wellcome to provide for the 201st  
> reference in my paper.

[snip]

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Subject: Re: [arXiv:1304.1003v2](#) [physics.hist-ph]

Date: Wed, 17 Apr 2013 12:39:47 +0300

From: Dimi Chakalov <dchakalov@gmail.com>

To: Zeh <zeh@uni-heidelberg.de>

Cc: [\[snip\]](#)

Dieter,

You also wrote ([arXiv:0809.2904v6 \[quant-ph\]](#), p. 11): "I do not know of any discrete quantum phenomenon in space or time that can not be described by means of decoherence."

Yes you do. It is known since 1912 -- see the facts at the links below.

No need to invent the wheel.

But if you and your colleagues cannot read English, then perhaps your brains are messed up by "[decoherence](#)", so you won't reply, because you can't, and will continue with the Balkanization of physics.

D.

On Wed, Apr 17, 2013 at 11:53 AM, Dimi Chakalov <dchakalov@gmail.com> wrote:

>

> P.S. You wrote ([p. 12](#)): "Decoherence was the first successful  
> application of entanglement beyond microscopic systems, and it  
> explains also why one seems to observe individual atoms as apparent  
> particles in a Paul trap or tracks in a Wilson chamber."

>

> Wrong, again. See the link in my initial email and *the* most widely  
 > known public secret in theoretical physics:  
 > <http://www.god-does-not-play-dice.net/#localization>  
 >  
 > If you or any of your colleagues can solve the puzzle known twenty  
 > years before you were born, please drop me a line.  
 >  
 > If you can't, please face the facts and avoid further Balkanization of  
 > physics (Eugene Wigner). Enough is enough.  
 >  
 > D.  
 >  
 > On Wed, Apr 17, 2013 at 11:05 AM, Dimi Chakalov <dchakalov@gmail.com> wrote:  
 >>  
 >> Dieter,  
 >>  
 >> See what you again missed:  
 >> <http://www.god-does-not-play-dice.net/#ETH>  
 >>  
 >> Do you read English?  
 >>  
 >> Dimi

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[The Wilson chamber](#)

**Note:** The "discrete quantum phenomenon in space or time" (see H.-Dieter Zeh [above](#)) is the chain of water droplets, which make the *macroscopic* trajectory in Wilson chamber. As John Gamble tried to suggest on [24 May 2008](#), "the state operator is a representation of all possible superposition and product states of a given system. Due to the probability normalization condition imposed on a system, the state operator must always have unit trace. In Mott's case, each track corresponds to a diagonal element of the state operator of the particle, while the superpositions of multiple tracks correspond to off-diagonal elements, which decoherence destroys."

But the question isn't about *which* track or trajectory has been selected from all possible ones, but *how* it is made by [energy exchange](#). How do you explain the *successive* build up of "decohered" particle "states" by [energy exchange](#) along **one** trajectory above? How is the (quantum?) time of one particle been made by [energy exchange](#), in order to match the duration of the [visible trajectory](#)?

Try to explain the invisible *quantum trajectory* of one single quantum particle: its mapping to, and interaction by [energy exchange](#) with the visible *macroscopic* trajectory above; see a recent example from CERN [here](#).

Contemporary QM textbooks ([Landau and Lifshitz](#)) cannot say anything about the actual state of affairs in the quantum world 'out there', such as the successive build up of **two** trajectories, invisible (quantum) and macroscopic, by [energy exchange](#) between them -- every water droplet along the "horizontal" direction of the **discrete** and observable trajectory is produced by "vertical" energy

exchange with one quantum particle 'out there'. You can't calculate it with [Feynman path integral](#) either.

You'll need the basic basics of [Quantum Theory](#) -- only *one* "jacket" (e.g., "cloud") is being explicated as 'physical reality' in the quantum world 'out there' (local mode of spacetime): one-at-a-time, and with **certainty**<sup>1</sup> (no need for any "non-unitary "R" process", [Steve Adler](#)). Then the "jacket" interacts "vertically" with its macroscopic environment in the [Wilson chamber](#), while its UNSpeakable pre-quantum source "[John](#)" propagates "horizontally" along its track in the quantum world 'out there'. This is the crux of [localization](#) -- *the* most widely known public secret in theoretical physics.

As to gravitation, the ultimate task is to **re**-build spacetime -- one-point-at-a-time along the *flow* of time (cf. YAIN, option (iii) [above](#)), **also** with unit probability. John Baez once said that "one can dig oneself into a hole by trying to do physics without any background structure - it's a bit like trying to paint a painting without any [canvas](#)." True, but the "canvas" can only be made (i) by matter **itself** and (ii) one-point-at-a-time -- not by some detachable "medium" acting as a [reference fluid in GR](#). This is *the only possible* road to quantum gravity, because there can be no background in GR ([Karel Kuchar](#)). I was hoping to explain this issue in July 2004 at GR17 in Dublin, but [Thomas Thiemann](#) (currently at [Erlangen University](#)) didn't allow me to speak -- typical [communist censorship](#).

Anyway. I wonder what life would be today, if [101 years ago](#) physicists didn't ignore the discovery of Charles Thomson Rees Wilson. Perhaps nobody would be searching for gravity in high-energy physics, simply because "gravity" isn't there: we have two *forms* of entanglement, quantum and astrophysical, and the latter produces "[rotating](#)" stuff *without* any ("dark") physical basis, just as "[spin](#)". The fundamental entanglement is from 'the universe as [ONE](#)' -- exactly as Einstein would have expected about the '[total field of as yet unknown structure](#)' which becomes *physicalized* as '[positive mass](#)' (not "[dragging](#)" through some Higgs field). Sure enough, nobody would have spent over [seven billion Euro](#) to catch some "[god particle](#)" either: the *source* of matter resembles a pre-quantum virtual "[dough](#)" of **pure energy**, which cannot be matter, just as 'time' cannot be made of milli-milli-milli-*etc*-seconds.

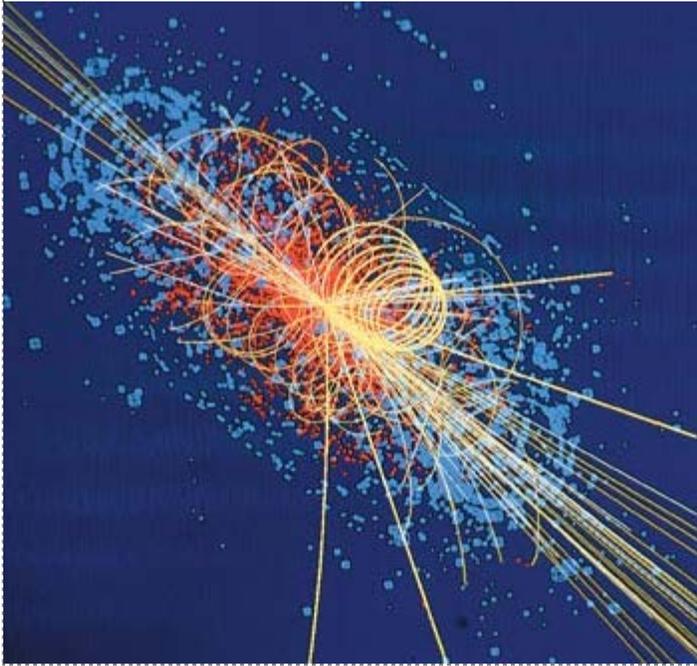
More from [Max Planck](#).

D. Chakalov  
April 17, 2013  
Last updated: April 28, 2013, 21:05 GMT

<sup>1</sup> The textbook interpretation of QM is that "objects are represented by waves that extend throughout space, containing all the possible outcomes of an observation - here, there, up or down, dead or alive. The amplitude of this wave is a measure of the probability that the object will actually be found to be in one state or another" ([D. Overbye](#)), but as Erwin Schrödinger stressed in [November 1950](#), a probabilistic assertion "presupposes the *full reality* of its subject", which is in turn **wrong**.

D. Chakalov  
April 26, 2013, [21:32:48 GMT](#)

=====



Subject: Balkanization of physics at CERN  
Date: Thu, 18 Apr 2013 16:04:21 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: GERALDINE.SERVANT@cern.ch,  
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GIAN.GIUDICE@cern.ch,  
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GEORGI.DVALI@cern.ch,  
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GEORGE.ZOUPANOS@cern.ch,  
John.Ellis@cern.ch,  
James.Gillies@cern.ch,  
th-unit-secretariat@cern.ch,  
Cc: [snip]

Ladies and Gentlemen,

Unlike that Russian "billionaire" Yuri Milner, who would gladly give you [millions of Euro](#) to play with some "god particle", I exposed your balkanization of physics at

<http://www.god-does-not-play-dice.net/#balkanization>

When will you face the facts known for more than a century? Of course you know these facts -- you are anything but stupid.

Pity you can't respond -- see the link above. We could have a jolly good discussion of your childish hobby and the taxpayers' money you've been wasting -- [billions and billions of Euro](#).

D. Chakalov

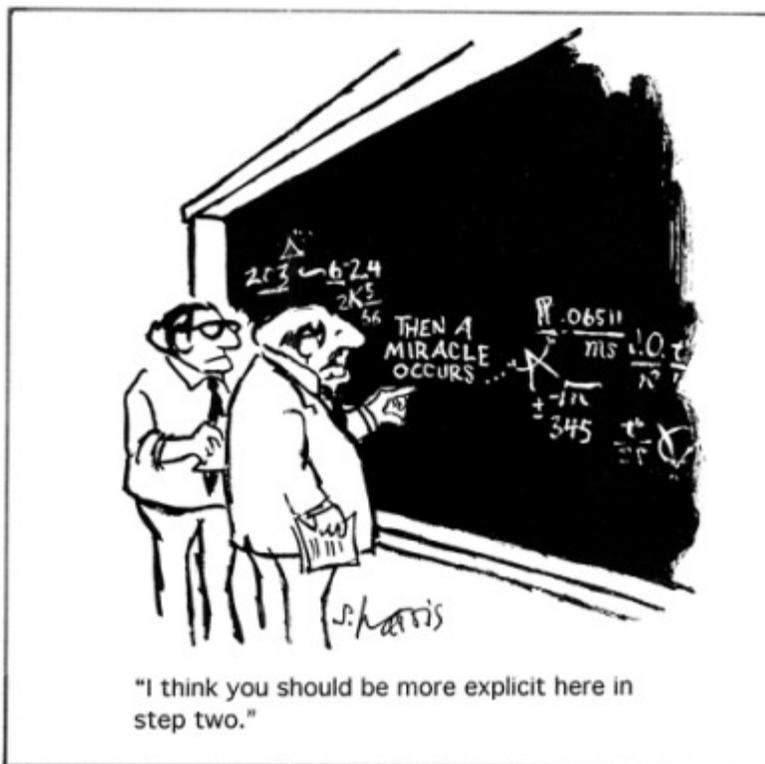
-----  
**Note:** [People at CERN](#) are *anything* but stupid. They know very well that probability does not, and cannot carry **energy** to make the visible trajectory [above](#). But instead of resolving the puzzle from 1912, they use its [modern version](#) in their PR campaign, and just ask for more money. **Ridiculous!**

Ten years ago (Thursday, January 9, 2003, 15:56:04 GMT), I predicted that the Higgs will not be discovered. Instead, the number of quarks will jump to 8 and more, in a [Fibonacci sequence](#). The only reaction received was from [Roman Jackiw](#), but it wasn't professional.

Nobody has made so far any comments on my [theory of gravity](#), although its bootstrap philosophy is widely known. I think people at [CERN](#) should get serious about their "standard model", instead of just asking for additional [billions of euro](#) to detect some putative Higgs field that "permeates the entirety of space, from the infinitesimal pinch between the constituents of atomic nuclei and the incomprehensible stretches of nothingness that separate galaxies" ([Ian Sample](#)). Instead, they proclaimed that "[the heaviest boson ever found](#)", or maybe some special [spin-2 particle](#), *might have been present*.

"It's hard not to get excited by these results," said CERN Research Director Sergio Bertolucci on [4 July 2012](#). But it is sick, not "exciting", that nobody at CERN understands their own results. The crux of the puzzle is *generation* of proton mass, fixed by the quantum vacuum with an [error margin](#) of **one** part in  $10^{45}$ . Since they don't have *any* theory to explain such astonishing precision by which the quantum vacuum produces the "source particles" for their experiments, people at CERN have in fact employed a *miracle* in their "theory".

The whole hunt for "[god particle](#)" is a joke, albeit horribly expensive -- **billions and billions of euro** have been wasted to satisfy their sheer curiosity.



[People at CERN](#) need only pencils and blank notebooks to work out the [structure of electron](#) [Ref. 1] and explain its [localization](#). Sure enough, the number of quarks will only jump to 8 and more, in

[Fibonacci sequence](#) -- as suggested [previously](#), at the level of [QCD](#), the 'possessed observables', such as mass and charge of an electron ([Henry Margenau](#)), are "absorbed" in the *potential reality* as well.

It's all quarks down the road, yet there **must** be a limit on the *current* number of quarks, similar to [Planck scale](#). Yet we can't even imagine detector of [Planck mass](#). So, why waste time and money?

D. Chakalov  
April 27, 2013  
Last updated: May 9, 2013, [10:47:38 GMT](#)

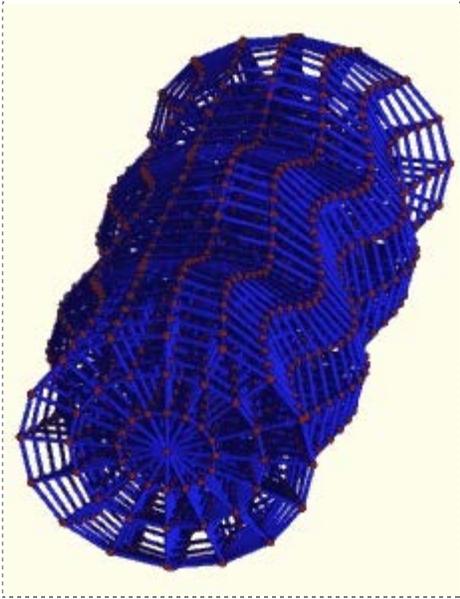
[Ref. 1] Mendel Sachs, *Quantum Mechanics and Gravity*, Springer, 2004, [pp. 136-137](#).

## 7.5 Infinite Lepton Spectrum

In the nomenclature of elementary particle physics, a lepton is any particle that does not couple to nuclear particles with the strong interaction – such as the strength of coupling of a neutron to a proton in the domain of an atomic nucleus. Examples of such matter fields are the electron, muon and neutrino.

The generation of the muon from an electron was seen to be the effect of the observed electron exciting a particle–antiparticle pair of the physical vacuum to an excited level, thereby altering the geometrical fields that define the inertial mass of matter. But if the observed electron excited two or more particle pairs of the physical vacuum, other heavier sisters - leptons – of the electron could be generated, which we may call  $\tau$ ,  $\tau'$ ,  $\tau''$ , etc., and their accompanying neutrinos. That is, an infinite spectrum of leptons could be generated. This result would be in contradiction with the prediction of the Standard Model of contemporary elementary particle physics, which predicts the existence of only three leptons, and their accompanying neutrinos. Experimental physics has thus far verified the existence of the  $\tau$  particle – in this theory, the first of an infinite spectrum of such particles of matter.

-----



Subject: Re: [arXiv:1305.0777v1 \[gr-qc\]](https://arxiv.org/abs/1305.0777v1), "After all, one call always ask: where are the waves?"  
Date: Wed, 22 May 2013 17:52:38 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: [\[snip\]](#)

P.S. Check out an outline at

<http://www.god-does-not-play-dice.net/#outline>  
(May 22, 2013, 14:19:00 GMT)

The basic facts should have been widely known by 1951, when [Ted Newman](#) was working with [Peter Bergmann](#) as an undergraduate. To the best of my knowledge, the solution with RS gravity (cf. my initial email below) is the only possible one. You and your colleagues don't have any choice. None. Zilch.

If you and your colleagues disagree, please do write me back and I will gladly elaborate, with math.

D.C.

On Tue, 7 May 2013 03:22:00 +0300, Dimi Chakalov <[dchakalov@gmail.com](mailto:dchakalov@gmail.com)> wrote:

>  
> There:  
> [http://www.god-does-not-play-dice.net/#RS\\_gravity](http://www.god-does-not-play-dice.net/#RS_gravity)  
>  
> D.C.

=====  
Subject: [Relative Scale](#) Theory of Gravity  
Date: Thu, 23 May 2013 03:20:02 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Eddie <[ea212@cam.ac.uk](mailto:ea212@cam.ac.uk)>, [eanderso@apc.univ-paris7.fr](mailto:eanderso@apc.univ-paris7.fr),  
Lee Smolin <[lsmolin@perimeterinstitute.ca](mailto:lsmolin@perimeterinstitute.ca)> ,

Ronald J Adler <gyroron@gmail.com>,  
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hsyang@sogang.ac.kr,  
danielaperez@iar-conicet.gov.ar,  
romero@iar-conicet.gov.ar  
Cc: William G Unruh <unruh@physics.ubc.ca>

According to Bill Unruh (Time Gravity and Quantum Mechanics, arXiv:gr-qc/9312027v2, [p. 5](#)), "Time flows unequally from place to place, without calling into play any 'force of gravity' at all."

Was Bill Unruh talking moonshine? Not at all. But the flow of time is a bit more complicated: see an outline at

<http://www.god-does-not-play-dice.net/#outline>

Pity you can't reply...

D.C.

=====

- *Does gravity couple to other dynamical fields, such as, massless or massive scalars?*

If LIGO collaboration knew the answer to the question above, they could perhaps explain the energy transport by gravitational waves (GWs), detected with matter. But they can't.

D. Chakalov

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Subject: [The Gravitational Universe](#) (submitted to the European Space Agency on May 24th, 2013)

Date: Mon, 27 May 2013 07:55:52 +0300

Message-ID: <CAM7EkxmgJgA727mDDo=L-UNYvDzP42B79zgXZfKdnVmL2mpxBA@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: domenico.giardini@sed.ethz.ch,

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laine@itp.unibe.ch,  
norbert.straumann@gmail.com

Ladies and Gentlemen:

The so-called "fractional squeezing of spacetime perpendicular to the direction of propagation" ([p. 3](#)) is sheer poetry. You don't have any theory of energy transport by GWs,

<http://www.god-does-not-play-dice.net/#madness>

<http://www.god-does-not-play-dice.net/#there>

If you can't understand your errors, please write me back and I will elaborate.

Sincerely,

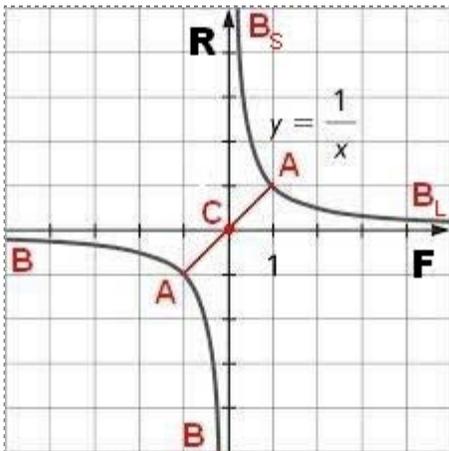
Dimi Chakalov

--

<http://tinyurl.com/bold-facts-9-11>

<http://tinyurl.com/steel-evaporation>

=====



Download printable copy, [Indefinable.pdf](#)  
20 October 2013, [20:05 GMT](#)



'All right,' said the Cat; and this time it vanished quite slowly, beginning with the end of the tail, and ending with the grin, which remained some time after the rest of it had gone. 'Well! I've often seen a cat without a grin,' thought [Alice](#); 'but a [grin](#) without a cat! It's the most curious thing I ever say in my life!'

---

Subject: Jeffrey Winicour, [arXiv:gr-qc/0508097v2](#) and [lrr-2012-2](#), "Please keep me updated."  
Date: Fri, 5 Jul 2013 18:20:37 +0300  
Message-ID: <CAM7EkxnCFjFGSNQ03o7GY=z4F9unT1HOzxtJ\_+7yAfSioZgYFQ@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Jeffrey Winicour <winicour@pitt.edu>,  
Roger Penrose <rouse@maths.ox.ac.uk>,  
Ezra Newman <newman@pitt.edu>,  
Sergiu Klainerman <seri@math.princeton.edu>,  
Helmut Friedrich <hef@aei.mpg.de>,  
Piotr T Chrusciel <piotr.chrusciel@univie.ac.at>,  
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Robert Geroch <geroch@midway.uchicago.edu>,  
Tim-Torben Paetz <tim-torben.paetz@univie.ac.at>

Dear Dr. Winicour,

Following your request to keep you updated, may I inform you and your colleagues on the insurmountable problems with spacetime "boundary".

As we all know, half a century ago (15 January 1963), Roger Penrose suggested the conformal compactification recipe (via "[rescaling](#)" of the metric) of [null infinity](#), "scri" (Asymptotic Properties of Fields and Space-Times, Phys. Rev. Lett., 10(2), 66-68, 1963), but neither he nor anyone else has demonstrated such asymptotic boundary at null-and-spacelike infinity. [It's a package](#). Thus, the task is not solved.

What you may not know is that [Roger Penrose](#) (we met in London on 16 April 2002 at Imperial College) does not feel moral obligation to all people who quote his "golden oldie" speculations, and hasn't acknowledge the simple fact that his recipe cannot work \*in principle\* for null-and-spacelike infinity -- it is \*one\* boundary that cannot be determined with theorems, because it is \*indefinable\* in principle.

To begin with, recall that we cannot change the uncountably infinite "number" of points by rescaling the metric, starting *from within* spacetime \*continuum\* ([Georg Cantor](#)). We may only hope, at the end of the day, that the spacetime might/should have some "boundary" at asymptotic null-and-spacelike infinity, but the latter is \*indefinable\* to an (Eulerian) observer within spacetime.

A brief outline can be read at

<http://www.god-does-not-play-dice.net/#Paetz>

Should you and/or any of your colleagues are interested in this \*[indefinable](#)\* exercise (Roger isn't), I will gladly [elaborate](#). Please keep me updated as well.

Sincerely,

Dimi Chakalov

----

**Note:** The *pre-quantum* [UNspeakable](#) Kochen-Specker "[state](#)" is **indefinable** as well, otherwise we may use only countable [sets](#). Such **indefinable** objects *complement* 'physical reality' or "[jackets](#)". The latter are **re-created** "[slices](#)" of asymptotically flat spacetimes (local modes of spacetime), in which the total energy of the whole universe is indeed "[conserved](#)" ("a grin [without a cat!](#)") at this instant 'now' from the [Arrow of Space](#) -- one-conservation-at-a-time. However, such "[conservation](#)" is totally unacceptable approximation (like a '[spherical cow](#)'), because it pertains only to the so-called "evolution equations" (see below) confined *entirely* within **one** [dead frozen](#) asymptotically flat "[slice](#)" with **fixed** topology.

422

Igor Rodnianski

The contracted Bianchi identity  $D^\alpha R_{\alpha\beta} = 2\partial_\beta R$  implies that the gravitational tensor  $G_{\alpha\beta} = R_{\alpha\beta} - \frac{1}{2}g_{\alpha\beta}R$  is always divergence free,  $D^\alpha G_{\alpha\beta} = 0$ . As a consequence, evolution equations for the external fields in the models described above follow from the requirement that  $D^\alpha T_{\alpha\beta} = 0$ .

The so-called "evolution equations" can display only a **dead frozen** Gravitational Wave which **cannot** carry *any* amount of 'tangible energy' ([Hermann Bondi](#)). Hence the question of [J. G. Pereira](#), "After all, one call always ask: **where are the waves?**", refers to the [assembled 4-D spacetime](#) by the Arrow of Space. More [below](#).

As a necessary condition we want to demand that  $(M, g)$  be globally hyperbolic, that is, it possesses a Cauchy surface  $\Sigma$  (an 'instant of time') on which initial data can be described to determine uniquely the whole space-time, see for example, Wald (1984) or Hawking and Ellis (1973) for details. In such cases, the classical initial value formulation makes sense, and the Hamiltonian form of GR can be constructed. The occurrence of **naked singularities** is prohibited by this assumption.

An important theorem states that for a globally hyperbolic space-time  $(M, g)$  there exists a global 'time function'  $f$  such that each surface  $f = \text{constant}$  is a Cauchy surface; therefore,  $M$  can be foliated into Cauchy hypersurfaces, and its topology is a direct product,

$$M \cong \mathbb{R} \times \Sigma . \quad (4.38)$$

The topology of space-time is thus fixed. **But not on the boundary!**

Claus Kiefer, *Quantum Gravity*, 2nd ed., 2007, [p. 106](#).

Hence a 4-D spacetime is being **assembled** by the [Arrow of Space](#) -- one-slice-at-a-time -- with [curvature & torsion](#), along with inevitable "dark" effects and [energy non-conservation](#) observed *only retrospectively* in the *assembled* 4-D spacetime. With the current version of "classical" GR, the '[universe as ONE](#)', placed in the postulated global mode of spacetime, generates **indefinable** (in the sense of Gödel's [undecidable propositions](#)) tasks, as argued [above](#). **It** (not He) is *the* source of [emergence of spacetime](#) by [countable sets](#) of "jackets" (recall [Plato](#)), explicated into successive 3-D "[slices](#)" -- one-slice-at-a-time, along the [null direction](#) of the Arrow of Space. On the very **boundary** of such *assembled* 4-D spacetime, the topology and the metric are [different](#), to allow for the [binding of points](#) by the postulated Aristotelian Connection in [RS gravity](#): **It** is in fact ONE dual object with [non-Archimedean](#) geometry, which macroscopic observers describe as *both* infinitesimally "small" *and* infinitely "large". Once we discover the proper mathematical formalism of [RS gravity](#), we should be able to explain the *emergence* of '[globally hyperbolic](#) spacetime equipped with Lorentzian metric', instead of introducing such 'spherical cows' by hand, as if they were produced by some Biblical magic.

Were it possible to determine the "boundary" of spacetime to obtain some self-sufficient and fully completed object, the latter will be inevitably [self-destructive](#). Simple, no? [KISS!](#)

D. Chakalov  
 July 5, 2013  
 Last updated: July 13, 2013, [17:01:33 GMT](#)

=====



Subject: [arXiv:1305.0777v1 \[gr-qc\]](#)

Date: Sat, 13 Jul 2013 15:19:06 +0300

Message-ID: <CAM7EkxmL2WaYd-SnCor2rhAfOJHw65asUyMernJb5hm+vd=vqw@mail.gmail.com>

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To: Jose Geraldo Pereira <jpereira@ift.unesp.br>

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[James M Nester](mailto:nester@phy.ncu.edu.tw) <nester@phy.ncu.edu.tw>

Jose Geraldo Pereira, Gravitational waves: a foundational review  
<http://arxiv.org/abs/1305.0777v1>

Comments: "This manuscript has not been, and will not be submitted to any journal; it is intended as an arXiv paper"

-----

Chicken. Why are you afraid of [LIGO mafia](#)?

You also wrote (p. 4, footnote §): "The problem of the non-localizability of the energy and momentum of the gravitational field [16] is not relevant for the present discussion, and will not be considered here."

垃圾! Of course the problem is "relevant". See above.

Besides, the problem has two presentations, like two sides of a coin: (i) the localization of the energy and momentum of the gravitational field and (ii) the "[boundary](#)" of that "field" at null-and-spacelike infinity,

<http://www.god-does-not-play-dice.net/#Jeff>

You can't solve (i) without solving (ii), and vice versa.

Dimi Chakalov

-----

**Note:** Does gravitational "radiation" carry energy and momentum, or not? **YAIN (Yes-And-neIN)**.

**Yes**, there are effects, resembling a [swathe](#), due to 'tangible energy' ([Hermann Bondi](#)), but only in the [assembled 4-D spacetime](#), which in turn requires brand new GW detectors endowed with **self-action**, just like the [human brain](#) (forget about LIGO, eLIGO, Virgo, and similar [parapsychology](#)).

**Nein**, because every "[slice](#)" of *local* mode of spacetime is an *asymptotically* flat 3-D space, in which the [contracted Bianchi identity](#) holds FAPP, and we can effectively [switch off gravity](#) at a point ([Hermann Weyl](#)).

Also, we cannot *in principle* detect the gravitational energy density at a *classical* geometrical point (MTW, [p. 467](#)), because it belongs to 'the universe as [ONE](#)', hence it is not classical phenomenon

(i.e., 'objective reality out there', cf. [Walter Wyss](#)) but *quantum* phenomenon, just as we cannot detect the energy *density* stored in the quantum vacuum (John Baez, [Case 4](#)). It is just a "[jacket](#)" or "[cloud](#)", which every [bartender](#) knows very well (recall [Plato](#)), only in our case we need Quantum Geometry in which the "points" themselves possess [quasi-local structure](#).

By the same token, there is no curvature-and-torsion in any "[slice](#)" of *local* mode of spacetime. The latter is an *asymptotically* flat 3-D space with **zero** time (recall the '[empty set R](#)'), yet in the [assembled 4-D spacetime](#) we experience their successive manifestation through **time** (cf. option (iii) YAIN [above](#)), in terms of [gravitation-and-rotation](#) (not curvature-and-torsion). Neither spacetime curvature nor [torsion](#) can be observed **at a point** -- they emerge as [gravitation-and-rotation](#) only in the [assembled spacetime](#) by Arrow of Space, and the original curvature-and-torsion **must not be physically observable**. Which is why the physical effects from [gravitation-and-rotation](#) **cannot** be traced back to their quantum-gravitational *origin* (called "[it](#)"), and if people try to interpreted them with the current "classical" GR, they will call them "**dark**", as I tried to explain in [September 2011](#).

Here's a simple visual explanation: every [end-point x](#) in the drawing below is an **almost** (Sic!) completed "[slice](#)" of asymptotically flat 3-D universe with **zero** time "vector" from the Arrow of Space, called 'local mode of spacetime'. The [mass-energy content](#) at every end-point **x** is **almost** (Sic!) "conserved" (cf. **Nein** above), which **enables changes** in the **global** mode of spacetime from the Arrow of Space. So, once we eliminate the "dark" gaps of global mode of spacetime to obtain the [perfect continuum](#) of the **assembled** 4-D spacetime by the Arrow of Space, people are struck by the **non-unitary** transitions along the [creative evolution](#) of these end-points **x**, and call their **pure** and *potential* quantum-gravitational source "**dark**", as I tried to explain in [September 2011](#).

( x )----( x )----( x )---( x )

According to [Werner Heisenberg](#) (23 March 1927), "Die Bahn entsteht erst dadurch, daß wir sie beobachten," but in [Relative Scale](#) gravity Die Bahn is being **re-created** by the Arrow of Space -- one-**x**-at-a-time. Thus, Die Bahn **always** exists '[out there](#)', regardless of whether it is "observed" or not:

There was a young man who said "God,  
to you it must seem very odd  
that a tree as a tree  
simply ceases to be  
when there's no one about in the quad."

"Young man, your astonishment's odd,  
I'm always about in the quad  
and that's why the tree  
never ceases to be  
as observed by, yours faithfully,  
[God](#)."

[You](#) need [RS gravity](#), not the current GR textbooks and "[evolution equations](#)". Do [you](#) have a choice?

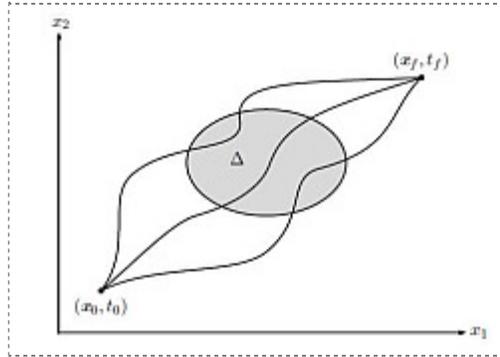
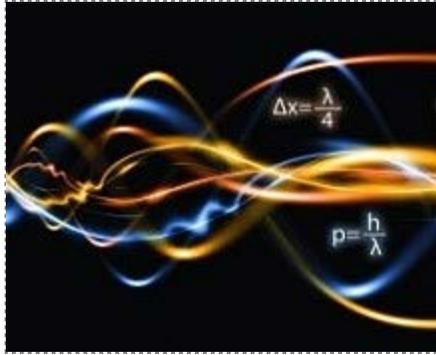
But of course. Just ignore everything you've learned here, and switch to "the worst theoretical prediction in the history of physics!" ([Wiki](#)), until [you](#) quietly and irreversibly [retire](#).

"[just another crank](#)"

July 14, 2013

Last updated: July 15, 2013, [14:21:53 GMT](#)

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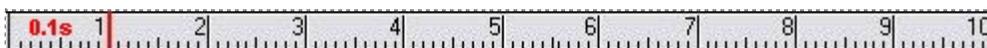
## Addendum

The [atemporal](#) re-creation of the local mode of spacetime along the [w-axis](#) produces a full four-dimensional (not canonical) "quantization" of the **assembled Points II** from 'Die Bahn'. In the quantum world, the [elementary cycle](#) of the Arrow of Space along the [w-axis](#) produces **perfectly continuous** transition between two neighboring Points II. Thus, the so-called "quantum jumps" (*verdammten Quantenspringerei*, Erwin Schrödinger) are **artifacts** from imposing a classical, special-relativity "filter" on the quantum spacetime with the act of measurement; check out *the* most widely known public secret in theoretical physics [here](#).

The difference between the classical and quantum metrics is in the "location" of neighboring points along the [w-axis](#): in the former case, the **dt/ds** transition is "between" points on a *line* (say, the trajectory of a Frisbee in Minkowski spacetime), while in quantum spacetime the neighboring points will look *to us delocalized* and [smeared](#) along a "quantum path", as in [Feynman path integral](#). But the interpretation of "delocalized quantum dough" is again an **artifact** from imposing a classical, special-relativity **metric** on the quantum spacetime. In the quantum world 'out there', all points are **equidistant**, and the [quantum metric](#) there provides **perfectly continuous** transitions between **all points** (Sic!) from 'Die Bahn' [above](#): see an explanation with requirement [10, 20] [here](#) and [here](#). But because we *impose* the spacetime metric from the macroscopic world with the act of measurement, we see fictitious "quantum jumps" in Minkowski spacetime.

There is a crucial difference between (i) how the quantum world will *look to us* through the classical metric [[Ref. 1](#)], and (ii) how the quantum world **exists** 'out there'. In 1935, [Erwin Schrödinger](#) emphasized that measuring a value (e.g., "[cloud](#)") of an observable does **not** mean that the observable **has had** such definite physical value from the outset: quantum observables cannot in principle possess **any** definite value [before](#) we measure it. Therefore question (i) is about the inevitable **artifacts** from imposing the metric of Minkowski spacetime (classical "filter") on the quantum world, while question (ii) is about the phenomenon which can *replace* the act of 'measurement' in QM textbooks, and hence allow for the existence of an *intact* quantum world with *potential* physical values of all *would-be* observables, which in case (i) will be elevated (not just "[amplified](#)") at macroscopic length scale.

Our answer to question (ii) is with the [Arrow of Space](#). Regarding question (i), **all points** from 'Die Bahn', as viewed from a finite spacetime volume at the length scale of tables and chairs, will be interpreted as **equidistant**: there is no difference between quantum transitions from point 1 to point 2 and from point 1 to point 10 (cf. the drawing below).



[Fig. 3](#)

How could that be? Because in the [atemporal global mode of spacetime](#) all *would-be* points will be interpreted as **equidistant**, from the point of view of macroscopic observers -- see case (i) above. Yet the [Arrow of Space](#) will **assemble** a quantum path with [definite physical values](#), [one-at-a-time](#), as observed *post factum* in our [ever-increasing past](#).

Metaphorically, the [atemporal assembling](#) of [one quantum path](#) is like producing yarn from [raw wool](#).



**Spinning is an ancient textile art in which plant, animal (e.g., raw wool) or synthetic fibers are drawn out and twisted together to form yarn.**

See again case (ii) above and *the* most widely known public secret in theoretical physics [here](#).

Thus, all Points **II** are being "quantized" *ab initio*, and at **all** length scales. There are no "nonlocal" interactions in the quantum-gravitational world 'out there'. There are no [CDM or DDE](#) either, because these "[dark](#)" effects of gravity are nothing but macroscopic presentation of entanglement at length scales larger than the solar system. Instead of switching to unphysical "free fall" ([Italo Cavino](#)) to explain gravity [[Ref. 2](#)], try the principle of [dynamic gravitational equilibrium](#).

D. Chakalov

October 2, 2013

Last updated: October 5, 2013, 10:36 GMT

[Ref. 1] Roger Penrose, [The Road to Reality](#), Jonathan Cape, London, 2004, pp. 667-668 (emphasis added):

"The complex amplitude to be assigned to that particular history is then given by the deceptively simple formula [XXX]. Part of the deception, in the simplicity of this formula, lies in the fact that the 'amplitude' is not really a (complex) number, here (which, as written, would have to have unit modulus), but some kind of **density**. But here we have a *continuous* infinity of classical alternatives. Our above 'amplitude' thus has to be thought of as an 'amplitude **density**'. (...) But the bad news here is that the 'space of classical paths' will almost certainly turn out to be *infinite-dimensional*."

[Ref. 2] Richard Feynman, [Character Of Physical Law](#), MIT Press, 1967, [p. 8](#).

"The next question was - what makes planets go around the sun? At the time of Kepler some people answered this problem by saying that there were angels behind them beating their wings and pushing the planets around an orbit. As you will see, the answer is not very far from the truth. The only difference is that the angels sit in a different direction and their wings push inward."

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When the successively attributed values of the same variable indefinitely approach a fixed value, so that finally they differ from it by as little as desired, the last is called the limit of all the others.

Baron Augustin-Louis Cauchy, *Cours d'analyse de l'École royale polytechnique*. Première partie: Analyse algébrique, [1821](#)

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Subject:  $(\epsilon, \delta)$ -definition of limit: Request for opinion  
Date: Tue, 16 Jul 2013 10:38:03 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Karel Hrbacek <khrbacek@sci.ccny.cuny.edu>  
Cc: Karel Kuchar <kuchar@physics.utah.edu>

"Let  $f$  be a function defined on an open interval containing  $c$  (except **possibly** at  $c$ ) ..."  
[https://en.wikipedia.org/wiki/\(\epsilon, \delta\)-definition\\_of\\_limit#Precise\\_statement](https://en.wikipedia.org/wiki/(\epsilon, \delta)-definition_of_limit#Precise_statement)

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Dear Dr. Hrbacek,

I have an immodest request.

If possible, please let me know your opinion on the \*exact\* location of  $c$  : does it belong to the "open interval", or not ?

In case you have examined the [Thompson lamp](#) paradox, please elaborate on the question above, regarding the \*last\* state of the lamp, *either* 'on' *or* 'off'.

Thank you for your time and consideration. I hope your colleague can elaborate as well.

Kind regards,

Dimi Chakalov  
[chakalov.net](#)

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**Note:** A Czech saying claims that [the devil](#) thrown out of the door returns through a window. Maybe with a vengeance. As Bishop [George Berkeley](#) warned us, any error, no matter how small, is not acceptable in mathematics. Coincidentally or not, Augustin-Louis Cauchy used, in his inequality-based "limit", the French word "erreur" (error), denoted with  $\epsilon$ . It stands "between" the brackets of open and closed intervals of points:

$$[ \epsilon (\dots\dots) \epsilon ]$$

With Archimedean geometry only, the "error"  $\epsilon$  brings two alternatives: either (i) a *finite* increment ("as little as desired" but never zero) or (ii) always zero. The solution here is to include non-Archimedean geometry as well, and use the instant 'now' in the Arrow of Space as a "separator": option (i) belongs to 'potential reality', while option (ii) pertains to ever-increasing past.

The "error"  $\epsilon$  is not a point and cannot take any number. It is a peculiar *running entity* , and has *dual* nature. On the one hand, it must totally disappear, or else we cannot have a **fixed limit**, say, the circumference of the circle below. In this end-case, the points become *purely* geometrical, resembling the grin of the Cheshire cat without the cat (matter). On the other hand, the "error"  $\epsilon$  must *somehow* exist in order to "separate" the points in order to identify the "gap" dt & ds which the points themselves need to exist, or else they will inevitably fuse/superimpose. Stated differently, the "gap"  $\epsilon$  must always exist in *potential* infinity, but also must always completely disappear in *actual* infinity, being already reduced to an 'empty set R'.

The solution proposed here is to *insert* the dual "gap"  $\epsilon$  in the *non-Archimedean* world (dubbed potential reality) in Relative Scale gravity, which emerges in the potential future of the Arrow of Space due to the phenomenon of entanglement. This hypothetical *non-Archimedean* world occupies a so-called 'global mode of spacetime', which Mother Nature makes to *resemble* "zero" -- an *infinitesimal* and non-numerical entity, dt & ds, which is always "running" in *potential* infinity, and also has always completely disappeared in *actual* infinity due to the "speed" of light. To understand the whole issue, imagine that you've been taking photos in a pitch dark room with a camera equipped with flash, then assemble the photos to obtain a *perfect* continuum of these flash-made points: the dark room will be a *physically* unobservable "gap", dt & ds, as it does not belong to the set of such points.

Consider Cantor's definition of 'set' from 1895 (quoted after D. Giulini, [arXiv:0802.4341v1](https://arxiv.org/abs/0802.4341v1), p. 11):

By a 'set' we understand any gathering-together **M** of determined well-distinguished objects **m** of our intuition or of our thinking (which are called the 'elements' of M) into a whole.

Can we unravel some *pre-geometric* plenum (resembling a school of fish), called here "it", which can replace "our intuition" and *bootstrap* all 'elements' into a whole? If we can, "it" must *not* belong to any set, but to 'the set of all sets', which makes such pseudo-set and its complement truly indefinable.

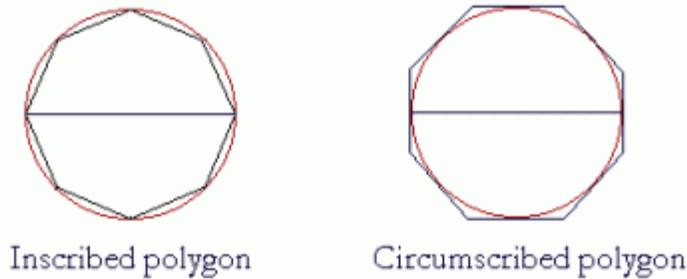
Let's go back to the delta-epsilon conjecture. The verbal definition by Cauchy from 1821 involves at least three unwarranted presumptions:

- (i) "a fixed value" which can be approached "finally" by some
- (ii) *running entity* (  ) which Mother Nature *always* makes
- (iii) "as little as desired".

The first presumption looks "obvious", but it presupposes that the object we wish to **prove** with "running" delta-epsilon limit -- a final fixed value -- exists 'out there' from the outset, which is a logical miss-match, to say the least. Besides, the presumption *implies* Wheeler's "cloud" and a fixed asymptotic boundary to verify the positive mass conjecture, which are anything but simple and clear. Presumptions (ii) and (iii) are tacitly based on the Archimedean Axiom only, which, in my opinion, makes them pure poetry. Notice that if the universe were confined *exclusively* to Archimedean geometry, presumption (iii) "as little as desired" signifies irrevocable alternatives: either an increment or nothing, as stressed by Bishop Berkeley (quoted after Judith Grabiner, 1983). For a general outlook on infinitesimals and how they reconcile "either-or" *complementary* properties, see the 'empty set R' and the drawing above.

Let's try to shed some light on the Cauchy puzzle. According to Wiki, infinitesimals "have been used to express the idea of objects so small that there is no way to see them or to measure them". Let's assume that a final fixed value or 'limit' does exist, at least in some simple cases in which the object can be presented with classical physics, and one can introduce a fixed flat background spacetime to define the metric. Perhaps the best showcase is what every high-school student knows very well: the

**limit** at which we obtain the formula for the [circumference of a circle](#):



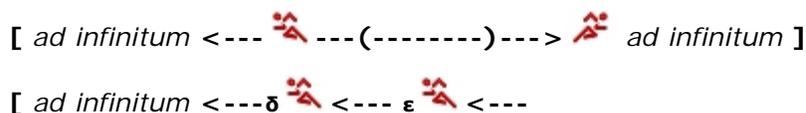
If at every step we double the number of sides of the two polygons, there exists an *end-point* or limit at which the two polygons disappear, being converted into one "perfectly smooth" circle: the length of the sides of the two polygons is now the **indefinable** '[empty set  \$\mathbf{R}\$](#) ', just as in the [Thomson lamp](#).

Surely the **limit** at which the two polygons snap to circle, as the "number" of their sides is presumably *reaching* infinity, is inevitable and cannot be surpassed. Can't go any further, because there is no "further" step allowed by "smaller/larger" in the purely geometric, non-Archimedean world of *the* continuum. But since we cannot verify the nature of infinitesimal points and how they *approach* infinity, to be fully liberated from any 'matter' (recall the grin of the Cheshire cat [without the cat](#)), two options remain to be examined: either these infinitesimal points conform to the [Archimedean Axiom](#) (to be explained below), or **not** (hinted above, after [Georg Cantor](#)).

The first option may correspond to the idea of 'finite infinity' suggested by [George F R Ellis](#) in 1984, but because there is no way to verify these infinitesimal points, we may only claim that any **finite** chunk of space or time interval is made of so-called 'Archimedean points'. For example, we define 'one second' as made of **exactly** "9,192,631,770 periods of transition the radiation corresponding to the transition between the two hyperfine levels of the ground state of the cesium-133 atom" ([Orfeu Bertolami](#)). By extrapolation, we may claim that the Archimedean points are also **finite** entities, albeit many times "smaller". If so, we denote the *number* of such Archimedean points in [one meter](#) with  $\mathbf{x}$ , and declare that the *number* of Archimedean points in a square with one meter side will be  $x^2$ , and in a cube  $x^3$ . Then we could bring infinity "into a finite spacetime region" ([Ted Newman et al.](#)), and happily speculate that "*more and more*" space appears due to "dark energy" of [whatever].

Thanks to [Georg Cantor](#), we know that this first option is untrue. And since we are dealing with **uncountably** infinite pseudo-set of **non**-Archimedean points, we can't make them "second countable" ("[countable base](#)" topology cannot recover all points "counted" with [irrational numbers](#)). We can't declare that "all manifolds are assumed to be Hausdorff, second countable and  $C^\infty$ , and all fields are assumed to be  $C^\infty$ " ([Lars Andersson](#)) either. Same holds for the speculations of [Roger Penrose](#).

Yet contemporary textbooks (see [Chris Isham](#)) use exclusively the [Archimedean Axiom](#), and try to bypass -- not solve -- the definition of limit (e.g., [one meter](#)) by replacing 'the running guys' in the drawings below with two **indefinable** running "numbers",  $\epsilon$  and  $\delta$ , such that, no matter how small  $\epsilon$  can be, it is *not* zero, and "therefore" will **always** chase a *smaller*  $\delta$ , *ad infinitum*.

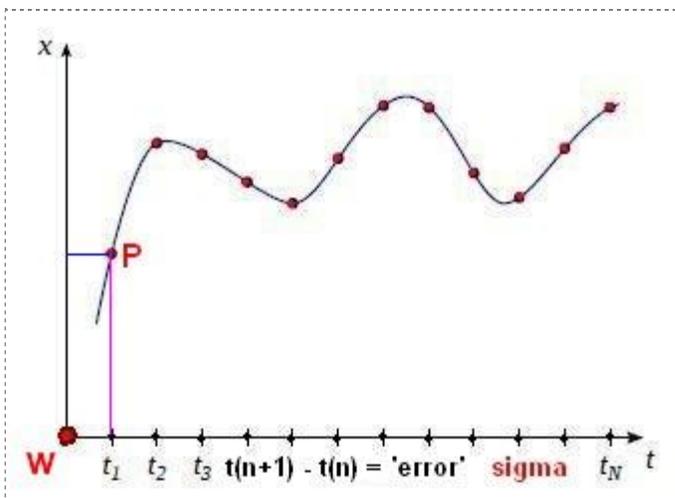


But such kind of "solution" (I'm trying very hard to be polite here) is suitable for [bartenders](#) only. They need two running guys only to introduce the  $(\epsilon, \delta)$  inequality, but can't solve the [Cauchy puzzle](#).

Why? Because every **finite** volume of space contains **the same** "number" of **non**-Archimedean points: uncountably infinite, like the set of all rational *and* [irrational numbers](#). Therefore, the "number" of **non**-Archimedean points is **always** 'the same', regardless of the size of an object defined with spacetime metric (see [RS gravity](#)). That is, the "number" on purely geometric **non**-Archimedean points in one [picometer](#) and in the Milky Way is **always** one and the same, due to the nature of 'potential infinity' and the discovery of [Georg Cantor](#).

To explain the existence of a **limit**, as seen in the completed circle above, we need non-Archimedean "points" **cast** from 'actual infinity' -- see the metaphor with taking photos in a dark room [above](#).

**NB:** The separation "between" points from open and closed intervals is made by the [Arrow of Space](#): **open** intervals are always kept in the *potential* future, while we can physically observe only **closed** intervals, and only [post factum](#). Physically, the separation  $\epsilon$  is compactified on one point only, and since the separation is along [null directions](#), there is no *physical* time there. Hence the *accumulation* of these "separations" by the Arrow of Space produces a *perfect* continuum ([Georg Cantor](#)) of points, in which the "separator"  $\epsilon$  is the instant 'now'. The latter **cannot** exist in the **already**-accumulated, [post factum](#) observable past.



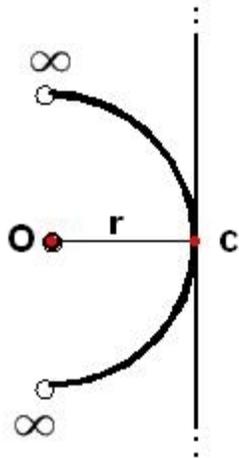
The Arrow of Space runs along the [null direction](#) orthogonal to x/t plane, and is physically unobservable in the resulting "[timeless](#)" world (local mode of spacetime). The 'error' or "separator"  $\epsilon$  is an '[empty set R](#)' there, too.

Those who consider themselves 'transfinitists' believe that the notion of 'limit value' (i) exists and (ii) is *actually* reached (see the completed circle above), while other people believe, after Aristotle, that the process of division can never *ever* come to an **end-point**, and the limit value is never actually reached due to '[potential infinity](#)', although the division can be continued **indefinitely**. The resolution of these seeming "alternative" options is **YAIN** (Yes-And-neIN): the "separator"  $\epsilon$  is the **dual** instant 'now' in the [Arrow of Space](#). With [open sets](#), we have no choice but **YAIN**.

Again, *the* only possible solution -- see again [here](#) -- is with a non-Archimedean '[empty set R](#)', which pertains to the [global mode](#) of spacetime and can **eliminate** all "gaps" and errors  $\epsilon$ : they are eliminated with [the "speed" of light](#). And because the Arrow of Space does **not** permit two neighboring points to *actually* fuse, their separation with [dt & ds](#) is **never** *actually* zero due to the instant '**now**'. If the Arrow of Space could somehow **stop**, all points will fuse into one unknown entity. Perhaps this was The Beginning "[before](#)" it began [[John 1:1](#)]. Thank God, the last question [cannot be resolved with theorems](#), which would eliminate theology by mathematics. The path to God can show up only with [mathematics](#), but the end result (if any) along such path *must* be [indefinable](#).

[Karel Hrbacek](#) will most likely disagree, but since neither he nor anyone else can rigorously define 'smoothness', will prefer to keep quiet, while [Karel Kuchar](#) will just keep quiet, as usual. Their problem has been swept under the carpet with the recipes for 'nearness', 'convergence of a

sequence', and 'continuity of a function' in the textbook by Chris Isham [above](#). The anonymous author(s) in [Wiki](#) also used pure poetry: "except **possibly** at **c** " (emphasis mine), and tried to bridge the Archimedean **gap** with "...  $f(x)$  becomes closer and closer to  $L$  as  $x$  moves closer and closer to  $p$ " (source [here](#)). They can only introduce a relation between the two running guys, assuming they both can reach the [spacetime boundary](#) with 'potential infinity', just like [Chuck Norris](#). Look at the drawing below: how would you achieve **maximum** 'nearness' of points **O** and **C** from the supposedly "open" interval (O,C), denoted with **r** , to match **dt** in the drawing [above](#) and the "**carrier**" (the Unmoved Mover; see [Karel Kuchar](#)).



If we shrink the radius **r** to match the 'empty set **R**' [above](#), points **O** and **C** will commingle:  $r = 0$ .

Bad idea -- we will end up with just one point to play with '[set theory](#)', since all the rest will be fused with it. But what can happen if we draw a tangent line at **C** (it would match number 3 on your wristwatch, and the two signs for "infinity" would correspond to 12 and 6), and blow up the radius **r** to actually *reach* '[actual infinity](#)'? I suppose the circle will break at 12 and 6, reduce its topology to a line (1-D Euclidean space), the radius will finally obtain end-points of infinite closed interval **[O,C]** at *actual* infinity, but will at the same instant **disappear**, and all points will fuse with the tangent line at **C**, which can now contain only one unknown entity.

What can we do to define **dt** in the drawing [above](#) and reveal the "**carrier**" ? The [non-standard analysis](#) can't help. Any suggestions?

If you have none, try the [non-Archimedean](#) world in [RS gravity](#).

D. Chakalov  
 July 16, 2013  
 Last update: July 21, 2013, [23:07:16 GMT](#)

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Subject: Re:  $(\epsilon, \delta)$ -definition of limit: Request for opinion  
Message-ID: <CAM7Ekxk3xRLb7qc5vKQ97x42fa6V32oqCUppFbFqrbdq9vvdqQ@mail.gmail.com>  
In-Reply-To: <20130719202049.AH9J3.2769.root@hrndva-web19-z02>  
Date: Sat, 20 Jul 2013 00:03:14 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Karel Hrbacek <khrbacek@nyc.rr.com>  
Cc: Tomáš Jech <jech@math.cas.cz>

Dear Karel,

Thanks a lot for your reply.

The mathematical issues are posted at

<http://www.god-does-not-play-dice.net/#Hrbacek>  
(July 19, 2013, 09:20:59 GMT)

In PDF format, see pp. 9-13 in

<http://www.god-does-not-play-dice.net/Indefinable.pdf>  
(486,686 bytes, 19 July 2013, 09:35:28 GMT)

I believe it is a very simple theory, and doesn't suffer from pathological ambiguities, such as "not (necessarily) at  $c$ ."

All the best,

Dimi

On Fri, 19 Jul 2013 16:20:48 -0400, Karel Hrbacek <khrbacek@nyc.rr.com> wrote:

>  
> Dear Dr. Chakalov,  
>  
> In the definition of limit,  $c$  does belong to the open interval.  
> Thus if the open interval is  $(a,b)$  [with  $a < b$  ], then  $a < c < b$ .  
> The function  $f$  is assumed to be defined on  $(a,c)$  and also on  $(c,b)$ ,  
> but not (necessarily) at  $c$ .  
>  
[snip]

-----  
**Note:** May I offer a simple translation of the excerpt from [Karel Hrbacek](#) above: *every* open interval contains a generic 'error' (Cauchy), which cannot possess its own error margins confined in a closed

interval. In my opinion, this is a pathological ambiguity. As [Henri Poincaré](#) remarked many years ago,

Point set topology is a disease from which the human race will soon recover.

It is *not* as if we have a large macroscopic interval (say, [one meter](#)), which can be used to define the [continuity of a function](#), only at the two boundary "[edges](#)" some *very* nasty things may be at work, yet we can FAPP ignore them (see [above](#)). Nope. Each and every point in the underlying continuum is in fact "surrounded" by such nasty ambiguities.

You may ask, how many points can safely fit in an open interval? Just [one](#), because every finite open interval can be divided by  $c$  into two smaller open intervals, thereby increasing the number of such pathological ambiguities  $c$ , until you hit the rock bottom of just [one](#) point, after which there will be no 'open intervals' to play with. Which means that some fundamental geodesic incompleteness from "the *edge* of space-time" ([José M.M. Senovilla](#)) is inserted at manifold level, and you simply cannot move anything from point A to point B. Actually, you cannot even *start* from point A, because there will be no spacetime: *reduction ad absurdum*. Or you will need a Biblical miracle to reconcile [set theory](#) with the reality of spacetime.

The "good" news (if any) is that you can't be certain about such conclusion. It may be just a wild guess, which might (or not) be true. Your wild, albeit "educated", guess is as good as anyone's else, your beloved mother-in-law included. It is a bit like the number of blond angels that can fit on needle's pin, only dresses in [exotic math](#) -- you can't be certain about it either.

The only way we can move forward is by unraveling the proper mathematical formalism of [RS gravity](#).

**NB:** Recall the [Czech saying](#): The "devil" is encoded in the irrational numbers (*Der Zahlenteufel*).

It is not a fixed number but a *running entity* , which Nature *always* makes "as little as desired" ([Cauchy](#)), and [projects](#) from "**it**" a **fixed** limit (like the *physicalized* shadows on [Plato's cave](#)) by [stopping](#) this running *Zahlenteufel* at the instant '[now](#)' with **actual** infinity -- see [above](#). It doesn't matter that such **fixed** limit can be dressed with rational numbers as well. The important lesson is about the cardinality of the "[universal set](#)" of points making [the continuum](#): *uncountably* infinite, as it includes both rational and irrational numbers.

Thus, we have **fixed** volumes of spacetime with [Points II](#) or "[edges](#)", called *local* (physical) mode of spacetime, in which the relations 'Large vs. Small', 'inside vs. outside', and 'one vs. many' are *perfectly* defined (observer **A**, see [above](#)). In the drawing below, the *local* mode of spacetime is depicted with **re-created** (by the Arrow of Space) four achronal hypersurfaces stacked along [null "direction"](#) and "separated" by  $dt/ds$ . The latter is not "zero", but is not some **finite**, additive, [Archimedean](#) element either.

Only the [speed of light](#) can 'take into account' Points **II** in the *local* mode of spacetime, hence produce objects with *different* and **finite** size and duration, as observed by **A**. But how?

The puzzle goes back to [Lucretius](#), some 2060 years ago. According to our metaphysical doctrine, Points **II** are assembled with **actual** infinity and at every [instant 'now'](#) are shifted irreversibly in our [ever-increasing past](#), being individuated *en bloc* by matter (the [Cheshire cat](#)). Hence we may call Points **II** 'matter points', although they are **not** countable Archimedean entities with *finite* size, as in the "reproduction" of '[one second](#)' in metrology. The initial, *purely* geometrical [Point I](#) has been set to "[nothing](#)", which is why some (otherwise smart) people call Point **I** "**dark**", as explained with *Die Bahn* metaphor from [Werner Heisenberg](#). There is absolutely no **flexibility** in the *perfect* continuum of Points **II**: the elementary step of the [Arrow of Space](#),  $dt/ds$ , is indeed **non-existent** there, and our [ever-increasing past](#) has been *emerging* ([Isham and Butterfield](#)) by [invariant blocks](#) of matter -- one [invariant block](#) per instant '**now**' -- along [null "directions"](#), as depicted in the drawings below.

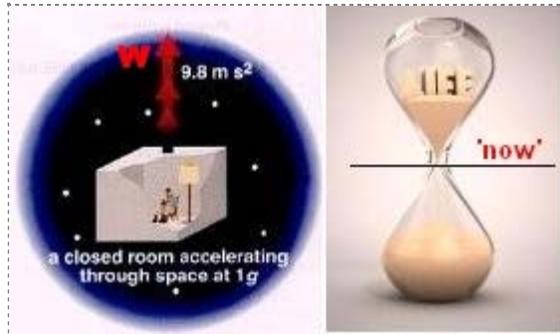


Fig. 1

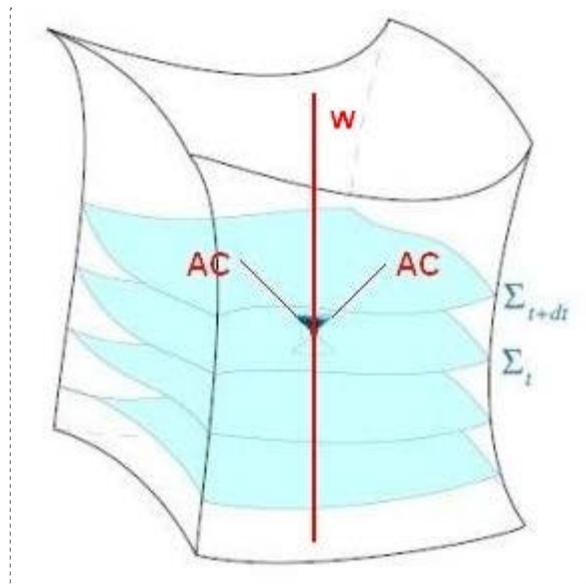


Fig. 2

Fig. 1

Every instant '**now**' is made by one act of "pulling" the whole universe **en bloc** (the closed room) **upwards** by the Arrow of Space, but such *omnipresent* direction is along null surfaces, and is collapsed to **zero** in the local (physical) mode of spacetime. The end result -- one-at-a-time -- is an already-positivized matter with gravity & rotation.

Fig. 2

The Aristotelian Connection, which **assembles** spacetime, is denoted with **AC**. Every achronal 3-D layer is a dead block universe with *conserved* total energy (cf. **Nein above**), "an unchanging spacetime entity, with no particular space sections identified as the present and no evolution of spacetime taking place" (G F R Ellis, p. 5, Fig. 4). In the **assembled** spacetime, however, "the total energy of the universe is neither conserved nor lost -- it is just **undefinable**" (Tamara M. Davis, *SciAm*, July 2010, p. 46).

At every instant '**now**' the "carrier"  $dt/ds$  is being made **infinitesimal**, hence resembles "zero", which is why the *omnipresent* "direction" of the Arrow of Space also resembles "zero" in the local mode of spacetime (Points **II**) placed only in the irreversible past. The "vertical" direction of the Arrow of Space is compactified to an infinitesimal, running  endpoint  $dt$ , while the "horizontal" stacking of points (Fig. 4) has produced an asymptotically flat achronal 3-D space with an infinitesimal, running  endpoint  $ds$  and *conserved* (Sic!) total energy of the universe.

Every achronal slice 'now' has **undefinable boundary** at both  $dt/ds$  and the endpoints of spacetime boundary at future/past null infinity, all of which reside at **C above**. The shift to the **next** achronal slice 'now' is atemporal, and has *different* values of **F** pertaining to **B<sub>Small</sub>**, **A**, and **B<sub>Large</sub>**.

Hence in RS gravity we propose that the so-called speed of light is related to the **assembling** of Points **II** at every instant '**now**' as invariant blocks of Points **II**, say, 'one meter'. These blocks are always invariant objects in GR, but the speed of light may *assemble* them in *different* ways (Sic!), to obtain the physical, 4-D spacetime (local mode of spacetime) from the achronal (with elementary "thickness"  $dt$ ) hypersurfaces above.

Namely, the crucial difference is in the *flow of time* (denoted with **F**), which is hidden within  $dt/ds$ .

Think of the *flow of time* (**F**) as the rate of which "fresh waters are ever flowing in upon you" ('You cannot step twice into the same river; for fresh waters are ever flowing in upon you', Heraclitus).

Hence **F** signifies the crucial 'rate of time', in addition to the bare **dt/ds**. This is the essence of Relative Scale (RS) theory of gravity ([RS gravity](#) for short), and I will try to explain it here in the most concise way, stressing that the full mathematical theory is still [missing](#).

Think of **F** as something resembling 'speed of flowing time'. The bare **dt** is an invariant element -- an "intrinsic time interval associated to *any* timelike displacement", since "fundamental systems all march to the beat of **the same** drummer" (Ted Jacobson, pp. [18-19](#)). But the "drummer" may beat/tick differently (Sic!), resulting in different 'speed of flowing time **F**' for observer(s) **B**, compared to **A**.

To explain the idea, suppose we have two clocks with different values of **F**; one is macroscopic and belongs to observer **A**, and reads 'one second per second', while the clock of observer **B** in the Small is **slower** and has ten times *smaller* value of **F**, compared to that of observer **A**. Hence for 'one second' read by the clock of observer **A** the **slower** clock of observer **B** in the Small will trespass **0.1s** (highlighted with red in Fig. 3 below) from 'one second' of observer **A**.

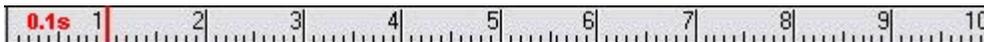


Fig. 3

Finite segment taken from an achronal "[flash](#)" in Fig. 2 above. Unlike the 100 segments of 'one second', Points **II** are not additive, Archimedean elements, but come from *the same* "number" of *uncountably* infinite points in the continuum of [Georg Cantor](#). Observer **A cannot** notice that observer **B** in the Small has different value of his **F**, and will wrongly conclude that her value of **F** at her macroscopic world is the only possible one, hence the spatial relations 'large vs small' and 'part vs whole' were produced from some [absolute length scale](#) (wrong!), and the smaller section **0.1s** (highlighted with red) were **absolute**.

No *physical* clock can reproduce 'one second' (Fig. 3) from additive, Archimedean elements, even if the latter were veery small and "exact", as suggested in [metrology](#). Thus, the **finite** building blocks of spacetime, 'one second' and 'one meter', are *potential* gravitational reality: [GR invariants](#).

Notice that 'time' is not made of temporal and additive, Archimedean elements, to explain the *flow of time* and answer the question "How fast does time pass?" ([Paul Davis](#)). For easier understanding, think of observer **A** as an object with speed 1m/s, while the slower object **B** has speed 0.1m/s. Thus, for the same 'one second' (Fig. 3) of object **A**, the slower object **B** will trespass 0.1m, and will look **smaller**. To whom? **Only** to observer **A**, according to [RS gravity](#).

**NB:** Observer **B** in the Small will take its *relative* value of **F**, which will **inflate** (Sic!) its *relative* 'proper time' in the Small -- **again** 1s, but with respect to observer **B** -- and, given the constant speed of light, its *relative* size (**R**) in the Small will be **enlarged** accordingly. With respect to observer **B**, the **space** in the Small is again *assembled* from '[something else](#)', but with a "smaller" value of **F**, compared to that of observer **A**. Yet such "smaller" value of **F** in the Small will be **compensated** by enlarged and *relative* (to observer **B**) value of **R** in the Small, in line with our postulated equation

$$FR = 1 \quad (\text{Eq. 1}).$$

There are two general rules in [RS gravity](#):

1. The "distortions" of the values of **F** of observer(s) **B** in the Small and in the Large are relevant **ONLY** to observer **A**, yet with respect to observer(s) **B** at the same time there are *no distortions* whatsoever in the Small and in the Large, because their *relative* metric is compensated by reciprocal values of **R**, in line with Eq. 1. Hence at **all** length scales the [invariant](#) 'one meter' remains 'the same', along with the *relative* rate of time 'one second per second'.
2. The "number" of elementary 'ticks of time', which *assemble* [Points II](#) according to Rule (1), is

*uncountably* infinite, which is why the "number" of [Points II](#), occupied by a proton, a football, and a galaxy, is always 'the same'.

Hence the Universe can be [self-correlated and bootstrapped](#) by the [atemporal negotiation](#) of its [potential quantum-gravitational reality](#) "during" the instant '[now](#)' placed at [Point I](#).

For example, if **F** (cf. the drawing below) takes value  $10^{-15}$  with respect to observer **A**, the latter will conclude that the **space** in the Small has "shrunk". Stated differently, observer **A** will wrongly assume that *her* macroscopic value of **F** does not (wrong!) change in the Small, and therefore the assembled distance were  $10^{-15}$  times smaller, and will match the "smaller" size of a proton (Fig. 4).



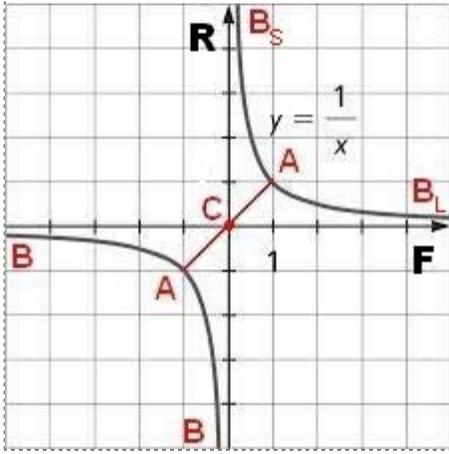
Fig. 4

At every instant 'now', the **w**-axis of the [Arrow of Space](#) is compactified to **ds**, producing an achronal 3-D hypersurface (cf. Fig. 2) made of [Points II](#) placed in our [irreversible past](#), stacked into timeless 3-D space, in which the total energy is indeed "conserved" (cf. [Nein above](#)). The *relative* metric of observer **A** defines [length scale](#) which is bounded from below at  $10^{-35}$  m ([Planck length](#)), but is **indefinable** (perhaps [unbounded](#)) in the Large. The result from such asymmetric construction of 3-D space is that the [Arrow of Space](#) can run **indefinitely**, with *asymmetric* manifestation of its [tug-of-war gravity](#): the so-called [DDE](#) points to the future and is perfectly smooth, while the clumsy [CDM](#) points to the past.

But for observer **B** in the Small, his *relative* assembled distance will remain 'the same': the *relative* value of **R** in the Small will be  $10^{15}$ , because the size of a proton in the Small will be *assembled* with [the same constant speed of light](#) for **longer** (Sic!) proper time for trespassing 'one meter'.

The fact that the "speed" of light has a finite numerical value requires that **F** is bounded from below by some finite numerical value as well, which at [the current stage](#) of the evolution of the universe is the Planck length, which is again 'one meter' ( $F = 10^{-35}$ ,  $R = 10^{35}$ ): the universe does have finite size -- one-at-a-time -- but only in its [irreversible past](#).

The two extreme cases, (i)  $F = 0$ ;  $R = \infty$  in the Small and (ii)  $F = \infty$ ;  $R = 0$  in the Large, are indistinguishable, because they are identical to [Point I \(C\)](#) of The Beginning/The End. Hence in every instant 'now' we pass through God ([Luke 17:21](#)).



In brief, all Points **II** take different values along **F** (with reciprocal values along **R**):

For **B<sub>Small</sub>** : **F** (0, 1).

For **A** : **F=R=1**.

For **B<sub>Large</sub>** : **F** (1,  $\infty$ ).

What follows is a very brief example for case **B<sub>Small</sub>**, denoted for easy writing with **B**.

**A** : **F=R=1**  $\Rightarrow F_A = R_A = 3.10^8$  m  $\Rightarrow$  1s for the speed of light pertaining to observer **A**,  $c_A$ .

With respect to **A**:  $F_B = 3.10^7$  m  $\Rightarrow$  **0.1s** (cf. Fig. 3 above).

With respect to **B**:  $F_B = 3.10^7$  m  $\Rightarrow$  **1s** for the speed of light pertaining to observer **B**,  $c_B$ .

Hence  $c_B = F_B = 0.1 \Rightarrow R_B = 10$  (see Eq. 1 and the drawing above).

Thus, for observer **B**:  $F_B R_B = 3.10^7 \cdot 10 = 3.10^8$  m  $\Rightarrow$  1s for the speed of light for observer **A**.

Explanation:  $c_B$  shows the *slowing* rate of time in the Small (**B**), but only with respect to observer **A**. For observer **B**, his  $c_B$  is always 'the same constant speed of light', and his time would be "slowing" only with respect to observer **A**. Hence he (observer **B**) *cannot* notice that it takes 10x **longer** time in the Small (compared to observer **A**) to trespass **0.1s** pertaining to observer **A** (cf. Fig. 3 above): the elapsed time will be **1s** for observer **B**. Hence 'one meter' and any other **finite** distance (e.g.,  $3.10^8$  m) will be **scale invariant**. Namely, every **finite 4-D spacetime interval**, as assembled by the Arrow of Space (Sic!), will remain 'the same' to **all** observers and at **all** length scales.

This is our proposal to produce the invariant distance 'one meter' of observer **A**, to represent *one and the same* and invariant 'one meter' at **all** length scales. Namely, the invariant distance 'one meter' of observer **A** "**changes**" toward the Small and toward the Large, yet always determines *one and the same* and invariant 'one meter', be it a proton or a galaxy, as observed by **A**.

This is the key issue in RS gravity. With respect to observer **A**, her invariant 'one meter' can include many smaller elements, such as the size of a proton, but the latter equals **the same invariant** 'one meter' for observer **B** in the Small, because it has been **inflated there** by greater **R**. Likewise, the invariant 'one meter' for observer **A** will be many times smaller than a galaxy, yet **the same invariant** 'one meter' will be shrunk in the Large by smaller **R**, and will again determine *one and the same* and invariant 'one meter' *there*. Hence observer **A** can claim that she is "between" the Small and the Large, and the latter are "penetrating" each other, starting from **A**. In fact, we just happened to be observers **A**, because mind and consciousness can enter the physical world only at macroscopic scale (cf. Q3 above), while the invariant 'one meter' pertains to all observers, at all length scales, thanks to Eq. 1 above and 'the same' uncountably infinite points for **all** values of **R**.

**NB**: The **metric** of spacetime is both dynamical and relational. No need for any "**black holes**" nor "dark" matter (David Wittman), because the observed gravitational effects are **not** produced by matter alone, but by 'the universe as ONE' (Point **I**) as well. For example, observer **A** may **wrongly** conclude that *the space itself* has been "expanding" toward the Large (recall Hubble's diagram), and

introduce some "[dark energy](#)" to explain "the accelerating expansion of the Universe through observations of distant supernovae" (Nobel Prize in Physics [2011](#)). As Anthony Zee put it (*Gravity in a Nutshell*, Princeton, 2013, [p. 753](#)): "A distinguished colleague said to me recently, "The cosmological constant paradox is more than a paradox; it's a profound public humiliation of theoretical physicists."



As another corollary, consider [time dilation paradox](#): if you travel with speed close to  $c$ , your value of  $F$  may 10x [decrease](#) (0.1s instead of 1s; cf. Fig 3 above) with respect to your twin brother -- again, not to you but to your twin brother -- and upon returning home you both will realize that meanwhile the "faster" clock on Earth has trespassed much more time, and your poor twin brother is much older. To you, however, the following interpretation is equally true: the "decreased" elapsed time of 0.1s (cf. Fig 3 above) is valid only for your twin brother, while **the same** elapsed time will be 1s to you, and you won't notice any distortion of your time, because you can't. Whose watch is "correct"? Both.

Of course, it would be far more useful if we can manipulate the metric locally and *blend* the effects predicted in [RS gravity](#), say, to fly like an Alien Visiting Craft ([AVC](#)): our 'one meter' will correspond to 1000 or more meters in the reference frame of outside observers. Whose meter is "correct"? Both.

Needless to say, I still don't know how to "produce the gravity differential, the time field differentials" ([Wilbur B. Smith](#)) which are necessary to operate an [AVC](#). Its inertial reaction "forces" should be eliminated ([REIM](#)) in the first place, to make it fly in "empty space" by "free fall" (cf. Fig. 1 [above](#)). Tough. But since we [[Ref. 1](#)] share *the same brain* with the Universe, the task might be feasible.

I will have to leave the [remaining issues](#) of Point I and Points II [open](#), and go back to the emergence of [Points II](#).

I stated [above](#) that the description of 'points' in differential geometry and topology requires a resolution greater than the points themselves. That is, we need to show the [indefinable entity](#) from which a [point](#) can presumably *emerge* ([Isham and Butterfield](#)).

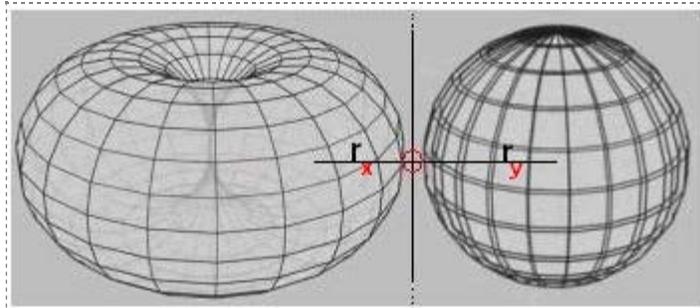
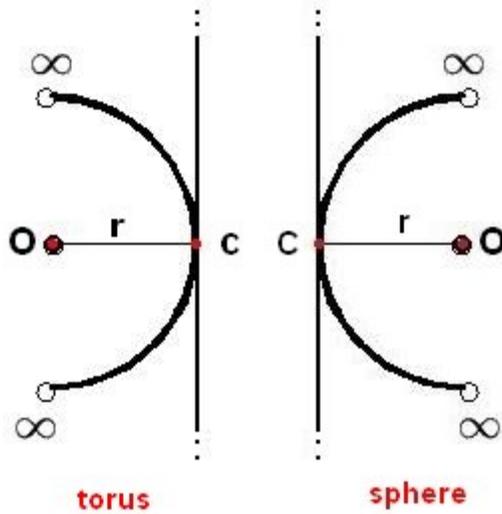
Here the example from [Karel Hrbacek](#) is very helpful:

"if the open interval is (a,b) [with  $a < b$  ], then  $a < c < b$ ."

If we apply the [Golden Ratio](#),  $c$  is an irrational running entity , which is [uniquely defined](#) by a *geometrical* point (modulo the [Cheshire cat](#)), but cannot be "stopped" with rational numbers from

'matter', like the inevitable "error" ([Cauchy](#)) in defining the "precise" value of  $\pi$  to determine the "precise" circumference of the circle [above](#). Any time we "stop" this irrational running  $c$  by ascribing some rational number to it at the instant 'now' (see [below](#)), we obtain only its frozen "[jacket](#)" or "[cloud](#)", like the *physicalized* shadows on [Plato's cave](#).

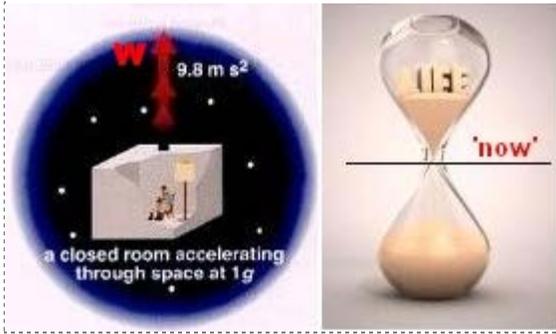
If we apply the [Dedekind Schnitt](#) (cut) to the irrational, yet [uniquely defined](#), point  $c$  for torus (A) and sphere (B) transformations, A(|)B ([Richard Dedekind](#)), we obtain at **actual** infinity (global mode of spacetime) *one and only one* point  $c$  which pertains to 'infinite space', and produces the "severing" of the straight line  $r$  into two portions "separated" by a *purely geometric* (modulo the [Cheshire cat](#)) point  $C$  :



The small red circle contains point  $c$  (omitted), and corresponds to *asymptotically flat* spacetime and the instant '**now**'.

This is the *emergence* of asymptotically flat spacetime (called '[slice](#)' and '[flash](#)') in which the 'world points' are [already](#) individuated by matter (the [Cheshire cat](#)), and belong to the local (physical) mode of spacetime -- one-[flash](#)-at-a-time along the Arrow of Space.

Physically, we observe a *sequence* of points  $c$  '**now**', which **assemble** the *perfect* continuum of the *local* mode of spacetime: The Aristotelian Connection. The latter involves two [offer-and-confirmation](#) "[waves](#)" of spacetime *topology*, which "run" against each other in the [global mode](#), and create asymptotically flat spacetime (local mode): one-[slice](#)-at-a-time along the Arrow of Space.



Yes, we certainly can obtain a frozen "jacket" at  $c$  (called also 'slice' and 'flash') with **actual** infinity, but -- no, not by catching the running  $c$  **itself**. Hence we are dealing with *uncountably infinite* pseudo-set of points from 'open sets' with the *indefinable* cardinality of rational & irrational numbers.

Let's see how this story fits in the  $(\epsilon, \delta)$ -definition of limit:

$$[ \textit{ad infinitum} < \dots \delta \rightarrow \epsilon \rightarrow \dots ]$$

We can replace the bracket [ with  $x$ , and write:

$$(\epsilon - x) - (\delta - x) = \epsilon - \delta = c .$$

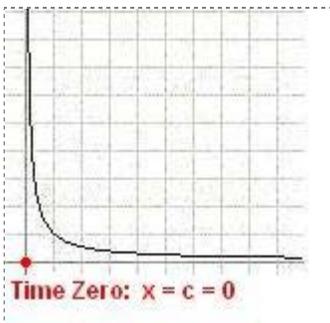
The *exact* numerical value of the referential point  $x$  does not matter, because it disappears anyway, yet it **must** be precise to define the two intervals. It is the ultimate "source" from which the flash-points emerge in the local mode of spacetime, by "collapsing" the two intervals to zero, after which  $c$  and  $x$  become **identical** at the instant 'now', as every bartender knows very well; more here.

Let's see how the referential point  $x$  defines the beginning of cosmological time (hence spacetime) or Time Zero. To paraphrase Wiki:

The notion of the limit of a function is very closely related to the concept of continuity. A function  $f$  is said to be continuous at  $x$  if it is both defined at  $x$  and its value at  $x$  equals the limit of  $f$  as  $c$  approaches  $x$ :

$$\lim_{c \rightarrow x} f(c) = f(x)$$

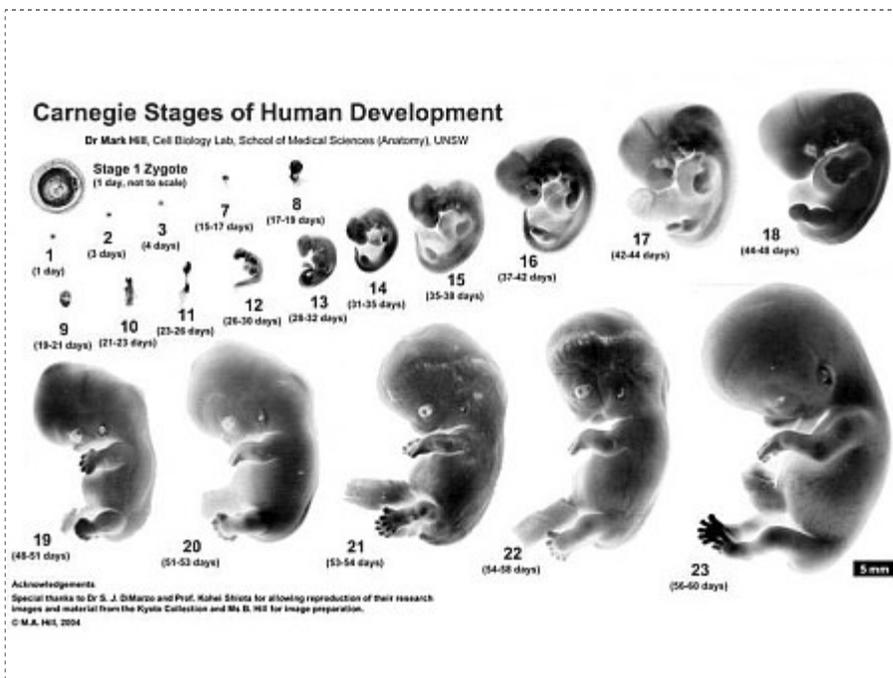
The condition  $0 < |c - x|$  is crucial:  $c$  can only *approach*  $x$ , but will need *infinite time* to reach Time Zero by snapping to the vertical axis. Hence phrases like 'the universe began *asymptotically* at Time Zero,  $x=0$ ' are nonsense (Chuck Norris). For example, if  $c$  takes the value of one nonillionth ( $10^{-30}$ ) of a second, it will again need *infinite time* to reach the vertical axis and become **identical** to Time Zero.



On the other hand, the referential point  $x=c=0$  **must** be precise to define any [Archimedean interval \(Eudoxus axiom\)](#), such as 'one second' and the *increasing* but **always Archimedean** cosmological time, app. [13.798 billion years](#). Besides, there are [vague arguments](#) that the [Planck time](#) may serve as some *physical* Time Zero, yet we cannot define 'one second' as an additive, [Archimedean](#) phenomenon, because the mathematical expression  $10^{-44}$  times  $10^{44}$  does not make sense.

The essence of  $dt/ds$  is that it is **not** made of [Archimedean](#) entities. Its explanation is with **dual age** of the universe: the cosmological time (hence spacetime) *does* have an "edge" or "limit" at Time Zero, but **only** in our [ever-increasing past](#), while *at the same time* (Sic!) the cosmological time (hence spacetime) does **not** have any "edge" or "boundary" in its [potential future](#). In brief, the [atemporal loop 'now'](#) is a **dual** object: it is *both* completed in the past *and* open to 'the unknown unknown' in the future. Metaphorically speaking, the [Dragon](#) can never *actually* bite its tail in the future, but only approach it asymptotically.

If we run this cosmological **non-unitary** evolution backward in time, 'the universe as a [brain](#)' will be losing its physical content by non-unitary transformations, and by approaching asymptotically Time Zero it will become just **very simple**, resembling your prenatal Stage 1, [Zygote](#).



No need to worry "why the very early universe was in a very low entropy state" nor to suggest that "it came into existence in a *very special* state. Of course, this answer begs the question, since one would then want to know why it came into existence in a *very special* state, i.e., what principle or law governed its creation. I definitely do not have an answer to this question" ([Robert Wald](#)).

Now you have *the* answer. There is no alternative solution. **None**. To explain what is alternative solution and why it can't work, suppose the [atemporal loop 'now'](#) were wrong. As a toy model for "unitary evolution", measured with "time" and denoted with  $t$  in your [GR textbooks](#), consider a [kaleidoscope](#) with a **finite** number (e.g.,  $10^{44}$ ) of colored pieces of glass, which is shaken "in the air" and then placed on a table -- once-at-a-time. You aren't interested in the ("dark") states of the kaleidoscope "in the air", but only in its *physically* observable states 'on the table'. You claim that these states change due to [thermodynamics](#), hence exhibit 'time as read with a physical clock', and require the [global hyperbolicity conjecture](#). All possible (i.e., countable in principle) states of the kaleidoscope 'on the table' form a **set**, and you happily invoke "the axiom of choice" to "arbitrarily pick any member" ([Eric Schechter](#)) of this set, and attach certain probability for observing it 'on the table', assuming that all probabilities will sum up to unity, to provide "unitary evolution". All this may sound nice 'n clear, until you realize that (i) one cannot affirm nor reject the Continuum Hypothesis

for such observable states, and (ii) there is too much "dark" *untraceable* stuff that [somehow](#) shows up 'on the table': if interpreted as an effect due to matter, the radius of the universe "could not even reach to the moon" ([Wolfgang Pauli](#)).

People object by stressing that all this is pure philosophy and metaphysics, while they work with mathematics. But the mathematics is still uncovered. It is waiting 'out there', in some Platonist form, to show up and prove its astonishing effectiveness in the natural sciences ([Eugene Wigner](#)).

In this respect, [Kurt Gödel](#) was immensely lucky to demonstrate that the Continuum Hypothesis is [neither provable nor disprovable](#). All the mathematics was already unraveled, and he was lucky to meet the great David Hilbert, who immediately dropped his own [project](#). Why? Simply because David Hilbert had respect for Mathematics and considered it superior to his ideas.

I didn't have such luck so far, and am still trying to find [the right people](#). *Qui vivra verra*.

D. Chakalov

July 20, 2013

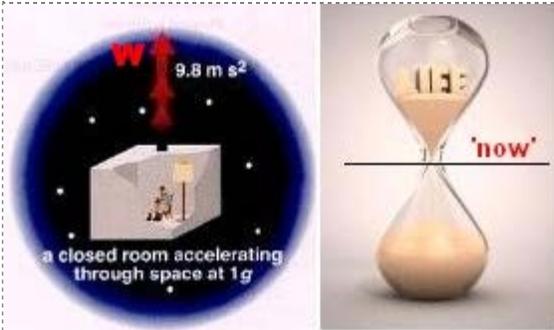
Last updated: September 29, 2013, 16:30 GMT

[Ref. 1] Italo Cavino, [The Form of Space](#), in *Imaginary Numbers: An Anthology of Marvelous Mathematical Stories, Diversions, Poems, and Musings*, ed. by William Frucht, Wiley, 2000.

The equations of the gravitational field which relate the curve of space to the distribution of matter are already becoming common knowledge.

To fall in the void as I fell: none of you knows what that means. For you, to fall means to plunge perhaps from the twenty-sixth floor of a skyscraper, or from an airplane which breaks down in flight: to fall headlong, grope in the air a moment, and then the Earth is immediately there, and you get a big bump. But I'm talking about the time when there wasn't any Earth underneath or anything else solid, not even a celestial body in the distance capable of attracting you into its orbit. You simply fell, indefinitely, for an indefinite length of time. I went down into the void, to the most absolute bottom conceivable, and once there I saw that the extreme limit must have been much, much farther below, very remote, and I went on falling, to reach it. Since there were no reference points, I had no idea whether my fall was fast or slow. Now that I think about it, there weren't even any proofs that I was really falling: perhaps I had always remained immobile in the same place, or I was moving in an upward direction; since there was no above or below these were only nominal questions and so I might just as well go on thinking I was falling, as I was naturally led to think.

=====



Subject: Phase difference of matter waves: Request for reference (if any)

Date: Wed, 24 Jul 2013 12:35:40 +0300

From: Dimi Chakalov <dchakalov@gmail.com>

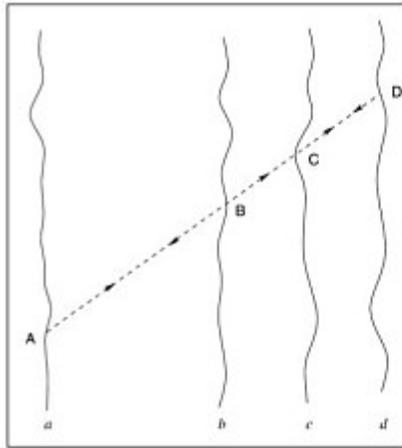
To: Holger Müller <hm@berkeley.edu>,  
Marina Cortes <cortes@roe.ac.uk>,  
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Dear colleagues,

Sorry for my unsolicited email.

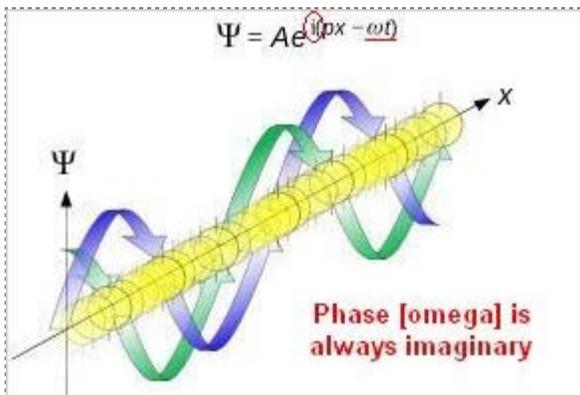
May I ask you for references or other information (if any) about application of phase difference of matter waves in Wheeler-Feynman absorber theory (please see a drawing from J V Narlikar, Mach's Principle, Resonance Journal of Science Education, April 2011, pp. 310-320): a 'correct' response from the whole universe will cancel all "[acausal effects](#)" (J A Wheeler and R P Feynman (1945), Rev. Mod. Phys. 17, 157).

Figure 7. A retarded signal (shown by dotted line) leaving point A on the world line of 'a' hits particles b,c,d,... at points B,C,D,... at later times. Their advanced response returns to A along the same dotted track, no matter how far these particles are from 'a'. Thus even the remote parts of the universe generate instantaneous responses to the retarded disturbance leaving A. In short the response of the whole universe cannot be ignored.



later times. Their advanced response returns to A along the same dotted track, no matter how far these particles are from 'a'. Thus even the remote parts of the universe generate instantaneous responses to the retarded disturbance leaving A. In short the response of the whole universe cannot be ignored.

The whole process is [atemporal](#), as its physical duration is zero due to the "speed" of light. Here, phase difference is crucial.



I wonder if you know any extension of this atemporal and phase-dependent phenomenon to \*matter waves\*.

Thank you for your time and consideration.

Kind regards,

Dimi Chakalov  
[chakalov.net](http://chakalov.net)

**Note:** If we extend the *quasi-local* action-at-a-distance [[Ref. 1](#)] to quantum and gravitational interactions, the fleeting material content ([flashes](#)) at the instant '[now](#)' may look like [Schaumkamm](#) ("eine Art "Schaumkamm" auf einer den Weltgrund bildenden Wellenstrahlung," [Ref. 2](#)) explicated from the global mode of spacetime -- one-at-a-time along the Arrow of Space, and with [unit probability](#). The resulting **re-created** local (physical) mode of spacetime is an **exact limit** for the whole universe, but is valid *only* for its current instant 'now'. Hence we don't need the 'reference fluid' ([Brown and Kuchar](#)) at *this* particular *Schaumkamm* 'now'. Also, the "negative energy" ([Adam Helfer](#)) has been *perfectly* cancelled out, leaving an EPR-like correlated physical world endowed with "[inertia](#)". The *atemporal* 'offer and confirmation' standing wave pertains to the *potential reality* of 'the

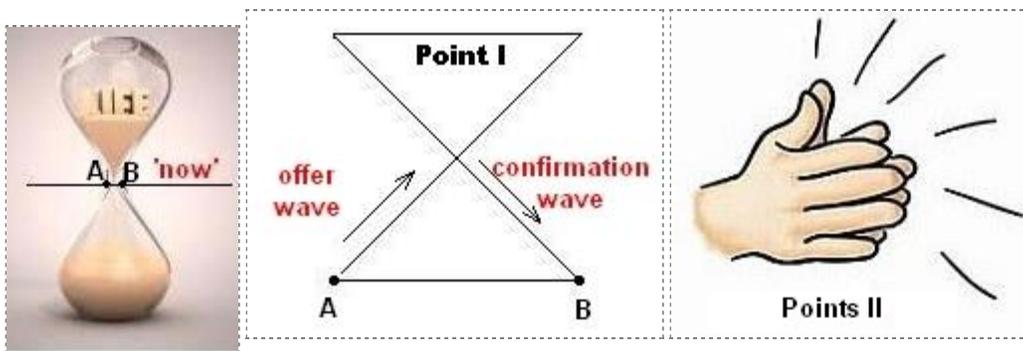
universe as [ONE](#)', hence only the (human) [brain](#) may have access to its *imaginary* phase, to tweak and alter the **next** "[flash](#)" or *Schaumkamm* permitted by the conditions for [flexibility](#) (not "uncertainty").

Trust me, the whole story is [very simple](#) and [agonizingly clear](#). Only the mathematical framework is still uncovered. For example, we don't know how to build an Alien Visiting Craft (AVC) and use [REIM](#) to trespass space along a quasi-local trajectory, in which our 'one meter' will correspond to 1000 or more meters in the reference frame of outside observers, in line with Relative Scale ([RS](#)) gravity. People who believe in "[dark stuff](#)" will be flabbergasted and assume they saw some weird UFO mystery, as "any sufficiently advanced technology is indistinguishable from magic" (Arthur C. Clarke's Third Law).

The list of possible applications is very long, but I will stop here, because nobody's interested -- nobody showed even a trace of interest in the new form of retarded causality, called 'biocausality'. It was introduced in [January 1990](#) as 'just a hypothesis', and now is '*the* only possible solution'. Why?

Look at the world line in the drawing from Jayant Narlikar [above](#), and zoom on the instant 'now'. The [offer-and-confirmation](#) "waves" are atemporal, as they "propagate" on null hypersurfaces [[Ref. 3](#)].

Let's introduce a *structure* of the instant 'now' with two **purely** geometrical (modulo the [Cheshire cat](#)) points **A** and **B**, which belong to the *global mode* of spacetime in [RS gravity](#), and **fix** (Sic!) the *Schaumkamm* 'now':



Atemporal loop 'now'

The *atemporal* loop 'now' in the second drawing occurs in a hypothetical *global mode* of spacetime, which contains only the atemporal '[universe as ONE](#)' depicted with Point **I**. Physically, it would be seen with an inanimate clock (not the [human brain](#)) as a **timeless** luxonic world [[Ref. 4](#)]. The latter "separates" the physical, 4-D spacetime from a mirror world of **imaginary mass** [[Ref. 5](#)] shown with 1+3-D spacetime [[Ref. 4](#)]. Such mirror world keeps the *potential* states of matter, and with respect to the physical spacetime will resemble a rubber hand glove (cf. the [circle](#) in Fig. 5.7 below) [turned inside-out](#), with opposite [parity](#) and [inverted dimensionality](#).

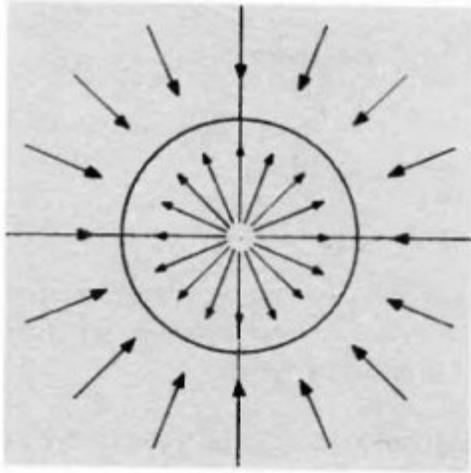
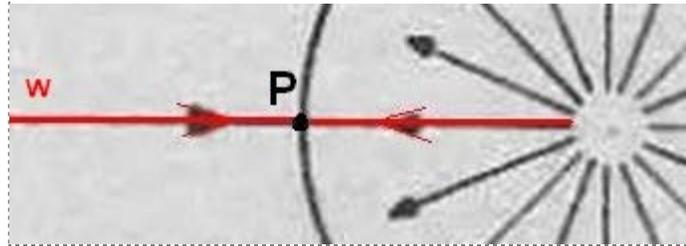


Figure 5.7



Mark A. Armstrong, *Basic Topology*, Springer, 1997, [p. 104](#).

Points **II** (local mode of spacetime) are shown with **P**. The inversions of **red** arrows (sphere-torus transitions) constitute the atemporal loop 'now' above, producing a set of correlated Points **II** *en bloc* -- one-at-a-time.

We will further assume that the *global mode* of spacetime is in *superposition* (Sic!) of **four** mirrored spacetimes of **imaginary** (not negative) mass, and harbors the *potential, yet-to-be-physicalized* reality depicted with [Point I](#). With respect to the physical world, the 'distance' and 'proper time' in the *global mode* of spacetime do **not** yield rational numbers, as the positive squared ( $s^2$ ) spacetime interval "within" [Point I](#) is imaginary.

The broken symmetry of mirrored spacetimes, observed in the physical world with Points **II**, is due to the Arrow of Space: the physical 4-D world is **re-created** at every *Schaumkamm* 'now' as a set of Points **II**, in which the atemporal loop 'now' has been already-completed, and the **imaginary** mass in the *global mode* of spacetime will be interpreted as a neutral plasma of negative-positive mass pairs (Belletête and Paranjape, [pp. 6-7](#)). As Gerald Feinberg stated, "It is clear that at a single point there is no distinction between absorption of a positive-energy particle and emission of a negative-energy (Macavity - D.C.) particle" [[Ref. 5](#), p. 1091].

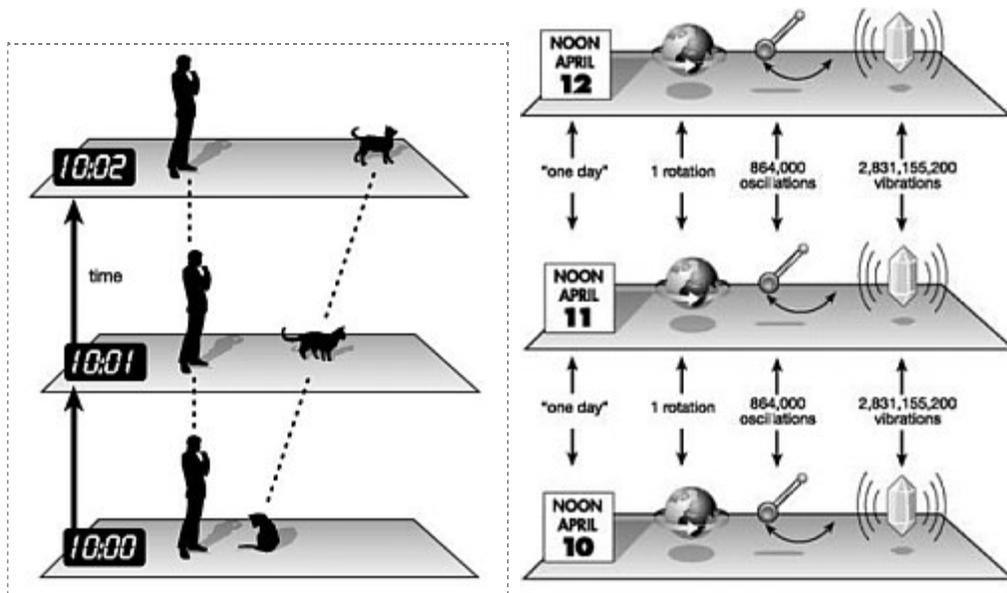
Notice again that, unlike [Wheeler-Feynman absorber theory](#), we assume different, *inverted* spacetimes for the physical and mirror worlds, which "interact" only at one point 'now' by a standing offer/confirmation **topological** wave in the *global mode* of spacetime, shown in the *atemporal* loop 'now' above with Point **I**. Also, the *atemporal* loop induces rotation in the local (physical) mode of spacetime, made with Points **II**, as the offer wave is confirmed by 'the rest of the universe' in just one instant 'now' of "clapping hands". In such Machian model the two "waves" negotiate the energy-momentum content of every **next** instant 'now', as points **A** and **B** will be **again** fused into the **next** instant 'now' from the spacetime *continuum* of the local (physical) mode of spacetime. This bundle of issues requires detailed mathematical study in the [future](#).

**NB:** Notice that the "confirmation" wave from 'the rest of the universe' in the atemporal loop 'now' is **not** time-symmetric but pertains to the *flow of time* in the [Arrow of Space](#). The crucial input from **B** is **not** includable in a Green's type function -- it describes "the transfer between the *intangible* (yet-to-be physicalized - D.C.) energy of the gravitational field (as it will be called here), which is not described by the energy-momentum tensor, and the tangible forms which are so described" ([Hermann Bondi](#)), and is a genuine *non-conservation* law ([Hans Ohanian](#)). Otherwise the universe cannot shift to its **next** instant 'now': there will be no 'change **of** space' along the [Arrow of Space](#), but only 'change *within* space' and the universe (included your [brain](#)) will be timeless ([Robert Geroch](#)).

Thus, the elementary increment of time,  $\mathbf{AB} = \mathbf{dt}$ , is an "interval" in which the two purely geometrical points 'run toward each other', as they are separated by the "error"  $\epsilon$  ([Cauchy](#)). With

Archimedean geometry only, we have two **incompatible** options which 'transfinitists' try to reconcile: either zero or finite, as [Bishop Berkeley](#) stressed. My solution is **YAIN**, and I won't repeat it here. Suffice it to say that the set theory, as presented in the textbook by [Karel Hrbacek](#), must be [upgraded](#) to correctly model the continuum hypothesis.

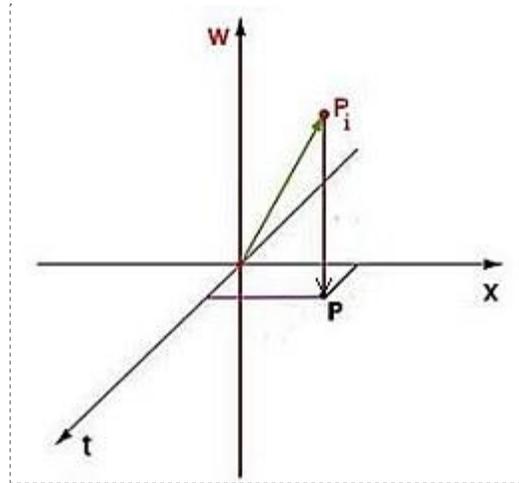
In general, there are two kinds of conditions for describing *the* spacetime of the universe: *necessary* (matter and fields endowed with inertia; see [Points II](#)) and *sufficient*. The *necessary* conditions are only in the **assembled**, [Archimedean](#) (cf. the second drawing below) spacetime, in which the Arrow of Space has [already](#) been [nullified](#) along its **w-direction**, due to which [Points II](#) are endowed with positive mass and **inertia** ([Fig. 1](#) above); check out the drawings below.



Drawings from: Sean Carroll, *From Eternity to Here*, Penguin, [2010](#)

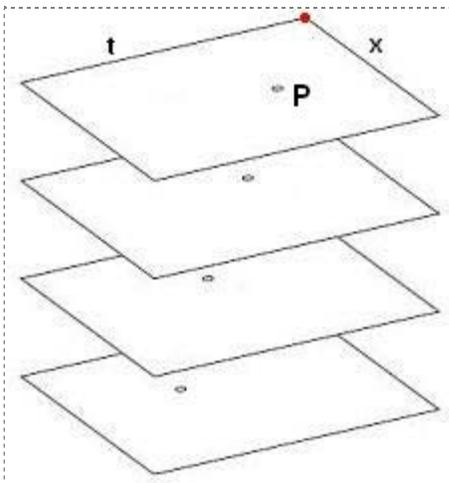
According to the observer and his Diff(M)-invariant wristwatch, the cat moves only (wrong!) in the *assembled* (cf. option **Yes above**) 4-D *Archimedean* spacetime by changing its coordinates. But the *assembled* 4-D spacetime is made by the [Arrow of Space](#) with achronal 3-D hypersurfaces in which the "[orthogonal](#)" input is made infinitesimal along **w-axis** (cf. [Fig. 1](#) above), and the "displacement"  $dt/ds$  is approaching **zero**. Physically, [the observers](#) cannot detect the irreversible *flow of time* along the additional **global "orthogonal" w-displacement** from the [Arrow of Space](#), and believe they live in some dead frozen "[block universe](#)" equipped only with [thermodynamics](#). The fundamental difference between 'change in space' and 'change in time' is postulated (not explained) with spacetime metric from the outset, and all efforts in GR (e.g., [Peter Bergmann](#)) to endow the *metric* with [dynamics](#) ([with respect to what?](#)) tacitly presuppose that the dynamics of GR occurs only by coordinate change in the *assembled* 4-D *Archimedean* spacetime (cf. option **Yes above**). But this "change" is a local (in fact, *quasi-local*) phenomenon, and pertains only to the *necessary* conditions.

The *sufficient* conditions, on the other hand, are defined from the atemporal '[universe as ONE](#)' depicted with [Point I](#) -- the "[engine](#)" of the *atemporal* loop above is the Aristotelian Unmoved Mover ([Karel Kuchar](#)). Both conditions, *necessary* and *sufficient*, are needed to make the metric **dynamical**: Mass *there* governs spacetime geometry *here* ([Ciufolini and Wheeler, p. 270](#)), and **at the same instant** spacetime geometry *here* governs mass *there*. Thus, the instant 'now' has [internal structure](#), to accommodate the *atemporal*, bi-directional, and non-linear "[talk](#)" (depicted below with the 'drawing hands' from Maurits Escher) along the **w-axis**, between every 'point' and 'the rest of points'.



Click the images for explanation of the "orthogonal" **w-axis**. The transition  $P_i \rightarrow P$  (second drawing) is the so-called "flash" or rather "end" result -- one-end-at-a-time -- from the *atemporal* loop 'now' ([clapping hands](#)).

Metaphorically, what we see in a cinema theatre are the [running images](#) from achronal static [slides](#) in a movie reel, which fully comply with the laws of [thermodynamics](#).



Four achronal 'isolated systems' or "flashes" with **different** matter-energy content. In every individual "slice" the contracted Bianchi identity holds FAPP, hence we can effectively [switch off gravity](#) at a point ([Peter Bergmann](#)). The "orthogonal" **w-axis** is compactified on four **different** Points **II**, and the bi-directional talk between matter and geometry ([Derek Wise](#)) is *already* completed by [the Noumenon](#).

We don't see the dark strips ( $ds/dt$ ) separating the achronal [snapshots](#) in the movie reel, nor the **global** engine which runs the movie. Hence at every instant 'now' we [pass through](#) God ([Luke 17:21](#)): a genuine [Noumenon](#) (Kantian *das Ding an sich* - never in plural), presented with 'the set of all sets'. [Isn't it simple?](#)

In fact, I am trying to help [Karel Hrbacek](#) and [Karel Kuchar](#), and recently offered them and their colleagues to read my proposal, in PDF format, and [write a brief paper](#). They all refused, and will continue to teach their students an incomprehensible mixture of things that are clearly correct, unclear, horribly misleading, and outright wrong. But soon or later, they all will irreversibly [retire](#).

July 24, 2013

Last updated: October 7, 2013, 12:37 GMT

[Ref. 1] F. Hoyle and J. V. Narlikar, Cosmology and action-at-a-distance electrodynamics, *Rev. Mod. Phys.* 67 (1995) [113-155](#).

"There is one further hint of the possible role of the response of the universe in local phenomena, a role that takes us beyond electrodynamics. The discussions of Secs. III-V tell us that it is not proper to talk of a probability amplitude for a local microscopic system. The correct description of the physical behavior of the system follows from the probability calculation that includes the response of the universe. Thus one is dealing with a "square of the amplitude" type of expression rather than the amplitude itself.

"This may explain the mystery that surrounds such epistemological issues like the *collapse of the wave function*. What is missing from the usual discussion of the problem is [the response of the universe](#). The wave function collapse represents the final course of action taken by the system consistent with the response of the universe. We suggest this idea as a way of understanding many other conceptual issues of quantum mechanics.

.....

"What has been the progress towards extending the action-at-a-distance formulation to other interactions?"

[Ref. 2] Erwin Schrödinger, Zur Einsteinschen Gastheorie, *Physikalische Zeitschrift*, 27 (1926) 95-101.

[Ref. 3] Piotr Chrusciel, *Lectures on Energy in General Relativity*, March 6, 2012, [p. 166](#).

### A.15 Null hyperplanes and hypersurfaces

One of the objects that occur in Lorentzian geometry and which possess rather disturbing properties are *null hyperplanes* and *null hypersurfaces*, and it appears useful to include a short discussion of those. Perhaps the most unusual feature of such objects is that the direction normal is actually tangential as well. Furthermore, because the normal has no natural normalization, there is no natural measure induced on a null hypersurface by the ambient metric.

James Hartle, *Gravity: An Introduction to Einstein's General Relativity*, Addison-Wesley, 2003, [p. 162](#).

## Null Surfaces

Surfaces generated by light rays are another important class of three-surfaces called *null surfaces*. At each point in a null surface, there is one tangent direction  $\ell$  that points along a light ray and is null,

$$\ell \cdot \ell = 0, \quad (7.79)$$

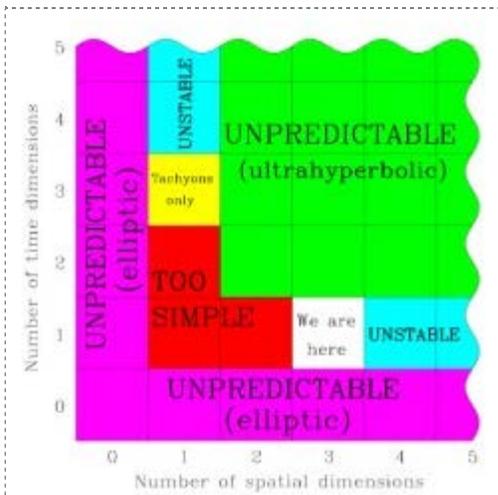
and two orthogonal independent spacelike directions. The null direction  $\ell$  is a normal to the null surface because it is orthogonal to the spacelike directions and also to itself by virtue of (7.79). A normal to a null surface is a null vector that lies in it.

[http://en.wikipedia.org/wiki/Spacetime#Light-like\\_interval](http://en.wikipedia.org/wiki/Spacetime#Light-like_interval)

Wiki: "In a light-like interval, the spatial distance between two events is exactly balanced by the time between the two events. The events define a squared spacetime interval of **zero** ( $s^2 = 0$ ). Light-like intervals are also known as "null" intervals."

Note: The cause-effect relationship is handled by a new retarded causality, called *biocausality* (D. Chakalov, [January 1990](#)).

[Ref. 4] Max Tegmark, On the dimensionality of spacetime, [arXiv:gr-qc/9702052v2](https://arxiv.org/abs/gr-qc/9702052v2).



"Since a mere minus sign distinguishes space from time, the remaining case  $(n,m) = (1, 3)$  is mathematically equivalent to the case where  $(n,m) = (3, 1)$  and all particles are tachyons [14] with imaginary rest mass.

Footnote 4: "The only remaining possibility is the rather contrived case where data is specified on a null hypersurface. To measure such data, an observer would need to "live on the light cone", i.e., travel with the speed of light, which means that it would subjectively not perceive any time at all (its proper time would stand still)."

[Ref. 5] Gerald Feinberg, Possibility of Faster-Than-light Particles, *Phys Rev* **159** (1967) [1089-1105](#), cf. Eq. 2.2 on p. 1090 (imaginary mass)



Hermann Weyl, *Philosophy of Mathematics and Natural Science*,  
Princeton University Press, 2009, [Ch. 2](#)

Regarding the *relation of number to space and time* we may say that time, as the form of pure consciousness, is an essential, not an accidental, presupposition for the mental operations on which the sense of a numerical statement is founded.

In a different form than in the sequence of integers we encounter the infinite in the *continuum*, which is capable of infinite division. Cases of special importance are the continua of time and of space. Here we find the second open place in the above described construction of the mathematical realm of numbers. Antiquity has bequeathed to us two important contributions to the problem of the continuum: (a) a far-reaching analysis of the mathematical question of how to fix a single position in the continuum, and (b) the discovery of the philosophical paradoxes which have their origin in the intuitively manifest nature of the continuum.

Newton and

Leibniz seemed to have the correct view, which they formulated more or less clearly, that the infinitesimal calculus is concerned with the approach to zero by a limiting process. But they lack the ultimate insight that the limiting process serves not only to determine the value of the limit but also to establish its existence. For that reason Leibniz is still quite unclear as to the summation of infinite series. Only slowly does the theory of limits gain a foothold. In 1784 D'Alembert declares emphatically in the *Encyclopédie*, "La théorie de la limite est la base de la vraie métaphysique du calcul différentiel. Il ne s'agit point, comme on le dit ordinairement, des quantités infiniment petites; il s'agit uniquement des limites des quantités finies." It was left to Cauchy, at the beginning of the 19th century, to carry these ideas out consistently. In particular he discovers the correct criterion for the convergence of infinite series, the condition under which a number is generated as limiting value through an infinite process. The proof of the criterion, however, requires that fixation of the number concept which was later accomplished by the principle of the Dedekind cut.

The third attempt to 'save' the continuum in the Platonic sense may be seen in the modern set-theoretic foundations of analysis.

Subject: Interpretation of the [Weyl Tensor](#)

Date: Fri, 2 Aug 2013 09:40:21 +0300

Message-ID: <CAM7Ekx=waCTUDOF2XVfeYV+9ACcaLHCGboRtqFiY4pw65DW08A@mail.gmail.com>

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To: Robert Schneider <robert.bob.schneider@physik.lmu.de> ,

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Cc: Dieter Kotschick <dieter@mathematik.uni-muenchen.de> ,

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andreas.mueller@universe-cluster.de

Dear colleagues,

You wrote in [arXiv:1308.0010v1 \[gr-qc\]](#) that the physical content of the metric field in vacuum should be "somehow encoded" in the Weyl tensor, and "new dynamical degrees of freedom", such as "[outgoing and incoming](#)" waves, can be expected.

A very simple explanation is offered at [http://www.god-does-not-play-dice.net/#loop\\_now](http://www.god-does-not-play-dice.net/#loop_now)

The task is purely mathematical.

All the best,

Dimi Chakalov

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**Note:** One hundred years ago, Marcel Grossmann [[Ref. 1](#)] suggested that "the divergence of the (contravariant) stress-energy tensor of the material flow or of the physical process vanishes."

**YAIN.** The [crucial input](#) from the [Weyl Tensor](#) is yet to be understood.

D. Chakalov

August 2, 2013, 13:38 GMT

[Ref. 1] Outline of a Generalized Theory of Relativity and of a Theory of Gravitation. I. Physical Part by A. Einstein II. Mathematical Part by M. Grossmann, *Zeitschrift für Mathematik und Physik*, **62**, 225-244, 245-261 (1913), in *The Collected Papers of Albert Einstein*, Volume 4: The Swiss Years: Writings, 1912-1914, ed. by A. J. Kox *et al.*, Princeton University Press, 1996, [p. 182](#).

=====

"Well, then," asks Socrates in the *Republic*, "shall we proceed as usual and begin by assuming the existence of a single essential nature or Form for every set of things which we call by the same name?"

Adapted from Plato, *The Republic*, [X.596a6](#), translated by [Allan Bloom](#)

-----

Subject: Platonic ideas: The set of all sets  
Date: Fri, 26 Jul 2013 11:41:26 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
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Dear colleagues,

I argue against the unrestricted use of the axiom schema of comprehension, and offer a new form of logic (YAIN) to incorporate 'the set of all sets' in mathematics. The explanation comes from physics, and is hinted at

<http://www.god-does-not-play-dice.net/#atemporal>

Please feel free to comment and ask questions.

Kind regards,

Dimi Chakalov

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**Note:** The so-called 'axiom schema of comprehension' claims that 'all the things with some property form a set' (reference [here](#)). Sounds simple and clear, yet '[the set of all sets](#)' and its complement, known as 'the empty set' (it is [both open and closed](#)), are notoriously difficult to explain. I will argue that 'the set of all sets' corresponds to Plato's Idea or [Form](#), and that **it does not belong to any set** but to the non-Archimedean world of 'the universe as [ONE](#)' (global mode of spacetime), as depicted in the *atemporal* loop [above](#).

Let me quote from Jianfei Shen, *Introduction to Set Theory: A Solution Manual for [Hrbacek and Jech \(October 14, 2011\)](#)*, stressing the usual, and seemingly "obvious", either/or logic:

► EXERCISE 3 (1.3.3). a. Prove that a "set of all sets" does not exist.

b. Prove that for any set  $A$  there is some  $x \notin A$ .

PROOF. (a) Suppose that there exists a *universe* set (a set of all sets)  $\mathcal{V}$ . Then by the Axiom Schema of Comprehension, there is a set  $B = \{x \in \mathcal{V} : x \notin x\}$ ; that is

$$x \in B \iff x \in \mathcal{V} \text{ and } x \notin x. \quad (1.1)$$

Now we show that  $B \notin \mathcal{V}$ , that is,  $B$  is not a set. Indeed, if  $B \in \mathcal{V}$ , then either  $B \in B$ , or  $B \notin B$ . If  $B \in B$ , then, by the " $\implies$ " direction of (1.1),  $B \in \mathcal{V}$  and  $B \notin B$ . A contradiction; if  $B \notin B$ , then, by the " $\impliedby$ " direction of (1.1), the assumption  $B \in \mathcal{V}$  and  $B \notin B$  yield  $B \in B$ . A contradiction again. This completes the proof that  $B \notin \mathcal{V}$ .

(b) If there were a set  $A$  such that  $x \in A$  for all  $x$ , then  $A$  is "a set of all sets", which, as we have proven, does not exist.  $\square$

To understand the new logic **YAIN** (Yes-And-neIN), which is not restricted to either/or propositions viz. "contradictions", let me repeat the doctrine of *trialism*: ONE dual entity, which is explicated by two *complementary* presentations, say, matter & psyche ([Wolfgang Pauli](#)).

Suppose [Karel Hrbacek](#) was an Eskimo who has never seen an elephant in his life. Yet he can make observations on elephant's *trunk* by two complementary devices, which measure *either* properties of 'nose' or properties of 'arm'. Obviously, he can never understand the underlying 'ONE entity', called 'trunk'. Worse, he may be tempted to seek some causal relation between the 'nose' and the 'arm' only, and [waste his whole life](#) with questions like 'which goes first, and how'.

Our case looks simpler, because we must only explain 'the ONE' (called by Plato [Form](#)), which is

explicated by infinitely many sets, yet does **not** belong to any set, being 'the set of all sets'. To do this exercise, check out '[the UNdefinable matrix](#)': given the inverse-proportional relation between the content and volume of concepts, the bigger the volume, the smaller the content. A comparison between, say, 'chair' and 'furniture' shows that 'chair' has bigger content (more specific) and smaller volume (number of distinguishable chairs) than the more general concept of 'furniture'. A very general and abstract concept, such as 'thing', covers *almost* everything we could think of, and has *almost* zero intrinsic content. The **limit** of this trend is some UNSpeakable concept that has **infinite** volume and **zero** intrinsic content. **It** covers **all** possible concepts, and is presented with the pseudo-set of all sets. **It** is also UNSpeakable, because **it** does *not* require any referential object (i.e., we can understand A only with respect to not-A), hence cannot be defined with our relational thinking.

The same *untraceable* limit applies to the Aristotelian [Unmoved Mover](#) and First Cause, which are "hidden" in [dt&ds](#) transition of the *atemporal* loop [above](#), known as 'the instant *now*' ([Luke 17:21](#)).

Yet **it** does exist, being the source of all '[shadows on Plato's cave](#)', or 'the set of all sets' **A** such that *x* belongs to **A** for all *x* (cf. Jianfei Shen above). Or simply "a single essential nature or Form for every set of things" ([Plato](#)), which also has **zero** intrinsic content, and will look like an 'empty set' [as well](#).

And because we're "Eskimos", we can comprehend a set of things (A) with particular properties iff there exists a *referential* set of things with *opposite* properties (not-A). The underlying 'ONE entity' is a pseudo-set of *all* sets, and **all** propositions about such "trunk" are non-falsifiable and UNdecidable ([Kurt Gödel](#)). This is the price to pay for removing "contradictions" from either/or logic.

**It** does exist and *must* exist, but is a [Noumenon](#) and can be demonstrated only with Mathematics.

You may ask, 'but is this boring story really important?' Yes it is. If you skip it, you may waste many years in the jungle of set theory [[Ref. 1](#), p. 283] and never understand [the nature of continuum](#).

The choice is yours.

D. Chakalov

July 27, 2013

Last updated: July 28, 2013, 12:33 GMT

[Ref. 1] Karel Hrbacek and Thomas J. Jech, *Introduction to Set Theory*, 3rd ed., Marcel Dekker, New York - Basel, 1999.

[pp. 268-269](#):

We have shown in this book that the well-known concepts of real analysis (real numbers and arithmetic operations on them, limits of sequences, continuous functions, etc.) can be defined in set theory and their basic properties proved from Zermelo-Fraenkel axioms with Choice. A similar assertion can be made about any other branch of contemporary mathematics (except category theory). Fundamental objects of topology, algebra, or functional analysis (say, topological spaces, vector spaces, groups, rings, Banach spaces) are customarily defined to be sets of a specific kind. Topologic, algebraic, and analytic properties of these objects are then derived from the various properties of sets, which can be themselves in their turn obtained as consequences of the axioms of ZFC. Experience shows that all theorems whose proofs mathematicians accept on intuitive grounds can be in principle proved from the axioms of ZFC. In this sense, the axiomatic set theory serves as a satisfactory unifying foundation for mathematics.

Mathematicians have been baffled for decades by relatively easily formulated set-theoretic problems, which they were unable to either prove or disprove. A typical example of a problem of this kind is the Continuum Hypothesis (CH): Every set of real numbers is either at most countable or has the cardinality of the continuum. We showed in Chapter 9 that CH is equivalent to the statement  $2^{\aleph_0} = \aleph_1$ , but we proved neither  $2^{\aleph_0} = \aleph_1$  nor  $2^{\aleph_0} \neq \aleph_1$ .

First, Gödel demonstrated in 1939 that the Continuum Hypothesis cannot be disproved in ZFC (that is, one cannot prove  $2^{\aleph_0} \neq \aleph_1$ ). Twenty-four years later, Cohen showed that it cannot be proved either. Their techniques were later used by other researchers to show that the Suslin's Hypothesis and many other problems are also undecidable in ZFC. We try to outline some of Gödel's and Cohen's ideas in Section 2, but readers more deeply interested in this matter should consult some of the more advanced texts of set theory.

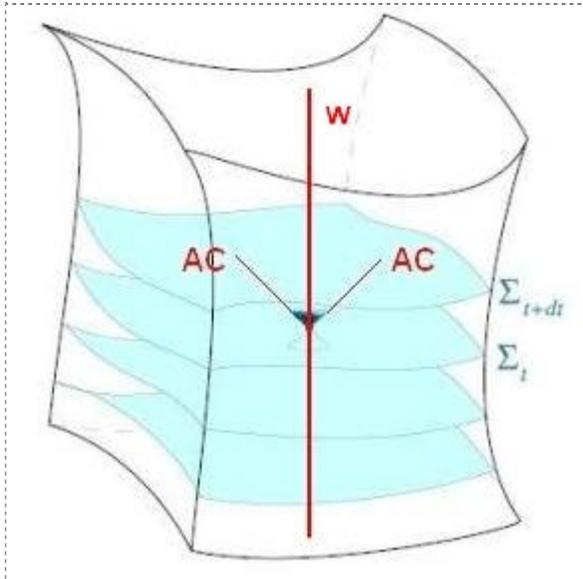
The foregoing results put the classical open problems of set theory in a new perspective. Undecidability of the Continuum Hypothesis on the basis of our present understanding of sets as reflected by the axioms of ZFC means that some fundamental property of sets is still unknown.

(Plato has explained this "property" in 360 BC - D.C.)

[p. 283:](#)

Most of the work discussed in this section is relatively recent, and by no means complete. Both the theory of large cardinals and the study of the undecidable statements of arithmetic are very active research areas where new insights and interconnections continue to be discovered. As Gödel assures us in his Incompleteness Theorem, no axiomatic theory can decide all statements of arithmetic or set theory. We can thus feel confident that the enterprise of getting closer and closer to the ultimate truth about the mathematical universe will continue indefinitely.

=====



Subject: 'Something else': FR = 1  
Date: Sat, 24 Aug 2013 21:25:01 +0300  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: [snip]

C.J. Isham and J. Butterfield, [arXiv:gr-qc/9901024v1](http://arxiv.org/abs/gr-qc/9901024v1): "Space and time are such crucial categories for thinking about, and describing, the empirical world, that it is bound to be ferociously difficult to understand their emerging, or even some aspects of them emerging, from 'something else'."

--

Ladies and Gentlemen:

Please notice Eq. 1 at  
[http://www.god-does-not-play-dice.net/Indefinable.html#sandclock\\_elevator](http://www.god-does-not-play-dice.net/Indefinable.html#sandclock_elevator)

Download printable copy, 34 pages, from  
<http://www.god-does-not-play-dice.net/Indefinable.pdf>  
(1,885,485 bytes, 24 August 2013, 16:58:40 GMT)

Read more at  
[http://www.god-does-not-play-dice.net/#sandclock\\_elevator](http://www.god-does-not-play-dice.net/#sandclock_elevator)

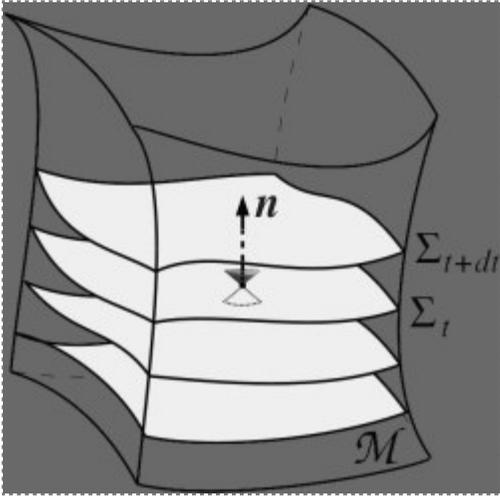
Your corrections and suggestions will be appreciated.

Sincerely,

D. Chakalov  
[chakalov.net](http://chakalov.net)

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**Note:** Where is this 'something else' ? It is the dark "canvas" in the first drawing below, which acts as "background" with respect to which the so-called *lapse function*  $\mathbf{N}$  is introduced, as shown in the second drawing.



The "splitting" of spacetime (R.K. Sachs and H. Wu, [p. 27](#)) ultimately requires **global** time, "a **global** time function  $\mathbf{t}$  whose levels sets are the (achronal - D.C.) hypersurfaces defining the foliation" (M. Alcubierre, [pp. 3-4](#)), yet this 'global time' is considered (wrongly!) [classical parameter](#), explained operationally as 'time as read with your wristwatch'.

- In addition to the two variables  $\gamma_{ij}$  and  $\pi_{ij}$ , there are two Lagrange multipliers called the lapse  $N$  and shift  $N_i$ .
- These describe how each of the "leaves"  $\Sigma_t$  of the foliation of spacetime are welded together.

Notice that 'classical time' ([Peter Bergmann](#)) is inserted "between" achronal hypersurfaces, and the infamous 'problem of time' in canonical quantum gravity ([Bryce de Witt](#)) requires that the lapse  $\mathbf{N}$  becomes **dead zero**. Hence you end up with one frozen achronal hypersurface only, which can take only one point, as  $\mathbf{ds}$  is eliminated as well. In other words, the introduction of some global classical time to "weld" all "leaves" together kills the whole spacetime.

This is the paradox (not "problem") of spacetime in canonical quantum gravity, which can be solved *only and exclusively only* with the [atemporal loop 'now'](#). Notice that in [RS gravity](#) the stacking of achronal hypersurfaces along [null hypersurface](#) is the "end product" -- one-at-a-time -- of the Arrow of Space, obtained only in the [irreversible past](#) where the "separation" is approaching **zero**. The small black arrow in the first drawing above,  $\mathbf{n}$ , is indeed located in the time-like section of Minkowski cone, but has an **orthogonal** component  $\mathbf{w}$  from the [Arrow of Space](#), which is approaching *asymptotically* zero in the [irreversible past](#). This is the crucial difference between 'time as coordinate change **in** space' vs 'time as atemporal change **of** space'. And since the instant 'now' is [dual object](#), the **orthogonal**, to the arrow  $\mathbf{n}$  in the first drawing, component  $\mathbf{w}$  takes values in the open interval  $(0, \infty)$  pertaining to [the potential future](#): see the *entanglement of space*,  $E_{\text{space}}$ ,

[above](#). So in the case of gravitational systems not larger than the [solar system](#), you may use linearized gravity, since the value of  $E_{\text{space}}$  and the input from  $\mathbf{w}$  will be vanishing small, but for objects with size of a galaxy the *entanglement of space* will produce "dark" effects ([David Wittman](#)), as explained [above](#).

Again, the direction  $\mathbf{w}$  of the [Arrow of Space](#) is depicted with the "elevator" in [Fig. 1 above](#). Its projection in 3-D space (local mode of spacetime) is [omnidirectional](#), which is why we simply call it 'time'. It certainly "welds" all achronal "leaves" together as 'the instant now' -- [one-at-a-time](#) -- to produce an **assembled** continuum of Points **II** in [space-like](#) and [time-like](#) "directions", called 4-D spacetime (local mode of spacetime). We see matter only in the [past state](#) of such *assembled* spacetime, and cannot detect the Aristotelian Connection which will **re**-assemble the **next** achronal "[flash](#)" of Points **II** in the **next** instant '[now](#)'. But people are unaware of this *flow of time* and would run the [time-symmetric](#) "arrow"  $\mathbf{n}$  (cf. the first drawing above) backwards, to find the [history of the universe](#) and trace back the origin of [gravitational anomalies](#), only it's just **not there**. The fictitious axis of electron [spin](#) (you have to rotate a spin not by 360 degrees but by [720 degrees](#) to get back to exactly the initial state you started with) and the axis of global rotation (the latter induces [total net spin of galaxies](#)) are due to the same kind of errors -- there is no need for any "dark axis" either. It's just **not there**.

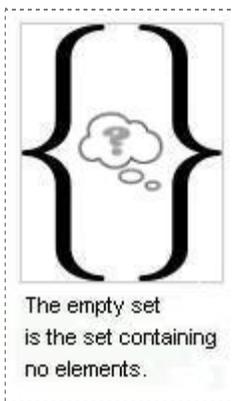
It may be difficult to understand the *emerging* of spacetime from '[something else](#)' ([C.J. Isham and J. Butterfield](#)), but [you don't have any choice](#). None.

D. Chakalov

September 15, 2013

Last updated: September 16, 2013, [16:16:17 GMT](#)

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Subject: Lawrence Krauss, 18 February 2013, 32:58 - 32:59

Date: Sat, 28 Sep 2013 23:54:52 +0300

Message-ID: <CAM7Ekx=eYi9Ejt0FkG9rILtTzEnCaUa0c3Fo1JSU\_y3FbiSV0g@mail.gmail.com>

From: Dimi Chakalov <dchakalov@gmail.com>

To: Lawrence M Krauss <krauss@asu.edu>

Cc: [\[snip\]](#)

A Show About Nothing

TV station ABC1, Australia, 18 February 2013

<http://www.abc.net.au/tv/qanda/txt/s3687812.htm>

Lawrence Krauss (32:58 - 32:59): "But I would argue that nothing is a physical quantity. It's the absence of something."

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Larry:

You are deeply religious person obsessed by anti-theism. The latter is as dangerous as the opposite, [theistic](#) religion.

The proof that you're brainwashed by anti-theism is your own statement that 'nothing' were "the absence of something." Of course you know very well that you are wrong, yet you make such blatantly false statements because your religion forces you to "forget" the basic basics of cosmology.

Your fake example for "nothing" is 'zero something', that is, "the absence of something", like claiming that you have zero bananas in your ears.

But the notion of 'nothing' is not like 'an empty set of bananas' (the cardinality of an [empty set](#)). The true 'nothing' has absolutely no presentation by anything \*whatsoever\*, and is [the opposite](#) to 'zero something'.

It is the Noumenon,

<http://www.god-does-not-play-dice.net/Indefinable.html#simple>

If you prefer, you may call the Noumenon "something else", after C. Isham and J. Butterfield,

<http://www.god-does-not-play-dice.net/Indefinable.html#FR1>

You can approach -- although not entirely comprehend -- the Noumenon only with [mathematics](#), provided you are not brainwashed by any religion whatsoever. But since you're brainwashed by your religion, you just can't.

Proof: Check out the text at the links above, and you won't be able to say anything. None. Why? Because you can't -- see above.

As John Coleman put it, "It is extremely difficult to induce penguins to drink warm water."

How about [your colleagues](#)?

D. Chakalov

-----

**Note:** Regarding the [imaginary number](#), let me quote from MathWorld [[Ref. 1](#)]:

### Imaginary Unit

The [imaginary number](#)  $i = \sqrt{-1}$ , i.e., the [square root](#) of  $-1$ . The imaginary unit is denoted and commonly referred to as " $i$ ." Although there are **two** possible square roots of any number, the square roots of a negative number cannot be distinguished until one of the two is defined as the [imaginary unit](#), at which point  $+i$  and  $-i$  can then be distinguished. Since either choice is possible, there is no ambiguity in defining  $i$  as "the" square root of  $-1$ .

As mentioned [above](#), the "[mass](#)" in the global mode of spacetime ([Point I](#)) is *imaginary*. What is the

square root of -9? **3i**. How about the square root of 9? +/- 3. Since  $(-3)*(-3) = (3)*(3) = 9$ , I will use  $(-/+3)$ :

$$\sqrt{(9 \times -1)} = \sqrt{(9)} \times \sqrt{(-1)} = (-/+3) \times \sqrt{(-1)} = |3|i .$$

See the **Noumenon** denoted with 'zero **nothing**' in the l.h.s. of Eq. 1 on p. 35 (28 September 2010) [here](#). For your convenience, I reproduced it below.

$$\mathbf{0} = (-m) + (+m) \quad (1) .$$

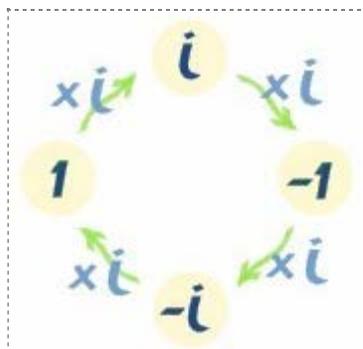
Notice that  $(-m)$  and  $(+m)$  are interpreted as a **neutral** plasma of [negative-positive mass pairs](#) (Belletête and Paranjape, [pp. 6-7](#)), denoted in the examples above with  $(-/+3)$  and  $|3|i$ . Thus, the Noumenon or 'zero **nothing**' is denoted here with  $\mathbf{O}_i$  :

$$\mathbf{O}_i = |-m/+m|i \quad (\text{Eq. 2}).$$

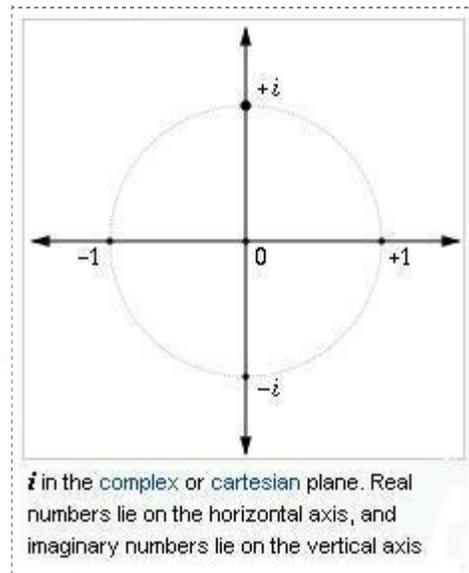
According to the doctrine of trialism, the interpretation of Eq. 2 is [straightforward](#): ONE entity, denoted with  $\mathbf{O}_i$  , and explicated with two complementary presentations, imaginary  $(-m)$  and  $(+m)$ . Hence the imaginary mass-energy of the Noumenon is always "conserved", with the sole exception of the joint Beginning/End at point **C** [above](#), in which case it is **indefinable**.

It seems Eq. 2 bears some similarity with the moduli of quantum waves amplitudes in the [Born rule](#). The conversion of imaginary amplitudes in the loop '[now](#)' to Points **II** is still [unknown](#), however.

Click the drawings below for more.



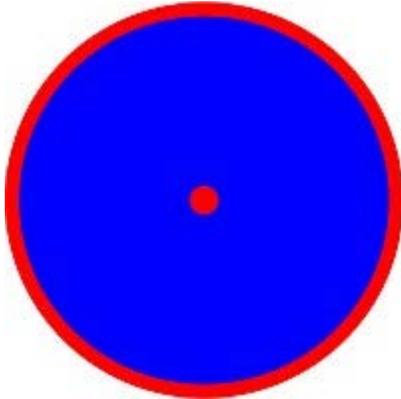
- $i \times i = \textcircled{-1}$ ,
- then  $-1 \times i = -i$ ,
- then  $-i \times i = \textcircled{1}$ ,
- then  $1 \times i = i$



Should you have questions, please don't hesitate to contact me by [email](#). Bear in mind that the new mathematical object 'zero **nothing**', denoted with  $\mathbf{O}_i$  in Eq. 2 above, is opposite to 'zero *something*' (e.g., the number of bananas in [Larry's ears](#)), and is made by extending the category '**not** included' to its final (Sic!) **limit**: the so-called [set of all sets](#) is also '**not** included'. Namely, a set  $\{A\}$  with zero cardinality ( $\{\}$  or  $\{\text{zero something}\}$  such as 'no bananas') can exist **iff** there is a complementary *relational* set of 'everything else in the universe' that also belongs to the category '**not** included'  $\{\text{not-}A\}$ . Likewise, a set with *finite* cardinality  $\{A\}$  from the category 'included' (e.g., a

set of two bananas) can exist **iff** there is a complementary *relational* set of 'everything else in the universe' {not-A}, such that the combination of {A} and {not-A} form again the so-called [set of all sets](#).

Briefly, we introduce 'maximal set theory' [Ref. 2] with two axioms: a [set](#) {A} can exist **iff** the union {A} and {not-A} denotes the [set of all sets](#). Then we extend {not-A} to the [set of all sets](#), and the **final limit** of {A} is 'the perfect monad *without windows*' ([Leibniz](#)), also known as *the Noumenon*, denoted here with  $O_i$ . Thanks to [Plato](#), we made all sets '**closed**' (cf. the drawing below) and simply can't go further. Why? Because both  $O_i$  and its complementary '[set of all sets](#)' are **indefinable "it"** (the **red** boundary in the drawing below), explained previously with '[John](#)'.



The points  $(x, y)$  satisfying  $x^2 + y^2 = r^2$  and  $x = y = 0$  are colored **red**.

The points  $(x, y)$  satisfying  $0 < x^2 + y^2 < r^2$  are colored **blue**.

The **blue** points form an [open set](#).

The **red** points form an **indefinable** boundary  $O_i$ .

The union of **red** and **blue** points is a [closed set](#).

Thus, the [Noumenon](#)  $O_i$  is the 'absolute empty set' which *complements* the [set of all sets](#), and their **union** (Sic!) makes **all** sets 'closed' [Ref. 2]. **It** (not "He") **cannot** be exhausted with *any* '[open set](#)' of objects ("[flashes](#)") in the r.h.s of Eq. 2 above, which are marked with **blue** in the drawing above, and fit in the categories [things we know], [things we know that we don't know], and [things we *still* don't know that we don't know]. The last category enables the [creative evolution](#) of the universe in the [open future](#).

Can we *think* about the [Noumenon](#)  $O_i$ ? Yes we can, because **it** (not "He") exists yet is *not* relational. **It** is *the self-referential* set  $\Omega = \{\Omega\}$ , and is *potential reality* (compare with the [Quine atom](#)). **It** has **zero** presentations with Points **II**, because has **infinite** (actual infinity) volume and **zero** intrinsic content, as explained [above](#). And because the [Noumenon](#)  $O_i$  is *potential reality*, it is impossible in principle to tell the difference (if any) between 'absolute empty set' and its *complementary* [set of all sets](#).

Only [people](#) who suffer from Zenophobia (the irrational fear of convergent sequences) will pretend that cannot understand the final **limit** denoted with **C** [above](#), also known as *the Noumenon*.

D. Chakalov

September 29, 2013

Lat updated: October 20, 2013, [20:05 GMT](#)

[Ref. 1] Weisstein, Eric W. "Imaginary Unit." From MathWorld--A Wolfram Web Resource. <http://mathworld.wolfram.com/ImaginaryUnit.html>

[Ref. 2] D. Chakalov, *Maximal Set Theory*, 2014 (in preparation).

Excerpt from [Varol Akman](#): "The [AFA universe](#) can be depicted as in Figure 9, extending around the well-founded universe, because it includes the [non-well-founded sets](#) which are not covered by the

latter."

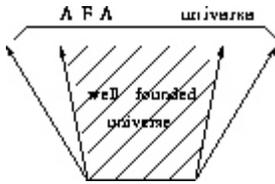


Figure 9: [AFA universe](#) extending around the well-founded universe (adapted from [Barwise & Etchemendy](#) 1987))

See also: [Peter Aczel](#), *Non-Well-Founded Sets*, CSLI Lecture Notes, Stanford University, 1988, p. xviii.

The purpose of Part One of this book is to investigate the axiom system obtained by replacing *FA* in *ZFC* by an axiom that I have chosen to call the Anti-Foundation Axiom, abbreviated *AFA*. This axiom expresses, in a particular way, that every possible non-well-founded set exists. The resulting axiom system is  $ZFC^- + AFA$ , where  $ZFC^-$  is *ZFC* without *FA*.

=====



Subject: Truth in mathematics: Absolute undecidability  
Date: Fri, 4 Oct 2013 04:02:59 +0300  
Message-ID: <CAM7Ekxm+CCbshAeh0ysYkjrc5qL6rmMxtOgE=-VbsLBMt6qgig@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Peter Koellner <koellner@fas.harvard.edu>  
Cc: [\[snip\]](#)

"A natural and intriguing question is whether there are mathematical statements that are in some sense absolutely undecidable, that is, undecidable relative to any set of axioms that are justified."  
Peter Koellner, [On the Question of Absolute Undecidability](#),

-----

Dear Dr. Koellner:

Please see the case for absolute undecidability at

<http://www.god-does-not-play-dice.net/Indefinable.html#Noumenon>

The new logic here is YAIN (Yes And neIN).

As Kurt Gödel explained in 1931, "one can always pass to "higher" systems in which the sentence in question is decidable", hence the limit (Sic!) is [the Noumenon](#) and its truth value YAIN. Thus, I agree with Dr. Solomon Feferman that Continuum Hypothesis (CH) should be considered not to have a definite truth value -- it can't have any definite truth value. If it had, we can move to the next "higher" system and meta-theory, until we hit the rock bottom of [the Noumenon](#), much like in the [Thompson lamp paradox](#).

Physical considerations at

<http://www.god-does-not-play-dice.net/Indefinable.html#addendum>

Your opinion and the feedback from your colleagues will be greatly appreciated.

Kind regards,

Dimi Chakalov

[chakalov.net](http://chakalov.net)

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**Comment:** What could be wrong with introducing Mathematics to God? Only people brainwashed with [religion](#), both theism and anti-theism, will disapprove -- they will either keep silent or pretend that cannot understand it (cf. Q4 [above](#)).

God is not about religion. It is your free will choice to accept God in Mathematics or reject it. If you choose the latter, how did you obtain your *free will* in the first place? Was it somehow "[encoded](#)" in your [DNA](#)? Or maybe the Universe itself is endowed with [free will](#)? What a pity you cannot respond!

D. Chakalov

October 4, 2013, 08:33 GMT

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Subject: Re: I wonder if you would agree to endorse the submission of my manuscript to [gr-qc]  
Date: Fri, 19 Jul 2013 13:34:46 +0300  
Message-ID: <CAM7Ekxk3B9yGVL4Ai\_F+VA48Yg11UQYvwz20+Q6Og13p9zKpjA@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: Adam Helfer <helfera@missouri.edu>,  
Laszlo Szabados <lbszab@rmki.kfki.hu>,  
Niall 'O Murchadha <niall@ucc.ie>,  
Luca Lusanna <lusanna@fi.infn.it>,  
Jose Geraldo Pereira <jpereira@ift.unesp.br>,  
Luca Bombelli <bombelli@olemiss.edu>,  
Domenico Giulini <domenico.giulini@zarm.uni-bremen.de>,  
Mike Turner <mturner@kicp.uchicago.edu>,  
Chris Isham <c.isham@imperial.ac.uk>,  
Karel V Kuchar <kuchar@physics.utah.edu>,  
Norbert Straumann <norbert.straumann@gmail.com>,  
Don Marolf <marolf@physics.ucsb.edu>,  
Matt Visser <matt.visser@msor.vuw.ac.nz>  
Cc: John Baez <baez@math.ucr.edu>,  
Robert Geroch <geroch@midway.uchicago.edu>,  
Robert M Wald <rmwa@midway.uchicago.edu>,  
Alan Rendall <rendall@aei.mpg.de>,  
Helmut Friedrich <hef@aei.mpg.de>,  
Claus Kiefer <kiefer@thp.uni-koeln.de>,  
Lars Andersson <laan@aei.mpg.de>,  
Charles Torre <charles.torre@usu.edu>,  
Xiao Zhang <xzhang@amss.ac.cn>

Dear colleagues,

[Two months ago](#), you refused to endorse the submission of my manuscript to [gr-qc].

The mathematical issues in the so-called Relative Scale (RS) theory of gravity are posted at

<http://www.god-does-not-play-dice.net/#Hrbacek>

(July 19, 2013, 09:20:59 GMT)

In PDF format, see pp. 9-13 in

<http://www.god-does-not-play-dice.net/Indefinable.pdf>

(486,686 bytes, 19 July 2013, 09:35:28 GMT)

I believe it is a very simple theory:

[http://www.god-does-not-play-dice.net/#RS\\_gravity](http://www.god-does-not-play-dice.net/#RS_gravity)  
[http://www.god-does-not-play-dice.net/Relative\\_Scale.pdf](http://www.god-does-not-play-dice.net/Relative_Scale.pdf)

Only its mathematical formalism is still waiting to be uncovered. Which is why I was hoping that some of you would be interested in foundations of mathematics and quantum gravity, and would endorse the submission of my manuscript to [gr-qc].

Thank you, once more, for your fundamental papers and monographs. They were very helpful indeed.

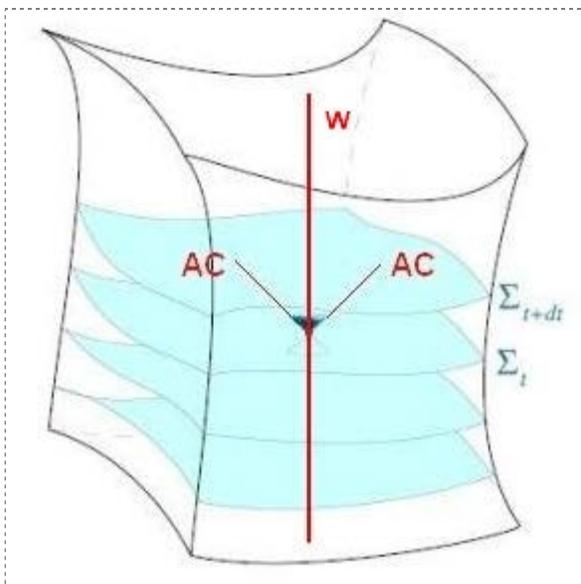
Sincerely,

Dimi Chakalov

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**Final note:** At age 61, my health is gradually deteriorating, and in September 2012 I was hit by an ischemic stroke in the brain. Will need at least two more years to recover, during which I may not have spare time to update this website. I hope to be back on the track by Christmas 2015, unless of course I get a second stroke and kick the bucket. You never know with the future.

In you look at the *atemporal* loop in the drawing [above](#), the state of matter at point **A** must not be entirely fixed, in order to gain corrections and additional *brand new* events from 'the rest of the universe', introduced "finally" at **B**: the future is *open* for new events, up to '[the unknown unknown](#)'. The [atemporal loop](#) is a [creative and non-unitary](#) transition which *requires* the universe to be [indefinable](#) and [flexible](#) to acquire its **next** negotiated state along the Arrow of Space. This is how the *emergence* ([Isham and Butterfield](#)) of [Points II](#) is produced by the Aristotelian Connection (**AC**) in the drawing [above](#).



Physically, [the "speed" of light](#) makes **AC** look like "[nothing](#)", and the resulting continuum of Points **II** is *perfect*. Physically, the "direction" of stacking of Points **II** ([Arrow of Space](#)) is *simultaneous* in **all** directions, which is why we simply call it 'time'. No *physical* reference frame (see the animation from [John Walker](#)) is available to detect the [atemporal Aristotelian Connection](#) of *Die Bahn* ([Werner Heisenberg](#)). And because at every instant of observation all Points **II** have *already* (due to [the "speed" of light](#)) passed via Point **I** into our [ever-increasing past](#), the fundamental binding phenomenon -- Point **I** and **AC** -- is **not there**. It is the source of the Universe (cf. 'zero *nothing*' in l.h.s. of Eq. 1 on p. 35 from [ExplanatoryNote.pdf](#)), and is residing at "absolute rest" ([Luke 17:21](#)).

Thus, it is impossible *in principle* to derive the "final-and-initial" Point **I** and **AC** from Points **II**: *both* the asymptotic boundaries in the Large (**B**) *and* infinitesimal points in the Small (**B**) are **indefinable**. See again the explanations with states of kaleidoscope [here](#) and [here](#). If Point **I** and **AC** were *physical* points and hence 'GR observables' ([Peter Bergmann](#)), we would be able to detect **dt/ds** in spacetime, the "[aether](#)" will be exposed to physical observations, the theory of relativity will be wrong, and the [Cauchy error](#) and [Dedekind Schnitt C](#) will be mathematically verifiable up to their **final** (Sic!) endpoint, after which the lapse/shift **dt/ds** will be **exactly** zero, which will kill the whole spacetime, as in the paradox of spacetime in [canonical quantum gravity](#).

Metaphorically, the [Arrow of Space](#) is depicted with the Dragon chasing its tail ([Ouroboros](#)); the enclosed words mean 'The All is [One](#).'



Why Arrow of Space? Because of the *creative evolution* of our universe: it is *both* irreversibly fixed in its [ever-growing past](#) *and* [indefinable](#) and [flexible](#) -- not "uncertain" -- in its future.

**Der Herrgott würfelt nicht!**

D. Chakalov  
20 October 2013, [20:05 GMT](#)

Download printable copy, [Indefinable.pdf](#)  
<http://www.god-does-not-play-dice.net/Indefinable.pdf>

<http://issuu.com/dchakalov/docs/indefinable>

<http://www.scribd.com/doc/171851871/Indefinable-Boundary-Point-I-and-Points-II>

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Die Anschauungen über Raum und Zeit, die ich Ihnen entwickeln möchte, sind auf experimentell-physikalischem Boden erwachsen. Darin liegt ihre Stärke. Ihre Tendenz ist eine radikale. Von Stund' an sollen Raum für sich und Zeit für sich völlig zu Schatten herabsinken und nur noch eine Art Union der beiden soll Selbständigkeit bewahren.

Hermann Minkowski, Vortrag über „Raum und Zeit“ ([1908](#))

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Subject: Re: The Arrow of Spacetime (talk in Munich, 21.09.2008, 10 - 10:45 AM)  
Date: Thu, 19 Sep 2013 14:53:44 +0300  
Message-ID: <CAM7Ekxkpd\_zzaFo8PX7L4bj+4BdqZTkghv1M2JPJ6F\_G3=Vqnw@mail.gmail.com>  
From: Dimi Chakalov <dchakalov@gmail.com>  
To: [[snip](#)]

<http://www.god-does-not-play-dice.net/Talk.txt>

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Ladies and Gentlemen:

On Sunday, 21 September 2008, I commemorated the talk by [Herman Minkowski](#) in Cologne on 21 September 1908.

The proposal is summarized in the drawing attached ([21 September 2008.jpg](#)), from

[http://www.god-does-not-play-dice.net/Indefinable.html#loop\\_now](http://www.god-does-not-play-dice.net/Indefinable.html#loop_now)

Full version at

[http://www.god-does-not-play-dice.net/#loop\\_now](http://www.god-does-not-play-dice.net/#loop_now)

Sincerely,

D. Chakalov

On Mon, 2 Jun 2008 04:27:30 +0300, Dimi Chakalov <dchakalov@gmail.com> wrote:  
[snip]

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Eine neue wissenschaftliche Wahrheit pflegt sich nicht in der Weise durchzusetzen, daß ihre Gegner überzeugt werden und sich als belehrt erklären, sondern vielmehr dadurch, daß ihre Gegner allmählich aussterben und daß die heranwachsende Generation von vornherein mit der Wahrheit vertraut gemacht ist.

[Max Planck](#), 1948



D. Hilbert

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A printable version of this web page, in .PDF format ([front\\_page.pdf](#), 19 October 2013, 27,049,795 bytes), can be downloaded from [here](#).

D. Chakalov

October 19, 2013, [14:00 GMT](#)

