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LIGO: The Schizophrenic Behavior of Gravity
<http://www.god-does-not-play-dice.net/Szabados.html#SBG>

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

Check out pp. 16-17 and pp. 20-22 (letter size)

http://www.god-does-not-play-dice.net/Szabados.html#wine_cellars

Subject: [arXiv:0902.0381v2 \[gr-qc\]](http://arxiv.org/abs/0902.0381v2), The path to the enhanced and advanced LIGO gravitational-wave detectors ...

Date: Fri, 13 Mar 2009 00:05:32 +0000

From: Dimi Chakalov <dchakalov@gmail.com>

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... ends up with wine cellars, for reasons explained at

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

Please don't ever say you knew nothing about it.

Sincerely,

D. Chakalov
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Note: An elucidating excerpt from [arXiv:0902.0381v2 \[gr-qc\]](http://arxiv.org/abs/0902.0381v2), "The path to the enhanced and advanced LIGO gravitational-wave detectors", pp. 6-7:

"The first Enhanced LIGO data run, S6, is planned for mid-2009, together with Virgo. (...) The initial LIGO, Enhanced LIGO and Advanced LIGO broadband curves correspond to distances to which the coalescence of a binary system of 1.4M_x neutron stars could be detected by a single detector of roughly 15, 30, and 200Mpc, respectively."

If LSC members had glanced at Robert Caldwell and Marc Kamionkowski, The Physics of Cosmic Acceleration, [arXiv:0903.0866v1](http://arxiv.org/abs/0903.0866v1), they should have noticed that Einstein's GR is strictly valid up to the length scale of the Solar system; anything larger than [our galaxy](#) will begin to show the two opposite "[dark effects](#)" of gravity, currently interpreted as CDM (e.g., extra force dominated orbital dynamics, [EFDOD](#)) and [DDE](#).

LSC play a totally irresponsible gamble by tacitly assuming that the problems from these "dark effects" are irrelevant to their GW hypotheses: see [above](#). They frantically hope that the [dipole "radiation"](#) would be

impossible, and that the forthcoming Enhanced LIGO run S6, planned for mid-2009, would produce at least a hint for GWs.

Until this S6 run and its negative outcomes are digested by LSC "think tank", they will probably keep dead quiet. But if LSC members really hope to get the cash for the **Advanced** LIGO -- a whole new and *terribly expensive* upgrade -- they will have to produce some scientific hypothesis for GW detection by LIGO and the like, as well as resolve their utterly obvious problems (see the GW lake [below](#); summary [here](#)).

The key issue is this: once we face the possibility for [dipole "radiation"](#), the "waves" we hope to detect can be displayed *only and exclusively only* with the **end results** from the *emergence* of mass with [positive energy density](#) in the RHS of Einstein field equation, as depicted with the famous Esher drawing below.

The present-day GR ([Robert Geroch](#)) says nothing on this fundamental mechanism of *emergence* of spacetimes ([Isham & Butterfield](#)) as a chain (or some kind of 'trajectory') of spacetimes with *already* actualized positive energy densities. Each 'spacetime' corresponds to a *global* instant 'now' from the [arrow of spacetime](#), and is also an "instantaneous" universe in its *local mode* of spacetime. Due to the correlation of all *potential* spacetimes in the realm of '[potential reality](#)' (notice the Esher drawing below), all the constituents of such "instantaneous" universe will display a **wave-like** pattern -- the genuine gravitational "waves" -- that ([hopefully](#)) can be recorded by an observer *inside* such "instantaneous" universe, provided the observer has access to the realm of 'potential reality' *as well*. Think of such "instantaneous" universe as an *emerging 'fish from the shoal'*, which is "surrounded" by infinitely many *potential* fish from the shoal. It's a [whole new ball game](#).

Also, I have reasons to rule out the [canonical quantum gravity](#) as possible path to solving this puzzle. We may need two kinds of time: a [global mode of time](#) for the realm of 'potential reality' -- the latter is **neutral** to the two "signs" of mass -- and a [local mode of time](#) for the *already* actualized mass-energy with positive "sign", placed (as we currently do it by hand) in the RHS of Einstein equation. With today's GR "no shielding is possible" ([John Stachel](#)).

To sum up, it is the correlation 'think globally, act locally' that produces these "waves", and if we wish to detect the metric waves of the positive **remnant** (*effectively* [Lorentzian signature](#) of classical spacetime) from the [dipole "radiation"](#), we need access to a new medium -- the reference fluid of GR called '[potential reality](#)' -- which is **neutral** to both "signs" of mass.

I can easily wait until Christmas 2009. We may end up with seven **huge** wine cellars all over the world -- see the drawing [below](#).

The fun part is just around the corner!

Meanwhile, I will leave LSC members to ponder on the issues raised by Adam Helfer [[Ref. 1](#)]. I have highlighted some of his thoughts regarding 'the idea of an isolated system' ([Xiao Zhang](#)), to express my disagreement with the very recipe for "cutting off" a spacetime, namely, by reaching some "limit" at which the system becomes "self-contained" [[ibid.](#)] You can't reach any limit *whatsoever* by moving away from [here-and-now] in **null directions** [[ibid.](#), Fig. 1]. This 'conformal infinity' ([Jörg Frauendiener](#)) is a sheer Gedankenexperiment performed in the direction opposite to that of [Thompson's lamp](#) Gedankenexperiment.

You need to *actually* (not just "asymptotically") reach *exactly* the **joint point** of [spacelike infinity](#) & null-infinity, in order to *actually* produce the crucial **joint** (if any) -- see my **NB** [below](#). Then you'll have to rush back to *exactly* the same [here-and-now] you started from, in order to deliver the message that the "system" has indeed been "isolated in the sense of Bondi and Sachs", and eventually support LSC project for "[GW astronomy](#)" -- in case you believe (as [Joshua Goldberg](#) apparently does) that LIGO was build on the basis of BMS group (it isn't; check out Hermann Bondi [below](#)).

I suppose LSC members can email Adam Helfer and ask him to express his opinion on their [wine cellars](#). Go ahead, Adam Helfer is a very polite person (notice also his [FQXi essay](#)), and will respond with math. Tons of it.

To sum up, there are three approaches to the *wegtransformierbar* [energy in GR](#): (i) pseudo-tensor formulations, (ii) global definitions of energy (e.g., the Bondi or ADM formulations), and (iii) quasilocal definitions of energy, pertaining to 'extended but finite' domains of spacetime. The first should be abandoned, as it aims at "the right answer to the wrong question" ([MTW](#)); the second is as good as is the current effort [[Ref. 1](#)] to define 'the entire spacetime' (there are no global existence theorems for the Einstein equations), and the [third approach](#) requires a special Aristotelian cutoff placed **both** at spacelike infinity & null-infinity **and** at *the* fundamental increment of time, **dt** (see [above](#)). Once the entire spacetime is wrapped by these two (in fact, ONE) [cutoff\(s\)](#), we should be able to define rigorously the *wegtransformierbar* energy in 'extended but finite' domains. In my view, this is the only option for quantum gravity.

But of course I could be all wrong. As Chris Isham put it, "You do not know enough theoretical physics to help with any research in that area."

"[just another crank](#)" D.C.
March 13, 2009
Last update: March 27, 2009

[Ref. 1] Adam Helfer, Angular momentum of isolated systems in general relativity, [arXiv:0903.3016v1 \[gr-qc\]](#), submitted on 17 Mar 2009

"(c) General-relativistic angular momentum, in the presence of gravitational radiation, has a qualitatively different character than special-relativistic angular momentum. It is represented not simply by a skew two-index tensor field, but contains other representations of the Lorentz group as well.

"Most remarkably, those "extra" contributions turn out to be precisely a standard measure of the gravitational radiation.

...

"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](#).

...

NB: "(b) the set I^+ has the topology it would for Minkowski space, and **can be joined** to M as a hypersurface **at infinity**;

...

"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.

"If we wish to study an isolated system and account for the radiation which it emits, we are led to consider **moving away** from it at the speed of that radiation, here the speed of light, that is, in **null directions**.

...

"The question of how to account for corrections due to the fact that real systems are not perfectly isolated is, however, a very important and hard one. There is no definitive progress on this (neither for energy, momentum nor angular momentum); this is the problem of **quasi-local** kinematics.

...

"... the BMS group does not represent isometries, but preservation of a weaker asymptotic structure, which has not been linked to a physically compelling conserved quantity. (...) This means too that we have an infinite-dimensional family of "instants of retarded time," ...

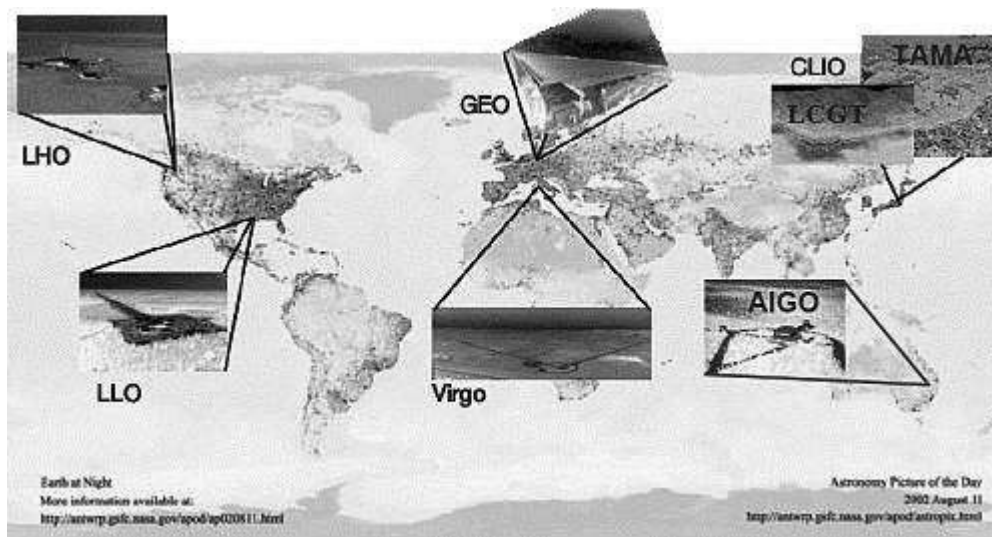
...

"This means that the emission, absorption, or exchange of angular momentum via gravitational waves may be a much more important feature of ordinary (not strongly radiating) general relativistic systems, than the corresponding phenomena for energy-momentum.

"While the treatment of angular momentum suggested here does appear to be satisfactory, in the sense that it is natural and has attractive features, it leads to deeper questions, which at present we do not have answers for: Why should the angular momentum have this form?

"What [underlying structure](#) — substituting for the isometries in special relativity — is responsible for the existence of angular momentum in general relativity?"

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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.

Sir Hermann Bondi, Gravitational Waves in General Relativity, February 1, 1990

A Taxpayer's Perspective On GW Astronomy

(download [ExplanatoryNote.pdf](#), 28 pages)

Explanatory note

Three questions and three tentative answers:

Q1. Is it possible, at least in principle, to extract energy from geometry?

A1: [Maybe](#).

Q2. Exactly what is 'fundamentally nonlinear' (cf. Sir Hermann Bondi) in [the recipe](#) of LIGO Scientific Collaboration ([LSC](#)) for detecting GWs?

A2: Nothing. Zilch.

Q3. Can LIGO's L-shaped "antennae" do the job, at least in principle?

A3: No. [Not even in principle](#).

Settling the issue of [Gravitational Waves](#) (GWs) could shed light on the [dynamics of GR](#), the *Wegtransformierbarkeit* of gravitational energy (cf. [Afriat & Caccese](#), p. 27 and p. 32), and the very meaning of 'spacetime' ([Alan Rendall](#)) in GR. I have sufficient reasons to suspect that I *might* -- perhaps accidentally -- have made a [discovery](#), and want to test this

what does GR say about the latter? The proof of the existence of some *global* constraints, which are needed for the global existence theorems for the Einstein equations, has not been found. If these unknown global constraints are to be derived with elliptic equations ([Alan Rendall](#)), perhaps they will uncover some *quasi-instantaneous* global property of spacetime ([James Woodward](#)) -- "the whole universe must know about everything instantaneously" ([Mike Zucker](#)). Such faculty of spacetime cannot be 'local', as understood in classical physics, so here's a **wild guess**: if the *Wegtransformierbarkeit* ([Afriat & Caccese](#)) of the gravitational energy-momentum and angular momentum (Laszlo Szabados, [23 Feb 2005](#)) turns out to be a corollary from the (currently unknown) *global constraints* and *quasi-instantaneous* global properties of spacetime, we could perhaps learn how to associate the quasi-local variables ([Bjoern Schmekel](#)) to extendable domains, from quasi-local "points" to the "**boundaries**" of spacetime. Then GWs might become comprehensible, or at least we would expect to understand the physical origin or "**necessity**" that the gravitational energy-momentum *has* to be *wegtransformierbar*.

Then we might be able to understand the [Equivalence Principle](#) ([John L. Synge](#) couldn't grasp it, although he was an expert in the equation of geodesic deviation) and the origin of [inertial forces](#), and perhaps the very essence of GR ([Einstein](#)), after which we could perhaps be confident about the *exact* applicable limits of the "linearized approximation" ([Jürgen Ehlers](#), [Ehlers.pdf](#), Sec. 5).

I mean, all this should be first done on paper, before asking for taxpayers' money. I believe every physicist from LSC can offer her/his 'wild guess' about how GWs may transport their *wegtransformierbar* energy across the universe, under the condition that "such transport is a fundamentally nonlinear phenomenon" (Sir Hermann Bondi), and by taking into account that the gravitational field "is not only nonlinear in its own coupling, but also makes *all matter fields* self-interacting" (T. Padmanabhan, [arXiv:gr-qc/0110046](#)).

The dynamics of GR is inherently *non-linear*, in the sense that "the metric has a double role: it is a field variable and defines the geometry **at the same time**" ([Laszlo Szabados](#) - emphasis added). [John Baez](#) explained it as follows: "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". This *double role* of the metric field is the essence of the non-linear GR. Its immediate consequence is the problem of time in classical GR ([Carlo Rovelli](#)), which is usually omitted in [GR textbooks](#). (BTW if we consider only one kind of time in GR, such as 'the time read by a clock', we face the [paradoxical situation](#) in which type I matter fields would "create" their time (and space), and at the same time evolve in *that same* spacetime.)

We can only speculate whether the proper time of the wristwatch of LIGO's operator reads some linearized "remnant" or "projection" from this utterly non-linear variable ([not 'observable'](#)) that captures the dynamics of GR. To paraphrase [John Wheeler](#), space acts on matter, telling it how to move, and at **the very same instant** at which space tells matter how to move, matter reacts "back" on space, telling it how to curve. We don't observe any push-pull negotiation between the two sides of Einstein field equations. Our poor wristwatch (not [brain](#)) cannot by itself "linearize" the talk between matter and geometry, along some "[polynomial time](#)". Any other non-linear phenomena can, at least in principle, be modeled with some linearized approximation (weather forecast, for example), provided

a **fixed** spacetime "grid" can be postulated.

Notice that the metric field in GR is **dynamical**: it changes at *each and every instant* at which space acts on matter, telling it how to move; and at *the very same instant* at which space tells matter how to move, matter reacts "back" on space, telling it how to curve; hence the metric field changes literally at *each and every instant*.



(One crucial precondition for deriving dynamics from [instantaneous state](#) is a background of Minkowski spacetime. With [ADM hypothesis](#), we wind up with a [dead frozen snapshot](#) resembling the ["collapse" in QM](#), and cannot, [even in principle](#), extend the solutions of Einstein field equations arbitrarily far in one direction, to recover the [dimensions of 3-D space](#).)

NB: Thanks to this **non-linear dynamics** of the metric "field", we have its **waves**. If you want to catch the energy transported by these "waves", keep their non-linear dynamics 'alive and kicking', because "such transport is a fundamentally nonlinear phenomenon" (Sir Hermann Bondi).

To elucidate this crucial issue, I asked Kip Thorne five years ago ([Sun, 16 May 2004 02:02:03 +0300](#)) the following question: "I wonder how would those gravitational waves propagate within themselves, and with respect to themselves." He failed to reply to this question, and to the rest of my email messages.

Of course we need some kind of '[reference object](#)' to even *think* of the dynamics of GWs; our thinking is also relational. The issue is, again, [very speculative](#), but at least we can say what this 'reference object' is **not**:

It is **not** some background of [undisturbed geometry](#), which is "there before the wave arrives and after it passes" (cf. Bernard Schutz below).

LSC members simply don't understand the dynamics of GWs and the [dynamics of GR in general](#). Notice that the proper time of the wristwatch of LIGO's operator can only read 'tangible forms of energy', as the "non-localizable form of energy is inadmissible" ([Hermann Bondi](#), p. 249). Such clock (not the [human brain](#)) can only read the **end result** from the conversion of the non-tangible form of GW energy into the tangible form of energy recorded by LIGO's interferometer. This 'end result' is like the

["collapse" in QM](#), in the sense that we can't get more than *one frozen instant* of quantum waves from their dimensionless amplitude either.

Recall that the very definition of '[isolated system](#)' is nothing more and nothing else than a kinematical snapshot of spacetime ([Robert Geroch](#)), since it depends "only on the (momentary) state of the system, not on its past or future history" (cf. Dieter R. Brill and Pong Soo Jang [below](#)). The very idea of 'isolated system' relies on [mathematically unclear](#) (recall the continuum hypothesis and "[Aleph-null bottles of beer on the wall](#)"), and physically unverifiable, procedure by which the "isolated system" would eventually reach the alleged "asymptotically flat" **final** state, namely, "in the limit when the system becomes completely spatially isolated from everything else" ([Roger Penrose](#)).

There is hardly anything more important in GR than the correct definition of the "[boundaries](#)" of spacetime and its [global properties](#), since such 'global properties' are projected on each and every "[point](#)" of the spacetime manifold.

Going back to the **end result** from the conversion of the non-tangible form of GW energy into some tangible, albeit [quasi-local](#), form of energy: If we look at the **history** of GWs (recall [PSR 1913+16](#)), we can observe only a *continual* chain of such 'end results' in the **past** (notice my remark about *relic* GWs [above](#)), but not the very *conversion* of 'non-tangible forms of energy' into the quasi-local 'tangible forms of energy', and back to the 'non-tangible forms of energy'. We are limited in studying the latter by examining their quasi-local or 'tangible forms' only (cf. [Lau Loi So et al.](#)), perhaps because in today's GR the **positivity** of mass and gravitational energy is [imposed by hand from the outset](#).

What we do know about gravitational energy is that defining a local energy **density** at a **point** and across its infinitesimally small neighborhood, in order to compute derivatives (cf. [Bjoern Schmekel](#)), is impossible. And because there is no well-defined local energy density of the field at a "point", there is no well-defined energy in a finite volume either (cf. [Yurij Baryshev](#)).

But this is exactly the "miracle" (see below) produced by LSC with their two approximations, the linearized and quadrupole approximations. In order to detect even a trace of GWs, LIGO's interferometer should detect the extraction of some tangible form of energy ([Hermann Bondi](#), p. 249) from 'pure geometry' (the "ripples" of the metric field), such that this tangible form of energy should have well-defined energy **density** in both a "point" and a finite volume of 3-D space. Such "miracle" contradicts [the essence of General Relativity](#). Nor surprisingly, it hasn't happened during the five "runs" of LIGO, and can never happen.

I admit that most of these issues fall in the basket of 'things we know that we do **not** know'; but this 'basket' should be clear to all people studying GWs, [Joshua Goldberg](#) included. For example, we can't approach this bundle of unresolved issues with some abstract 'isolated gravitational system' ([Jörg Frauendiener](#)), because there are many unresolved tasks from both the conformal recipe for "[cutting off](#)" a spacetime and the kinematics of the gravitational field (cf. Adam Helfer below), as well as from [the affine connection](#). I can only offer some [very speculative](#) ideas, which won't be discussed in the 'white paper' aimed at examining the alarming situation with LSC project and its [perpetual funding by NSF](#).

2. Any attempt at manufacturing some "undisturbed background metric"

with the *linearized* approximation, to model the propagation of the "ripples" of the metric field (see below), is *exactly opposite* to the unique task for detecting these "ripples": if you flatten the metric, you kill the very effect you were trying to detect. If LSC members believe that they stand a chance, I will ask them to derive -- [reversibly](#) -- the 'weak limit' of GWs, hence prove that the *linearized* approximation is the correct model. Of course they can't do that (cf. David Garfinkle below). The task is highly non-trivial (not like playing with some mock "data", see below), but the good news is that it requires only blank notebooks and sharp pencils, which I believe LSC members can purchase with their own savings.

3. The third unresolved issue deals with the L-shape of LIGO tunnels, namely, the specific recipe for detecting those weak GWs. I offer a simple [Gedankenexperiment](#), which shows that this task is not feasible in 3-D space [in principle](#). Moreover, there is a brand new argument by [Jose Pereira et al.](#), which also denounces the LSC project. Last but not least, check out the articles by Angelo Loinger [here](#), and recall that with GWs "no shielding is possible" (cf. [John Stachel](#)); more [above](#).

As of February 16, 2009, I've asked many prominent experts in GR to review my paper (a partial list is [here](#)). Please be assured that the issues raised in the paper are focused on the very foundations of GR. I will not discuss in the paper any technical issues, such as, for example, the Gedankenexperiment by LSC, based on carefully "selected" (with wishful thinking or precognition) mock "data" ([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."

About the [Gedankenexperiment](#): Notice that the "longitudinal direction" of GW propagation cannot be shown in 3-D space, because the proof that GW were indeed transverse waves (by canceling their "phase", just as we can cancel the phase of a light beam with two Polaroid filters) cannot be performed in [3-D space](#). **It's a package**. If LSC members manage to "discover" the *direction* of GW propagation in 3-D space, call it ***z***, they will automatically and inevitably "recover" the **dimensionality** of GW amplitude projected on the "transverse" ***x/y*** axes: *redictio ad absurdum*.

Besides, they will need some object that can be mapped onto itself by 180° rotation ("force pattern invariant under 180° rotation", see Kip Thorne's slide 4 at [this link](#)), which clearly does not correspond to anything directly observable in 3-D space. As [Warren Davis](#) explains, "the values of the components of all tensors, regardless of order, return to their original values under a 360-degree rotation of the coordinate system in which the components are described. By contrast, the components of spinors change sign under a 360-degree rotation, and do not return to their original values until the describing coordinate system has been rotated through two full rotations = 720-degrees!"

Hence spinors are the opposite case of the "force pattern invariant under 180° rotation" (Kip Thorne). LIGO tunnels cannot be "arranged" in 3-D space to detect effects from some stuff described with spinors either. This L-shape is just grotesque. It would have been hilarious, had LSC members been investing their own savings for such exercise.

Notice that the "explanation" offered by Kip Thorne for the mysterious "invariance angle", elevated at the length scale of LIGO, is from [1960s](#) (this is not a joke).

More from Hans-Jürgen Schmidt ([gr-qc/0407095](https://arxiv.org/abs/gr-qc/0407095), p. 35, Sec. 4.2, *Why do all the curvature invariants of a gravitational wave vanish?*) and from Hans Stephani (*General Relativity*, Cambridge University Press, 1982, Sec. 15.3).

Notice two statements by Hans-Jürgen Schmidt (emphasis added - D.C.): "**Global** considerations - e.g. by considering the far-field of asymptotically flat spacetimes - soon led to satisfactory answers." I strongly disagree with the adjective "satisfactory", and will explain why, by quoting from both published articles by LSC members and mathematical physicists not affiliated with LSC. The second statement by Hans-Jürgen Schmidt is this: "**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." We should not employ the gauge-like choice for Killing vector field to deal with global features of spacetime such as GWs, since a Killing time vector field is something we can only "hang our boots on." We cannot "discover" some [reference system applicable to GWs](#), and the only thing that matters -- curvature invariants -- is 'gone with the wind': "... it is not a priori clear whether one can constructively distinguish flat spacetime from a gravitational wave." More from Hans Stefani (cf. above).

How do LSC respond? They try to 'sweep the garbage under the rug', by insisting on their "linearized approximation of GR". But if you flatten the metric, you flatten **the whole** metric. You cannot **split** it into two "parts" (see below). It is just ridiculous.

To be fair to [LSC](#), I will finally spell out the conditions under which I will accept the feasibility of their project, and will expect the reciprocal courtesy from them, namely, to declare the conditions under which [LSC](#) will accept defeat, and dissolve. This is the beauty of science, as opposed to discussions on the number of angels that can fit on the tip of a needle.

With "angels", or with equally unclear "approximations", you can only make bets. To quote Daniel Kennefick ([Traveling at the Speed of Thought](#), Princeton University Press, Princeton, 2007, p. 1):

"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."

In 2009, we don't want more "bets" on "increasing sensitivity". Billions of dollars and euro are at stake, and an *enormous* scandal may be looming at the U.S. [National Science Foundation](#).

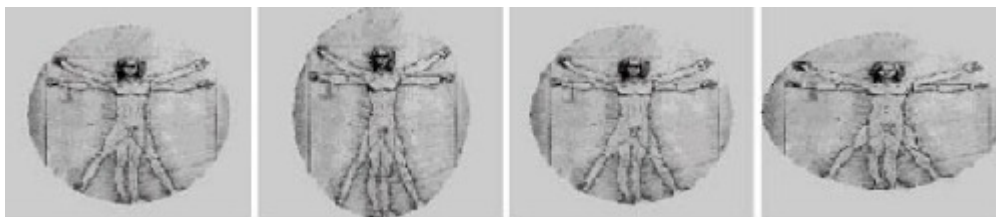
Surely the linearized approximation of GR has many practical applications (e.g., adjusting the [GPS system](#)), all of which tally to the applicable limits

of this approximation. An example from Carlo Rovelli ([gr-qc/0110003v2](#), p. 4): "Locally around [X] the metric can be taken to be Minkowskian". But since LSC have adopted the linearized approximation of GR, they flatten the metric *from the outset*, yet acknowledge that "energy is localized only in regions, not at points" ([B. Schutz](#)). Thus, by using the linearized approximation of GR, they throw out the baby with the bathwater, yet hope that GW energy may be some localized-along-a-trajectory animal, completely different to the non-tensorial gravitational energy in the non-linear GR. (I will elaborate in the paper; check out *Gravitational Waves* (Studies in High Energy Physics, Cosmology and Gravitation), ed. by Ignazio Ciufolini *et al.*, Taylor & Francis, 2001, Sec. 5.2.2, *Gravitational-wave action*, pp. [52-56](#), and notice the discussion at p. 56: there is no unique way to calculate GW "action", as you can get the same result even with pseudo-tensors; hence all this math exercise, pp. [52-56](#), is just fishing in murky waters.)

Recall that we may only *compute* the apparent localization of the quasi-local gravitational energy (provided some mathematically unclear and physically unverifiable preconditions about the "[boundaries](#)" of spacetime were fulfilled), but cannot *understand* it. All we can say is what this apparent localization is **not**: it is not like the localization of energy and momentum at each and every "point" from some continual trajectory fixed on flat Minkowski space (e.g., the trajectory of a Frisbee).

Very briefly: Under the conditions of the linearized approximation of GR, the wristwatch of LIGO's operator should **not** be able to read the very **conversion** of the non-tangible gravitational energy into some tangible form of energy and, subsequently, into some physically observable effect that is being displayed ([present continuous](#)) by LIGO's interferometer "online", from t_1 to t_2 -- first in one arm (denote this instant with t_1), then in the other arm (instant t_2), "which is arranged at a right angle to the first" (source [here](#)). Were the wristwatch of LIGO's operator able to read this **conversion** as 'proper time of timelike geodesic', the linearized approximation of GR would make the full non-linear GR totally redundant, or at least prove [Hermann Weyl](#) and [C. G. Torre](#) wrong, by showing some localized-along-a-trajectory time-and-gravitational-energy animal.

Regarding the [wristwatch of LIGO's operator](#): at instant t_1 , the **+** polarization, which "has its own gravitational-wave field" ([Kip Thorne](#)), must be **totally shielded** from the neighboring gravitational-wave field of the **x** polarization, in such a way that the latter can patiently wait for its turn to wobble the metric field at t_2 , as recorded by the wristwatch of LIGO's operator.



For if the two "polarizations" interfere in 3-D space, it is completely unclear what can happen to the poor GW "detector", by being **simultaneously** stretched and squeezed by the **+** polarization, and squeezed and stretched in 45° by the **x** polarization.

If you can understand such [schizophrenic](#) behavior of gravity, chances are you can pass Kip Thorne's course Physics 237-2002 at [Caltech](#).

Here's the recipe of LSC for detecting GWs: look at the GW lake below.



The lake is a lake if it has a source (or "[spring](#)") and a shore (boundaries). Now, imagine that at the shore of the lake you have some "[asymptotic flatness](#)", and picture LIGO's arms as a buoy ([a bead on a stick](#)) fixed near the shore where the lake surface is "flat" (the background or undisturbed geometry, which is there before the wave arrives and after it passes; see Bernard Schutz below, details from [Grishchuk & Polnarev](#) and [Ehlers](#)). The "wave" would be very weak by the time it reaches the buoy, yet it will wriggle the buoy in a [two-step cycle](#): first at t_1 , then at t_2 , repeating this cycle until it passes the buoy. But in order to observe the "straight path" (geodesic) of the buoy and time its wiggling, you need to take the stand of some absolute ([anti-relativistic](#)) observer, who can see the whole lake *en bloc* (and fix all problems from geodesic incompleteness), and also observe *simultaneously* all "straight paths" (geodesics) of the buoy ([before, during, and after](#) the passage of the wave), as well as the shore and the mountains (the latter must be [causally disconnected](#)). Finally, you may need a couple of billion dollars and euro to extract energy from geometry (the grin of the cat without the cat, as observed by [Alice](#)) with a very "sensitive" buoy, because the force that wriggles the buoy (the *quasi-local* gravitational energy) comes from modulating the "straight path" (geodesic) that the buoy is following -- the poor buoy itself has [no capacity](#) to find out whether its "straight path" has or has not been altered. And if you manage to explain convincingly [the whole story](#) to a blond girl over a glass of wine (or whatever she drinks), chances are she will be *deeply* impressed.

I really don't know what keeps up the faith of LSC members. It is true that we observe things that are manifestly [gauge-dependant](#), such as the cosmological time ([Thomas Thiemann](#)), but to claim that one could detect such 'global properties of spacetime' with LIGO and the like is akin to detecting the amount of "dynamic dark energy" producing the "intrinsic time interval associated to any timelike displacement" ([Ted Jacobson](#)) or the spin of Earth in the reference frame of the [cosmic equator](#). Anyway.

The proper GW detectors should be based on strictly non-linear principles (cf. "[at the same time](#)"), but will not be discussed in this paper due to their highly [speculative nature](#): the issues raised in the paper are about what the localization of the quasi-local gravitational energy is **not**. Details from [Laszlo Szabados](#); I suppose he can kill the LSC project with one stroke, but doesn't want to.

As a crude analogy of LSC enterprise, imagine a TV antennae that is specifically designed to detect *very* weak TV signal, **because** the "theory" behind it cannot cope with any strong TV signal whatsoever. That would

be "TV parapsychology", accordingly.

Here my opponents responded, -- 'but we can ignore effects that are very weak, just as we can work with the notion of *effectively* flat Earth, at least locally and FAPP.' Sure. But then you should forget about any effects produced by the curvature of Earth, since you've eliminated them from the outset.

To elaborate further on this *crude* analogy (I am writing this specifically for Dr. [Denise S. Henry](#), Sr. Program Assistant for EIR, GP, and LIGO Project, Division of Physics, U.S. National Science Foundation), recall the shortest path of a plane from LA to London, say. If the Earth were flat, the trajectory of the plane would be entirely different. Now, imagine that the very curvature of the trajectory was somehow influencing the flight of the plane at **each and every** instant from its 'proper time' during the whole flight from LA to London. If you examine some short interval from this trajectory, it will indeed look to you as 'effectively flat', at least locally and FAPP, yet you know that the trajectory of the plane, at **every point**, is not "flat". So, you need some **weak limit** of some theory that describes strong influences on the trajectory from "strong curvature". Namely, the tangent at **any** point from this "weakly curved" trajectory should not coincide with the trajectory itself. If you decide to model this trajectory -- locally, in the immediate neighborhood of your location at London -- as a dead flat line, you will kill the very effect you wish to measure.

Another crude analogy: you can safely ignore quantum vacuum effects with the Schrödinger equation, but can switch to QFT and prove that Schrödinger equation is indeed a justified approximation for your *specific* purposes. And of course you cannot "derive" with Schrödinger equation some effect that contradicts, or is incompatible with, quantum vacuum effects in QFT (=full non-linear GR).

In the case of LSC, this analogy will be tantamount to demonstrating the propagation of GWs and the "transverse" localization of their energy for very strong gravitational field, and then derive the appropriate **weak** (not "linearized") **limit** (not "approximation"), and be ready to get back to the case of strong gravitational field.

NB: This should be a smooth and bi-directional transition, without any *explicit* background *whatsoever*. (Perhaps this transition can only be defined **with respect to** the omnipresent "[direction](#)" of the expansion of space due to the "[dynamic dark energy](#)"; perhaps this "direction" leads to a realm of '[potential reality](#)' that might show up in GR as a *pre-geometric* 'reference fluid' or "[ether](#)" -- the missing 'back bone' of GR, as well as Karel Kuchar's Unmoved Mover. But this is a [very speculative](#) thread from [1994](#), which will not be discussed in the paper.)

As David Garfinkle acknowledged in one of his "pedagogical" (as he put it) papers ([arXiv:gr-qc/0511083v1](#), p. 8, emphasis added - D.C.): "In a strong gravitational field, including those where the gravitational waves of interest are **produced**, the field equations of general relativity are highly nonlinear and **somewhat** (notice the poetry - D.C.) complicated."

This poetry shows that the linearized approximation adopted by LSC is just a *wild guess*, prompted perhaps by its success in addressing tasks that have *nothing in common* with the specific task of LSC. With such poetry, you can only place bets, as Kip Thorne did in 1981.

In 2009, this poetry costs **billions**.

To be specific, the recipe for this "linearized approximation" was explained by David Garfinkle as follows (private communication): "... where g_{ab} is small where g_{ab} is the metric of spacetime and η_{ab} is the metric of Minkowski space. You just write down the Einstein field equations for g_{ab} and notice that certain terms in the equations are very small and can be neglected."

Again, if you "neglect" them, you obliterate the very effect you wish to measure. The latter is rooted on the dimensionless GW "amplitude" which, just like the dimensionless amplitude of quantum waves, may be "pointing" to the realm of '[potential reality](#)'. (Needless to say, the dimensionality of the very entity which fixes a 'meter' cannot be presented with 'meters', hence the "amplitude" of GWs is inevitably dimensionless, and cannot be shown in the non-linear GR either. We can't define the very entity that determines 'the length of a meter' with what it produces -- [meters].)

LSC is seeking some fictional 'referential background' that would somehow emerge from the linearized approximation of GR. As [Bernard Schutz](#) eloquently explained (p. 317, emphasis added): "Energy is only conserved in situations where external forces are independent of time. 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."

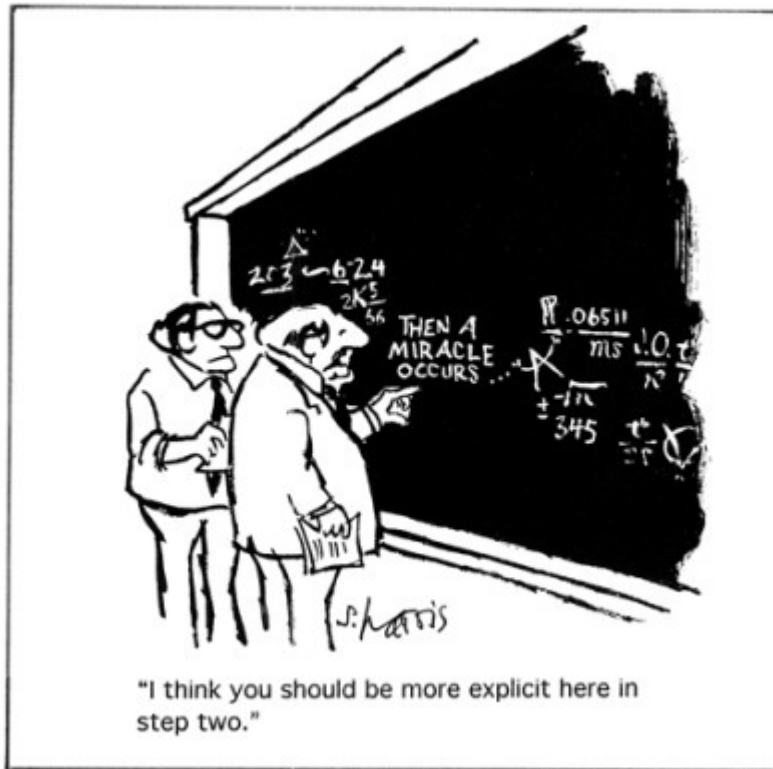
I suppose both Bernard Schutz and Sir Hermann (cf. [above](#)) would at least agree that the question of the "reality" of the waves is essentially the question of whether they transport energy. Perhaps we all can agree that, if some entity is capable of transporting energy, it should be 'real and detectable' in principle, but there is a glitch: *exactly* how would GWs transport energy in the **non-linear** GR? Sir Hermann stressed that such transport is a "fundamentally nonlinear phenomenon."

And on this crucial issue, he and LSC had taken entirely different paths.

Namely, LSC -- over 600 members from over 50 institutions and 11 countries -- have ignored the basic basics from Sir Hermann Bondi, and have postulated some *referential background*, namely,

"... the "**background**" or undisturbed geometry, which is there **before** the wave arrives and **after** it passes." ([Bernard Schutz](#), p. 317; details from [Grishchuk & Polnarev](#) and [Ehlers](#))

To achieve their tantalizing goal, LSC actually **split** the metric field, originating from the non-linear GR, in two "parts": one that has become (in their imagination) an 'undisturbed background', *with respect to which* they hope to detect the interferometer disturbances at LIGO, caused by the other "part" from **the same** metric field, the "disturbed" one.



Once they achieve this miracle, they install in this "disturbed" sector two "independent polarizations", with their own "[gravitational-wave fields](#)" (Kip Thorne). Surely every measurement is relational by its nature, so LSC need a new *referential background*, but they had made an incredible error of "producing" it from the very stuff they were supposed to measure.

This is one of the many reasons to accuse LSC of [aggressive professional negligence](#). Can't have your cake and eat it. Only [Baron Munchausen](#) can perform such self-acting miracles.

In the case of LIGO, the two modes, longitudinal quadrupolar ([J.G. Pereira et al.](#)) and transverse quadrupolar, and all "radiating" and "non-radiating" features of GWs, will inevitably conflate and intermingle, like [spaghetti bolognese](#). There is no sense of seeking "increased sensitivity" with the "[enhanced](#)" LIGO and the "[advanced](#)" LIGO, and to spend [billions on LISA](#).

NB: LIGO Scientific Collaboration (LSC) do not have any **nonlinear** theory of energy transport by the "ripples" of the metric field. Also, the tacit assumption that there is no difference between (i) *inferring* the loss of energy due to emission of GWs, as recorded *post factum* ([PSR 1913+16](#)) and (ii) detecting GWs **online**, along the time read by the wristwatch of LIGO's operator, could be wrong. We just don't know the dynamics of GR.

Moreover, LSC continue to arrogantly ignore the crucial issue of **dipole** "radiation", which has been brought back on the discussion table since 1998, with the so-called "[dark energy](#)".

All financial support for GW "astronomy" should be put on hold, until LSC members sort out their mess, the implications from '[no bans for dipole radiation](#)' included. All they need is blank notebooks and sharp pencils.

NB: Let me stress that if I've hit *the* right path, I believe one could suggest [brand new](#) GW detectors. We should be fully prepared to face the case of LIGO and LISA being totally useless, and then say: *le Roi est mort, vive le Roi!*

Finally, let me declare the conditions under which I will accept the feasibility of LSC project, as promised [above](#).

I [respectfully invite](#) all LSC members and experts in GR to review my paper *and* prove that GWs are indeed transverse waves, by (i) resolving the problems with their phase and amplitude (cf. my [Gedankenexperiment](#)) and (ii) explaining the detection of GWs along the time of the wristwatch of LIGO's operator. Additional remarks on these two tasks -- it's a package -- can be read [below](#) (pp. 20-22 from [ExplanatoryNote.pdf](#)).

If you wish to use the linearized approximation of GR -- be my guest.

I can say a lot more, but prefer to follow 'the two rules for success':

Rule #1: Never tell them everything you know.

D. Chakalov, a.k.a. "[just another crank](#)"

January 9, 2009

Last update: March 24, 2009

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Subject: Re: LSC March 2005 and June 2005 Meetings

Date: Tue, 07 Jun 2005 00:13:17 -0400

Message-ID: <20050607001317.q6tlvjh1c00gsk4c@web.mail.umich.edu>

From: gustafso@umich.edu

To: Dimi Chakalov <dimi@chakalov.net>

> I don't know you and wish you out of my face, my computer.

[snip]

Note: This is the sole meaningful feedback I got so far from LSC members. It came from [Prof. Dick Gustafson](#), Research Scientist at the University of Michigan.

D. Chakalov

February 16, 2009

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Addendum: I mentioned [above](#) that there is a [very speculative](#) issue, which will not be discussed in the 'white paper'. It is about a new "torsion"

degree of freedom in GR, to account for the hypothetical [Aristotelian Connection](#). But because we cannot attach a non-vanishing torsion to the Christoffel connection, and because I personally do not consider Einstein-Cartan theory a viable alternative to GR, I am trying to speculate on [Ted Newman's H-space](#). Now, that's *really* tough. The H-space is some sort of "observation space" that "should not to be treated as real in **any** sense", says [Ted Newman](#). The same is valid for the new kind of reality, called here '[potential reality](#)'.

There *might* exist new physics associated to torsion, and I want to introduce, right from the outset, two "dark" torsion (?) effects on the spacetime *manifold*, which means that the Lorentzian signature, which is also postulate from the outset, should be replaced with some sort of "more general" kind of signature. The latter should somehow "encode" the non-linear "talk" of matter and geometry (cf. John Wheeler above), and remove the pitfalls from the [Hamiltonian formulation](#) of GR. At the end of the day, all these speculative efforts should introduce two tug-of-war effects: "implosion" (a generic effect of spacetime, called '[cold dark matter](#)') and "expansion" (another generic effect called '[dynamic dark energy](#)'). As in Einstein's GR, I don't want to introduce any 'gravitational force *per se*', but instead to work out a Machian-type theory in which the holistic or "dark" effects from 'the whole universe as ONE' would be interwoven in the spacetime. In the context of the '[forest metaphor](#)', the "forest" would act on each individual local "tree", but this *additional holistic* influence will be totally "dark", and completely entangled/interwoven within the dynamics of the local "tree". This additional influence is not like spreading butter on a piece of bread, but rather like the ([quasi-local](#)) holomovement of all fish in a shoal, guided by 'the shoal as a whole'. We can see the individual fish only, as they show up only in the [RHS of Einstein equation](#), where their mass has *already* been made "positive".

There are no GWs from 'positive mass' nor from 'negative mass' -- this is the starting point for addressing the issue of "dipole radiation", as there are no bans for it due to the so-called '[dark energy from empty space](#)'.

All this is *very* speculative, and I can only quote [Lluís Bel's conjecture](#) that "the two connections, Christoffel's and Weitzenböck's, do not have to be considered as options of an alternative, but that in the contrary they have to be correlated and used jointly". But HOW? And how does it "happen" that we observe mass with one "charge" only? Positive mass "theorems" presuppose an *exact* definition of spacetime "[boundaries](#)", which is not yet available.

Let me comment on Dieter R. Brill and Pong Soo Jang, Positive mass conjecture, in *General Relativity and Gravitation*, ed. by A. Held, Vol. 1, Ch. 5, Plenum, New York, 1980, [pp. 173-193](#) (links and emphasis added):

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 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](#))."

Comment: The positive mass conjecture is an outstanding puzzle, because the Strong Energy Condition (SEC) is "violated on cosmological scales **right now!**" (Barcelo & Visser, [gr-qc/0205066v1](#)), and we have no idea how the "[dark energy](#)" is related to the apparent positivity of mass.

Perhaps the LIGO Scientific Collaboration ([LSC](#)) -- over 600 members from over 50 institutions and 11 countries -- will sort out the whole bundle of issues raised above. With so much "[dark stuff](#)" in the universe, we really need [new ideas](#).

Perhaps it is worth mentioning that the problem of interpreting Einstein field equation is strikingly similar to the mind-body problem: picture the [human self](#) in the LHS, and recall that the human mind doesn't possess any intrinsic "mental energy" or "psi field" whatsoever. In order to "guide" the human brain and the rest of the body, the human self should only *alter* their "geodesic paths", a bit like altering the *potential* railroad of a train, hence guiding the train/body toward its chosen, by the human self, destination. One crucial prerequisite is that the body should be *flexible*: examine your tongue or arm, and you will see that they are not predetermined to *any* particular movement (unlike the arm of a robot), thanks to which the human self can perform *any* movement with it (cf. [Neurophysiology 101](#)).

Going back to GR, we would expect to encounter the same kind of *flexibility* in the RHS, meaning that there should exist an *evolving* cosmological "constant" and "[dynamic dark energy](#)" from "[empty space](#)", the Cauchy problem for Einstein field equations should **not** be "well-posed", and the input from '[potential reality](#)' would be camouflaged as "[gauge-dependent](#)". Last but not least, the *Wegtransformierbarkeit* ([Afriat & Caccese](#)) of the gravitational energy-momentum and angular momentum (Laszlo Szabados, [23 Feb 2005](#)) could be the ultimate

expression of the *flexibility* of matter: it must *not* have **real**, in the sense of '[classical determinism](#)', values at any "point" from the spacetime manifold, or else it cannot be *guided* by its non-material counterpart -- the grin of the cat without the cat, as noticed by [Alice](#).

There are no pre-determined paths in GR. Paths are made "by walking" ([Antonio Machado](#)). Interactions are inherently non-linear, and there is no explicit background or 'reference fluid' or '[back bone](#)' to "hold onto" during the walk. If the Aristotelian Unmoved Mover exists, perhaps it will show up in Quantum Theory as well, perhaps as '[potential reality](#)'. Any other ideas?

D. Chakalov
January 14, 2009
Last update: February 11, 2009

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Subject: Re: On Gravity-Waves detection
Date: Wed, 18 Feb 2009 12:42:29 +0200
From: Dimi Chakalov <dchakalov@gmail.com>
To: christian.corda@ego-gw.it

Hi Christian,

> if you will send me a paper where, WITH THE AID OF SCIENTIFIC
> FORMULAS AND EQUATIONS AND NOT ONLY WITH PHRASES AND
> SENTENCES

Please don't behave like a [Russian](#).

> you will show that the detection of Gravity-Waves is impossible

[Hermann Weyl and Angelo Loinger](#) already did it, in the framework of the linearized approximation. No need to invent the wheel. Do you know what is 'white paper'? I have no creative contribution, just wish to remind people like you that you can't detect GWs with LIGO and the like, because the linearized approximation you use is not applicable. Which is why I suggested in 2006 that LIGO tunnels may be converted to wine cellars.

I'm afraid you can do nothing to revive the project of your LSC colleagues, even if you write all along with capital letters.

> Regarding the overlapping of the two polarizations, kindly see my paper
> Astropart.Phys. 27: 539-549,2007, available also on [arXiv:0806.3397](#).

You discuss a solution of **linearized** Einstein field equations in **vacuum** (Eq. 77, p. 16), and speculate about some "tidal forces" that act along the direction orthogonal to the "direction of propagation" of GWs (p. 2). You talk (p. 9) about "a variation of the proper distance in the **x** direction (transversal effect of the GW), while there is not a variation of the proper distance in the **z** direction (no longitudinal effect)", and compute "the proper duration" of the round-trip of a photon (Eq. 48, p. 11) along the **x** arm of the interferometer.

But notice the puzzle about the wristwatch of LIGO's operator in my email below: how would you separate the two gravitational-wave fields pertaining to the two "polarizations"?

Do you understand such [schizophrenic behavior of gravity?](#)

Moreover, if you wish to speculate about "direction of propagation" of GWs, you should first resolve the Gedankenexperiment, from our discussion last September,

http://www.god-does-not-play-dice.net/Szabados.html#spaghetti_bolognese

You will have to recover the dimensionality of the amplitude of these transverse waves. Notice that my Gedankenexperiment is leading you and the whole LSC to a dead end. The approach I use is 'reductio ad absurdum'. Capiche?

As Steven Weinberg noticed (email to Leonid Grishchuk, [25 Feb 2003](#)), "I often find that people who say silly things actually do correct calculations, but are careless in what they say about them."

More from Sir Hermann Bondi at the link below.

Regards,

Dimi

On Tue, Feb 17, 2009 at 4:56 PM, Dimi Chakalov <dchakalov@gmail.com> wrote:

>
> [Dear Colleagues](#),
>
> Please check out an explanatory note (21 pages, 17.02.2009) at
>
> <http://www.god-does-not-play-dice.net/ExplanatoryNote.pdf>
>
> Regarding the wristwatch of LIGO's operator (p. 9 therein): at an
> instant t_1 , the + polarization, which "has its own
> gravitational-wave field" (Kip Thorne), must be totally shielded from
> the neighboring gravitational-wave field of the x polarization, in
> such a way that the latter can patiently wait for its turn to wobble
> the metric field at t_2 , as recorded by the wristwatch of LIGO's
> operator.
>
> For if the two "polarizations" interfere in 3-D space, it is completely
> unclear what can happen to LIGO's arms, as being simultaneously
> stretched and squeezed by the + polarization, and squeezed and
> stretched in 45o by the x polarization.
>
> Can you understand such schizophrenic behavior of gravity? If you can,
> please do not reply to this email.
>
> Regards,
>
> Dimi Chakalov
>

=====

Subject: Re: On Gravity-Waves detection
Date: Wed, 25 Feb 2009 16:02:36 +0200
From: Dimi Chakalov <dchakalov@gmail.com>
To: christian.corda@ego-gw.it

Hi Christian,

> in my paper [Astropart.Phys. 27: 539-549,2007](#) I have also computed
> the response functions of an interferometers for the "plus" and the
> "cross" polarization, see equations (98) and (104).
> Then, if you will use the "overlapping principle", I recall that, as we
> are in the linearized theory, **we can use** such a principle, you will see
> that the sum of equations (98) and (104) is not equal to zero for
> various directions of the incoming gravitational wave. This shows that
> it does not exist a schizophrenic behavior of gravity in the case of
> gravitational waves.

Sorry, all this does not resolve the schizophrenic behavior of gravity in the case of GWs.

You have to prove that ***the sequence*** of effects from the two "polarizations" are indeed present along the time read by the wristwatch of LIGO's operator. Otherwise you get nothing but [spaghetti bolognese](#).

> However, I would like to further discuss this point with you, thus, I
> invite you to write a review of the work of [Hermann Weyl](#) and Angelo
> Loinger and to present it at my Conference in Greece.

I will first wait patiently for your proof, as explained above. If possible, please include the Gedankenexperiment we discussed last September: if you believe can demonstrate the "direction" of propagation of GWs, you will automatically and inevitably "recover" the dimensionality of its "amplitude" (and will be nominated for a Nobel Prize).

Please drop me a line when your proof is posted on ArXiv.org server. Then I will be more than happy to attend your Conference in Greece.

Best regards,

Dimi

=====

Subject: Re: Request for review
Date: Wed, 14 Jan 2009 23:11:46 +0200
From: Dimi Chakalov <dchakalov@gmail.com>
To: Joshua Goldberg <goldberg@physics.syr.edu>
In-Reply-To: <496E34AA.2090703@phy.syr.edu>

Dear Professor Goldberg,

You said that don't agree with my objections against GW "astronomy", but decided to "make no comment" on my work.

I'm afraid you simply cannot afford to do that. You started this whole mess with GW "astronomy" back in 1957, and you have the moral obligation to sort it out -- one way or another.

Billions of US Dollars -- all taxpayers' money -- are at stake. BILLIONS.

NB: It is utterly illogical to claim that my theory is wrong because it contradicts what is rejected by it *from the outset*. Of course I reject [Bondi et al paper](#) published in '62. You've been on the wrong track *from the outset*.

Please read carefully my arguments at the link from my preceding email, and respond to my specific objections.

I am respectfully urging you to get professional. The sooner, the better.

Sincerely,

D. Chakalov

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
>
>
> Dimi Chakalov wrote:
>
> Dear Professor Goldberg,

[snip]

> I believe you are at the bottom of "GW astronomy". You were
> responsible for US Air Force support of research in GR, based at the
> Aeronautical Research Lab at Wright-Patterson Air Force Base in Ohio,
> and managed to support the 1957 Chapel Hill conference "Conference
> on the Role of Gravitation in Physics", organized by Bryce De Witt in
> January 1957, with US Air Force money.

[snip]

> No need to comment on any "current research". My objections to GW
> astronomy are based on GR and its linearized approximation. The
> problems are known since 1922, if not earlier. Recall what Hermann
> Bondi said at your Conference in January 1957 (I have the quote in my
> files).
>
> Please check out an explanatory note (11 January 2009) at

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

[snip]

Note: Back in 1962 (cf. [Bondi et al.](#)), the Bondi-Metzner-Sachs (BMS) group was introduced. (It was initially hoped that BMS group would play an important role in particle physics or in quantized GR, either through its representation theory or via possible reduction to the Poincare group, but it didn't work out at all.) However, the seemingly convincing conjecture (attributed to Hermann Bondi) that GWs can "carry away" **positive mass** is derived under the crucial presumption of some "isolated system" in GR, which supposedly falls off "toward infinity" to eventually produce a geometry that could be modeled as **asymptotically** Minkowskian. Which reminds me of Murphy's Law #15: Complex problems have simple, easy-to-understand wrong answers. With so much "[dark stuff](#)" around, there is no way we could be certain about the [global properties](#) of spacetime, such as its topology.

Perhaps Joshua Goldberg should read 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](#); particularly the discussion of kinematics at null infinity (p. 311).

Moreover, where is the dynamic dark energy in all these papers? How do you define 'isolated, [from the dark energy](#), gravitational system'? This problem has not been recognized until 1998. In 1993 (cf. Adam Helfer's paper written in 1991), the cosmological "constant" problems weren't acknowledged, and in 1962 Joshua Goldberg would have probably said that "the definitive paper on gravitational waves is that by Bondi et al written in 1960, but published in '62." Read my mind.

D.C.
January 15, 2009

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Date: Tue, 20 Jan 2009 14:48:57 +0000
Subject: Re: Request for review
From: Dimi Chakalov <dchakalov@gmail.com>
To: Joshua Goldberg <goldberg@physics.syr.edu>
Cc: kip@tapir.caltech.edu

P.S. I can kill LIGO with a little help from Sir Hermann Bondi: check out his statement quoted at

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

Can you save LIGO?

I'm afraid you just can't afford to keep quiet. Neither you nor Kip Thorne [and the like](#).

D.C.

On Wed, Jan 14, 2009 at 9:11 PM, Dimi Chakalov
<dchakalov@gmail.com> wrote:

>
> Dear Professor Goldberg,
>
> You said that don't agree with my objections against GW "astronomy",
> but decided to "make no comment" on my work.
>
> I'm afraid you simply cannot afford to do that. You started this whole
> mess with GW "astronomy" back in 1957, and you have the moral
> obligation to sort it out -- one way or another.
>
> Billions of US Dollars -- all taxpayers' money -- are at stake. BILLIONS.
>
> NB: It is utterly illogical to claim that my theory is wrong because
> it contradicts what is rejected by it *from the outset*. Of course I
> reject Bondi et al paper published in '62. You've been on the wrong
> track *from the outset*.
>
> Please read carefully my arguments at the link from my preceding
> email, and respond to my specific objections.
>
> I am respectfully urging you to get professional. The sooner, the better.
>
> Sincerely,
>
> D. Chakalov

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Subject: Re: Request for review
Date: Wed, 28 Jan 2009 14:16:23 +0000
From: Dimi Chakalov <dchakalov@gmail.com>
To: Joshua Goldberg <goldberg@physics.syr.edu>
Cc: kip@tapir.caltech.edu

Do you have a recipe for GW energy with well-defined *energy density*
in both a "point" and a finite volume of 3-D space?

I think only Kip can produce such miracle, contrary to his textbook ([MTW](#)
Ch. 20).

D.

On Tue, Jan 20, 2009 at 2:48 PM, Dimi Chakalov
<dchakalov@gmail.com> wrote:

>
> P.S. I can kill LIGO with a little help from Sir Hermann Bondi: check
> out his statement quoted at
>
> <http://www.god-does-not-play-dice.net/Szabados.html#review>
>
> Can you save LIGO?
>
> I'm afraid you just can't afford to keep quiet. Neither you nor Kip

- > Thorne and the like.
- >
- > D.C.

Note: To explain why I am expecting to hear from Joshua Goldberg, let me first quote from his article "Invariant Transformations, Conservation Laws, and Energy-Momentum", in *General Relativity and Gravitation*, ed. by A. Held, Vol. 1, [Ch. 15](#), Plenum, New York, 1980 (emphasis added):

pp. 487-488: "In this review the relationship between invariance of the Lagrangian and conservation laws was discussed. It was shown that one cannot define a unique expression for the energy-momentum.

...

"Only the Einstein complex is derivable from the invariance of the Lagrangian and gives the correct physical results at both spatial and null infinity. One can expect that with careful handling it will also give the correct results in situations that are yet to be uncovered."

Comment: This was written by Joshua N. Goldberg in 1979. My wild guess is that the "situations that are yet to be uncovered" may turn out to be those related to the contribution, or perhaps determination, of 'positive mass' with/by the "dark energy of empty space". As of today, however, all this is 'the unknown unknown', since we *impose* the positivity of mass in Einstein equations from the outset.

pp. 469-470: "In general relativity the space-time itself is the physical system under study. The symmetry transformations of the theory are the allowed diffeomorphisms of the four-dimensional manifold. These diffeomorphisms may be used to set the metric tensor equal to the Minkowski metric and the affine connection to zero at **any point** of the manifold.

"Indeed, these conditions may be satisfied along an arbitrary geodesic of the space-time. It is in this way that the principle of equivalence, the equality of inertial and gravitational mass, is described in general relativity: to first order in their separation, all bodies moving on parallel geodesics move at the same rate.

"Just this property is also responsible for the inability to define a **local energy density** for the gravitational field. Minkowski space describes a space-time with no gravitational field. Therefore, in Minkowski space any meaningful energy density should be zero. But a general space-time can be made to appear Minkowskian along an arbitrary geodesic.

"As a result, any nontensorial "energy density" can be made to be zero along an arbitrary geodesic and, therefore, has no invariant meaning."

Q1: Can you make the local energy density of GWs to be zero, in both a "point" and a finite volume of 3-D space ? (Hint: consult [Angelo Loinger](#).)

Further, LSC believe that, in the case of weak GWs, they can be viewed as small perturbations of a background metric, namely, their influence on the background spacetime is **quadratic** in h_{ab} , hence this influence is "small" and can be neglected. In this case, the background metric is a solution to the so-called "unperturbed Einstein's equations" (Eq. 4.1 in [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. 416).

Regarding the interaction of GWs with the background curvature, [L. P. Grishchuk](#) and A. G. Polnarev also wrote (*op. cit.*, 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."

Q2: How "small" is this particular influence that may cause dispersion of GWs, as compared to the "small" perturbations of the background metric that is **quadratic** in h_{ab} , hence can also be neglected?

Q3: Can you, Joshua Goldberg, derive the above "small" influences from the strong influences of strong gravitational fields and strong GWs?

If you can't, let me tell you an old joke. Do you know how one can catch planes? All you need is a plastic bag and tweezers. Just go to your local airport and watch for the planes to take off, and when they become very "small", pick them with your tweezers and drop them in your bag. *Voila*.

D. Chakalov
February 2, 2009

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Subject: Happy New Year!
Date: Tue, 27 Jan 2009 14:08:27 +0000
From: Dimi Chakalov <dchakalov@gmail.com>
To: Lau Loi So <s0242010@cc.ncu.edu.tw>
Cc: Hwei-Jang Yo <hjyo@phys.ncku.edu.tw>,
James M. Nester <nester@phy.ncu.edu.tw>,
Szabados Laszlo <lbszab@rmki.kfki.hu>

Dear Dr. So,

Happy New Year to you and to your colleagues.

I read with great interest your recent paper [[Ref. 1](#)], and am concerned about "the explicit use of the Minkowski metric as a reference in the pseudotensor".

I have some alternative ideas about a new quasi-local formulation, which start from the so-called 'potential reality' in QM,

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

Namely, the "boundary terms" [[Ref. 1](#)] are fixed by 'the whole universe as ONE'. No need for any positive energy proofs for 'potential reality', since the latter is neutral to both "charges". The crux of the issue is the [dipole radiation](#), and of course the efforts of some people to detect 'GWs from positive matter',

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

I wonder if you or your colleagues may be interested.

Kindest regards,

Dimi Chakalov

[Ref. 1] Lau Loi So, James M. Nester, Hsin Chen, Energy-momentum density in small regions: the classical pseudotensors, arXiv:0901.3884v1 [gr-qc], <http://arxiv.org/abs/0901.3884>

"One quasi-local formulation is in terms of the Hamiltonian. The Hamiltonian for evolving a (generally finite) spacetime region includes a boundary term. Quasi-local quantities are associated with this Hamiltonian boundary term. There are many possible quasi-local expressions simply because there are many possible boundary terms. They are all physically meaningful, for each distinct boundary term is associated with a distinct physical boundary condition (which is given by what must be held fixed in the Hamiltonian variation)."

...

"Now there is another case where there is a natural and unambiguous reference: namely in a small region, where one can use the flat tangent space at some interior point to determine a Minkowski coordinate system. Here we shall test the classical pseudotensors in this limit.

...

"No entirely satisfactory expression has yet been identified. One of the most restrictive requirements is positivity.

"It is generally accepted that gravitational energy should be positive; indeed positive energy proofs have been heralded (e.g., [21, 22, 20]). Positivity is difficult to prove in general. One can regard positivity as an important test for quasi-local energy expressions. One limit that is not so difficult, and which has not been systematically investigated for all the classical pseudotensor expressions, is the small region limit. The small region requirements have not yet been applied to many energy-momentum expressions. We found that they afford both interesting restrictions and unexpected freedom."

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Subject: Request for review
Date: Tue, 27 Jan 2009 00:57:00 +0000
From: Dimi Chakalov <dchakalov@gmail.com>
To: [Bernd Brügmann](mailto:b.bruegmann@tpi.uni-jena.de) <b.bruegmann@tpi.uni-jena.de>,
[Stefan Krückeberg](mailto:Stefan.Krueckeberg@dfg.de) <Stefan.Krueckeberg@dfg.de>,
IMPRS-GW <imprs-gw@aei.mpg.de>,
SFB/TR7 Principal Investigator <zumbusch@math.uni-jena.de>,
werner@astro.uni-tuebingen.de,
wolfgang.vodel@uni-jena.de,