Can Geometry Produce Work?

GR textbooks begin with a “massive body” (Wikipedia) that somehow, and for some unknown reason, would create particular influence in non-flat 4D spacetime (watch the clip below), and then “the Christoffel symbols play the role of the gravitational force field and the metric tensor plays the role of the gravitational potential”, etc.

Can non-tensorial Christoffel symbols produce work? What kind of “influence” is that? It doesn’t look like electromagnetism. All we know for sure is that gravity can alter the rate of time, as demonstrated in GPS navigation and time dilation. But the rate of time (W.G. Unruh) cannot produce work either. If it could, it will be physical entity.

Let’s read the experts in GR. Quote from John Baez and Emory Bunn, The Meaning of Einstein’s Equation, January 4, 2006, Sec. Spatial Curvature:

“One on a positively curved surface such as a sphere, initially parallel lines converge towards one another. The same thing happens in the three-dimensional space of the Einstein static universe (cf. Einstein 1918 and Hubble - D.C.). In fact, the geometry of space in this model is that of a 3-sphere. This picture illustrates what happens:

“One dimension is suppressed in this picture, so the two-dimensional spherical surface shown represents the three-dimensional universe. The small shaded circle on the surface represents our tiny sphere of test particles (say, an apple - D.C.), which starts at the equator and moves north. The sides of the sphere approach each other along the dashed geodesics, so the sphere shrinks (emphasis mine - D.C.) in the transverse direction, although its diameter in the direction of motion does not change.”

This last sentence may sound comprehensible only to my dog. I can certainly see that “the sphere shrinks” in the drawing above, but the ‘shrinking’ itself cannot produce work. Apples are physical objects, not some fictitious “vacuum” devoid of matter. Let me offer an explanation of the question posed in the title.

Consider two kitchen scales, A and B, on a table at rest, and two apples on them, with different weight, say, an apple with 200g on scale A, and another apple with 400g on scale B. How would you relate their “trajectories” in 4D spacetime to the non-tensorial Christoffel symbols, so that the former will produce different weight?
Obviously, an apple with weight 400g will resist acceleration harder than 200g apple. Obviously, *something* is doing *work* by pressing the scales A and B on the table.

**What is it?**

If you can answer this question in the framework of GR, you may discover the coupling of geometry to matter sought by Felix Klein, David Hilbert, and Hermann Weyl, among many others. Also, you might (eventually) *vindicate* the claim by Kip Thorne and his LIGO collaborators about their “discovery” of so-called GW150914 (p. 13 in Zenon). You might also qualify for Nobel Prize for your astounding discovery of renormalizable perturbative quantum gravity based on “gravitons” with mass $m_g \leq 7.7 \times 10^{-23}$ eV/c$^2$: see the ground-breaking experiment proposed by Kip Thorne at p. 24 in BCCP. Good luck.

If you cannot answer the question, read Über Die Gravitationsfeldrelativitätstheorie. In an nutshell, gravity can produce enormous work (for example, Earth tides), but we need first to explain why we observe only one “charge” with positive energy density. This is totally unexplained puzzle, and theoretical physicists talk only about ‘positive mass conjecture’ (references are available upon request). The idea suggested in GTR is very simple: recall QM operators (*ibid.*, p. 7). They are not geometric points. They take some stuff, denoted $P$, at the input and convert it into another stuff $Q$ at the output. The latter becomes physical stuff ($Q$), which is ‘geometric point’ that can be located at the apex of the light cone. But $P$ (from *Plato*) is *not* on the light cone. We observe only $Q$-stuff, with positive energy density only. So, QM operators act $P \rightarrow Q$.

For comparison, consider another operator from particular pattern (Gesetzmäßigkeit): if I gently stroke Linda’s head ($L$), she will wave her tail ($Q$): $L \rightarrow Q$. In this case, I can track the entire sequence of events in $L \rightarrow Q$ with light. Not so in QM: $P$, at the input and convert it into another stuff $Q$ at the output. The latter becomes physical stuff ($Q$), which is ‘geometric point’ that can be located at the apex of the light cone. But $P$ (from *Plato*) is *not* on the light cone. We observe only $Q$-stuff, with positive energy density only. So, QM operators act $P \rightarrow Q$.

The *origin* of gravity is also $P \rightarrow Q$, because again we observe only $Q$-stuff, once at a time, as recorded with a physical clock: read A4 on p. 4 in GTR. Namely, the *Platonic* origin of quantum gravity ($P$) does *not* live on the light cone. We can see with light only its waving *tail* ($Q$). People claim that the trajectory of the *physicalized* tail implies some non-flat 4D spacetime (watch the clip below). But we cannot see our Linda ($P$). She has *already* disappeared at the very instant of observation, just like Macavity. See Escher’s ‘drawing hands’ and my note on the spacetime interval here.

To sum up, the *origin* of gravity ($P$), called also ‘John’, does *not* act on any physical stuff. What actually acts on the physical world is the *physicalized* ‘John’s jacket’ ($Q$). And since in $P \rightarrow Q$ the former is physically absent, the latter ($Q$) becomes self-acting, like your brain. Hence the *origin* of classical gravity ($P$) is *not* physical field, but $Q$ is. Yet $Q$ only *facilitates* the Platonic origin of gravity ($P$), like a *hand* in 4D glove ($Q$).

Moreover, GTR offers the path to quantum gravity from the outset: read my endnote here and pp. 2-4 in Gravitational Energy, and notice the Heraclitean flow of events (recall the puzzle above) depicted with the vector $W$ in the drawing at p. 8 therein.
Needless to say, Einstein was fully aware of the problems in his General Relativity (see p. 13 in Gravitational Energy):

The right side 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 (Gesamtfeld) of as yet unknown structure.

My theory is also incomplete, firstly because “the total field (Gesamtfeld) of as yet unknown structure”, suggested by Plato many centuries ago (p. 9 in BCCP), lacks mathematical presentation: we need new Mathematics. Read NB at p. 6 below.

Feel free to download the latest version of this paper from this http URL.

D. Chakalov
20 March 2020
Last update: 2 April 2020, 11:52 GMT

Addendum 1

General Relativity: Einstein vs. Newton
https://www.youtube.com/watch?v=DdC0QN6f3G4

“In Einstein’s model space-time is distorted.” Fine. But there is no explicit time parameter $\tau$ in GR: read Carlo Rovelli, Bill Unruh, and Charles Torre. Why? Because the Heraclitean flow of Time, shown with the radius of the ‘inflating balloon’ (Hubble), is missing in Einstein’s equations. The misleading drawing by John Baez and Emory Bunn above shows “Einstein static universe” from 1918 without the crucial unphysical inflating radius.

We read that “space acts on matter, telling it how to move. In turn, matter reacts back on space, telling it how to curve.” (J.A. Wheeler, p. 1 in Gravitational Energy.)

Fine. But which goes first? Space acting on matter (telling it how to move) or matter acting on space (telling it how to “curve”)? See again Escher’s ‘drawing hands’ and my note on the spacetime interval $\Delta s^2$ (R.M. Wald, Ch. 11, p. 286) here. Simple, isn’t it?

In GTR, the statement by J.A. Wheeler above is amended as follows:
Spacetime acts on matter, telling it how to move-and-rotate. At the same instant, matter acts back on spacetime, telling it how to alter the rate of Time in the invariant spacetime interval $\Delta s^2$.

Namely, the local deflation of $\Delta s^2$ creates attractive gravity, like going from Bob (B) to Alice (A), and the local inflation of $\Delta s^2$ creates repulsive gravity, like going from Bob (B) to Carol (C): p. 12 in GTR and p. 2 above. See the ‘general rule’ ($1 + 0 = 1$) in p. 2 in Gravitational Energy and the ‘atom of geometry’ at p. 7 therein, shown below.

The Platonic hand (P) in 4D glove (Q).
Examples from QM in The Physics of Life.

The arrow of Time cannot be modeled with temporal orientability of spacetime: see the enormous smashing errors by Robert Geroch and Gary T. Horowitz in 1979 here. The orientability of 3D space by “a choice of spatial parity” (“left-handed and right-handed triads”, *ibid.*) is also false. The fact that in 3D space we can invert 2D left rubble glove into its mirror image of 2D right rubber glove (parity inversion) does not represent the fundamental asymmetry in spacetime topology: time reversal symmetry ($t \leftrightarrow -t$) and left glove $\leftrightarrow$ right glove symmetry (parity inversion) do not model the fundamental asymmetry along the 3D “axis” of Small and Large. That is, if you have a large 3D ball in front of you, you cannot “invert” it inside-out, so that you will wind up inside the ball. Do you know how mathematicians would catch a lion in Sahara? Check out p. 19 in Hyperimaginary Numbers and Mark Armstrong at p. 26 in BCCP. The non-trivial topology of spacetime is a big can of worms, which has been quietly swept under the carpet by the established mathematicians and theoretical physicists.

Further information on the flow of Time is available to qualified individuals: read the last paragraph of p. 15 in Über Die Gravitationsfeldrelativitätstheorie.

Feel free to download the latest version of this paper from this http URL.

D. Chakalov
24 March 2020
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Addendum 2

This is what we know about gravity: read William G. Unruh and compare the local rates of time read by the two (highlighted) clocks in the animation (time.gif) below.

Read the principle of GTR at p. 4 above. There is no explicit time parameter in GR: read Carlo Rovelli and Charles Torre, as well as Adam Helfer, Mihaela Iftime, and my comments at p. 4 in The Atemporal Platonic World. The latter is always nullified in the squared spacetime interval $\Delta s^2$ (R.M. Wald, Ch. 11, p. 286): click here. If it were possible to “discover” a local expression for gravitational field energy density (ibid.), the gravitational field will be local tensorial observable (L. Szabados and MTW p. 467) and gravity will become a classical force field. Therefore, GR cannot be a bonafide classical theory. But it cannot be quantum theory either. We need quantum gravity with superposition viz. “collapse” of not-yet-gravitalyzed and not-yet-physicalized atemporal states (dubbed John): read pp. 16-17 below. We need new Mathematics.

More in Über Die Gravitationsfeldrelativitätstheorie and Gravitational Energy. There are two classical limits in quantum gravity, depending on the “direction” taken from the macroscopic world (denoted B) along the 3D “axis”, toward the Small or the Large (p. 12 in GTR): (i) from Alice (A) to Bob (B), and (ii) from Carol (C) to Bob (B). At the first classical limit (i), the nonlocal effects from the quantum world are FAPP zero; for example, in the effect discovered by Charles Wilson. At the second classical limit (ii), the nonlocal effects from large-scale gravity are also FAPP zero. That is, the physicalized effects facilitated (Sic!) by the “glove” (Q), as explained with $P \rightarrow Q$ at p. 2 above, do not lead to any “anomalous” Q; for example, in Earth tides. There is no violation of energy conservation by “dark energy” or by “mystery matter” at (ii): the phenomenon of self-action, exhibited also in the human brain, is FAPP zero, too. With very few exceptions, people can use at (ii) only Newtonian gravity (e.g., NASA), and everything is sweet, because nobody dares to talk about gravitational rotation.

Those interested in quantum gravity would eventually acknowledge that it would be ferociously difficult to understand the emerging of spacetime from ‘something else’ (C.J. Isham and J. Butterfield), although Plato suggested it many centuries ago (p. 2).
The latest feedback to my pre-geometric Platonic theory of spacetime, initiated in July 1997, came eight years ago from Prof. Dr. Maurice de Gosson at the University of Vienna: “Buzz off, idiot!” (Mon, 21 May 2012 18:47:46 +0200). That’s it. Nothing else.

Regarding the topology of spacetime discussed at p. 4 above: the 4+0 D spacetime, made exclusively by physicalized 4D ‘jackets’ Q (p. 2 above), has simply connected topology of perfect continuum, as it consists of one asymptotically flat (Ω0=1) ‘piece’ that does not have any “holes” denoted P above. The intrinsic dynamics of spacetime topology is highly non-trivial, as it also requires hyperimaginary numbers. This is how we live in 4+0 D spacetime (|w|^2 = 0): read carefully pp. 3-4 in Gravitational Energy.

NB: In my model of causality (dubbed biocausality, January 1990; p. 16-17 in Zenon), the atemporal Platonic world, denoted P above, is exactly re-nullified: read here. Thus, we can observe only matter (Q) acting on itself (Q): the universal self-action.

The new re-interpretation of the so-called negative mass (H. Bondi 1957) is the only possible path toward the explanation of universal self-action. Nature does not put “positive and negative mass side-by-side”, as Robert Nemiroff claimed at YouTube.

To understand how the universal self-action is implemented by your brain, try the experiment at p. 5 in Gravitational Energy. Also, watch Flavian Glont arranging 10^{30} permutations of the Rubik Cube blindfolded: at the end of the video clip posted here, he finished with arranging the cube and then “looked” at it for nearly 2s. But he was still blindfolded, so what was he “looking” at? Watch Kyudo Master Ishikawa-san here. This is Spacetime Engineering 101: read p. 6 in Gravitational Energy and p. 16 in GTR.

We need advanced, large-scale effects of spacetime engineering. The best example is Anomalous Aerial Vehicle (p. 16 in BCCP), but first we need to know much more about gravity and gravitational rotation (Richard Feynman). Suppose, just for the sake of the argument, that one day some guy decides to fly over River Thames in London. Surely many tourists there will be fascinated (tourists love free entertainment), but what is the chance for the established mathematicians and theoretical physicists to become interested in spacetime topology, the origin of gravity, general topology, set theory, and number theory viz. hyperimaginary numbers (pp. 22-23 in BCCP)? When pigs fly.

Again, further information on the flow of Time is available to qualified individuals: read the last paragraph in p. 15 in Über Die Gravitationsfeldrelativitätstheorie. Read also the story about the ‘large yellow button’ at p. 15 in Hyperimaginary Numbers.
Addendum 3

I asked a friend of mine (p. 5 in Über Die Gravitationsfeldrelativitätstheorie) to read this online paper and to tell me if he could understand my interpretation of gravity. He replied today with text message “Sorry, can’t read it”. Obviously, it is my fault. Let me try harder. Quote from The Adventure of Silver Blaze, by Arthur Conan Doyle:

Gregory: Is there any other point to which you would wish to draw my attention?
Holmes: To the curious incident of the dog in the night-time.
Gregory: The dog did nothing in the night-time.
Holmes: That was the curious incident.

The ‘curious incident’ here is the origin of gravity, denoted \( P \) at p. 2 above. It can never show up in the physical world, just like Eliot’s “mystery cat” called Macavity.

We see (with light) only the end result \( Q \) from \( P \rightarrow Q \). The latter only facilitates the origin of gravity \( (P) \) to act like a hand \( (P) \) in 4D glove \( (Q) \): see Escher’s drawing hands in p. 4 above. Surely I can see (with light) my dog Linda \( (L) \) waving her tail \( (Q) \), \( L \rightarrow Q \) (read p. 2), so how come we cannot trace with light \( P \rightarrow Q \)? Because the origin of gravity, pictured with the Platonic \( (P) \) above, is atemporal: read closely p. 31 in Platonic Theory of Spacetime and notice the two atemporal “waves”, dubbed offer wave and confirmation wave, at p. 7 in Gravitational Energy. With a physical clock, the duration of the atemporal “waves” is zero: \( P \) itself never “barks”. Only the end result \( Q \) from \( P \rightarrow Q \). Notice that \( Q \) is universal, from apples (p. 1) to galaxies.

Thus, any time you look at me, the atemporal “waves” have already (Sic!) produced the 4D glove \( Q \) in \( P \rightarrow Q \). This is the meaning of ‘at the same instant’ in GTR above.

But what is ‘atemporal’? Follow the experiment mentioned at p. 6 above. Capiche?

Note to GR experts: read Hermann Bondi and my two questions here. Let me know what you could not understand, it will be entirely my fault. See the references here.

Note to mathematicians: if you are interested in spacetime topology, the origin of gravity, general topology, set theory, and number theory (pp. 22-27 in BCCP), feel free to contact me by email. The task is to develop the phase space of the Platonic world (read A4 on p. 4 in GTR) and reveal the so-called hyperimaginary numbers and two forms of gravity (see below) in asymptotically flat \( (|w|^2 = 0) \) 4+0 D spacetime.
The atemporal sphere ⇔ torus transitions (pp. 20-22 in BCCP).

Look at the circle in the sphere ⇔ torus drawing here, and picture the point at the top as 12:00 from your analog watch. Then inflate the circle until the length of its radius (p. 21 in BCCP) reaches actual/completed infinity, shown with the horizontal line in the drawing above. At this ‘point zero’, the radius will be exactly zero as well: it will be fused with all points from the former circle. You keep inflating, but now you are inflating a torus, and you’ll pass through the same ‘point zero’ back to the circle. NB: You will also rotate the 3D sphere ⇔ torus, in infinite-dimensional Hilbert space.

Read p. 11 in Spacetime Engineering and pp. 11-12 in GTR.

As stated above, the task is to develop the phase space of the Platonic world, in which one could “see” all points in the physical world simultaneously and from all directions in 4+0 D spacetime, including the inner structure of solid objects and things obscured from three-dimensional viewpoint; for example, all six sides of an opaque box (Wikipedia) and, at the same instant, everything that is inside the box, from “inside out”. Hence you will be able “see” the atemporal Platonic image (also called matrix) of the opaque box and work with ‘It’ (pp. 5-7 in Gravitational Energy).

As always, I am ready to explain the task (p. 22 in BCCP) in details. The full-blown quantum gravity (cf. p. 5 and my endnote here) can describe only the self-acting Brain of the Universe, similar to the human brain: the ultimate 4D ‘glove’. The ultimate Platonic ‘hand’ (denoted P in p. 4 above) can manifest itself only by pure mathematics, as quantum gravity enters physical theology (John 1:1; Luke 17:21). If it were possible to reduce physical theology to physics and mathematics, people could propose a theorem of the existence of God without UNdecidable statements. Then God (1 John 4:8) could be either proved or disproved. Thank God, this is impossible.
Let me stress, however, that the idea of God is inherently incomprehensible with human cognition based on binary logic and the current formulation of set theory. The same restriction applies to the incomprehensible idea of ‘the Universe as ONE’ viz. ‘universal set’ discovered in 1899 by Ernst Zermelo. This was the reason to formulate the so-called Maximal Set Theory (MST), in which I introduced the Axiom of Existence (details upon request). Check out the doctrine of tralism at p. 25 in BCCP and pp. 5-6 in Über die Substanz von Raum und Zeit. In one sentence: Nature is smarter, as It (not “He”) contains absolutely everything fused into ONE incomprehensible entity. The bipolar structure of both physical world (Res extensa) and noetic world (Res cogitans) is inevitable, as demonstrated by both the theory of relativity and the human cognition: we can formulate an ordinary set, denoted A, iff we can relate A to non-A. Otherwise the notion of ‘set’ will be incomprehensible to us. But again, Nature is smarter. The latter cannot be proved nor disproved, which brings us to the Axiom of Existence.

In Platonic theory of spacetime, the “intuitively clear” statement that the distance from a point to itself is “zero” (Wikipedia) is amended with the new notion of ‘zero’ in 4+0 D spacetime: the Universe as ONE at sub-photon level “inside” null intervals (x = ±ct). Read about physical theology on p. 12 in GTR and on p. 2 (‘It’) in Plato.

How do we split the geometric point that “has no part” (Euclid)? See again (p. 4) the general rule (1 + 0 = 1) at p. 2 in Gravitational Energy and the new atom of geometry (p. 7 therein) reproduced below: P → Q replaces the ‘quantum of time’ (chronon).

We need Mathematics: read p. 8 above.

Note to theologians: God is by no means “downgraded” in physical theology. Instead, we postulate that Nature has two dual and ontologically different explications, which are equally legitimate “copies” of Nature, similar to wave-particle duality. See again the doctrine of trialism at p. 25 in BCCP. It doesn’t matter if people commemorate Jesus’ Birthday, or choose the complementary “copy” called ‘the Universe as ONE’. They both are correct. It is up to your free-will decision, which is a gift from God as Love (1 John 4:8). Only you will decide which “copy” suits you best. I choose both. In my opinion, both theism that anti-theism are horrible brainwashing religions. Period.
Let me go back to (i) the interpretation of gravity (p. 7), which depends on (ii) the new notion of ‘zero’ applicable to the Platonic Universe as ONE at sub-photon level (p. 9) called ‘It’ (p. 2 in Plato). The origin of inertia (John Wheeler) and gravitational rotation (Richard Feynman) is still unknown, so the proposed interpretation of gravity (i) cannot be tested — it will look like sheer “entertainment” (p. 6). The second issue (ii) cannot be verified either, as we still do not know the topology of spacetime in the first place: read p. 4 above. At this moment, I can only offer the explanation of ‘It’ (ii) with the “boundaries” of spacetime at “asymptotic flatness” (forget R. Penrose).

**NB:** If the reader can offer any other theory of fixing spacetime “boundaries”, then my theory will be wrong, and I will immediately delete this paper and my website. Bottom line is that these “boundaries” must not belong to the physical 4+0D world. The Platonic Universe as ONE, called ‘It’, wraps the entire physicalized world, being both “inside” the spacetime point with zero dimensions (p. 9) and infinitely far away, “outside” the entire physicalized world at null and spacelike infinity denoted W:

![Diagram of the Universe as a ring with no circumference](image)

The Universe is like an unbroken ring with no circumference, for the circumference W is nowhere and the center W (‘It’) is everywhere.

Look at the dark “boundaries” of spacetime below, discussed at p. 5 in Zenon.

The dark “pizza” shows the idea of ‘inflating universe’ pictured as the surface of the inflating balloon, after Arthur Eddington. We cannot see the nullified atemporal radius of the inflating balloon and its center at ‘time zero’ (John 1:1). Physically, we live in “inflating” 4+0D universe. You may try to suggest physical “boundaries” of spacetime, but they must (Sic!) be accessible from within spacetime and will inevitably belong to the 4D physical world; for example, some GW mirrors placed exactly at the dark boundary of the “pizza”. Can’t have you cake and eat it. You need new spacetime “boundaries” fixed by ‘It’.

Needless to say, the atemporal Platonic ‘It’ could be accessible with the human brain.

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D. Chakalov
6 April 2020
Last update: Easter 2020, 20:56 GMT
Addendum 4

This is the balloon analogy by Arthur Eddington from 1933: every 4D point/event on balloon’s surface (p. 9) belongs also to the nilpotent (Sic!) radius denoted \( W \) (p. 10).

Consider the time-like sequence (world line) from the Beginning: \( T_0, \ldots, t_1, t_2, t_3, \ldots \). Notice the drawing at p. 6 in GTR:

The Beginning at \( T_0 \) will disappear.

Back on 8 May 1998, Ned Wright explained: “the balloon analogy is a 2-dimensional model, and the center of the balloon and the space around are not (Sic! - D.C.) part of the 2-dimensional universe. In our 3-dimensional universe, these points could only be reached by traveling in a 4th spatial dimension (not the time dimension of 4-D spacetime), but there is no evidence that this dimension exists.”

Sounds fine, but why “4th spatial dimension”? In my opinion, we face pre-geometric infinite-dimensional Euclidean space \( \mathbb{R}^{\infty} \). Let me try to explain.

Fig. A below shows one of the six sides of an opaque box: read p. 8 above. To “see” all six sides instantaneously, you will need a new god Janus capable of seeing objects simultaneously along the three spatial axes, \( x/-x, y/-y, z/-z \), and also along \( t/-t \). We can look at one of the six sides, once at a time; for example, along axis \( z \) (not shown in Fig. A) orthogonal to \( x/y \) plane. Fig. B is borrowed from Mark A. Armstrong (Basic Topology, Springer, 1997, Fig. 5.7, p. 104): read p. 19 in Hyperimaginary Numbers. Can you count all \textit{infinitely many} arrows in Fig. B, including those “inside out”? \( \mathbb{R}^{\infty} \)!
To understand Fig. B above, recall the old joke about how to catch a lion in Sahara: see the small red circle in Fig. C below.

![Fig. C](image)

If you ask a mathematician, 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 with respect to the cage surface (the circle in Fig. B above), 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, and they both will undergo parity inversion.

Our task is far more complicated — read p. 8 above. The so-called point zero/infinity, depicted in the drawing at p. 10, is the breaking point in sphere ⇔ torus transitions (p. 8). I tried to explain it to my (adult) children, but they weren’t interested at all. Only Linda showed genuine interest in the phase space of the Platonic world. Anyway.

Read again NB at p. 10 above. The only possible path toward understanding gravity and inertia (p. 1) is by separating the origin of gravity (P) from the effects of gravity (Q): P → Q (p. 2). And P is ‘It’ (p. 10). This is the only possible path toward quantum gravity as well (p. 2). Not convinced? No problem, start from the rate of time (p. 5). My solution is spelled out on p. 4 above. What is yours?

The latest version of this paper can be downloaded from [this http URL].

D. Chakalov
Great Friday 2020, 22:37 GMT
For the Record

I am organizing two-day conference GRAVITY 21 on 26-27 March 2021 in Munich (EU), to present my theory of gravity (references above) and discuss it with many experts in mathematical general relativity and topology of spacetime (p. 4). If the reader would like to present her/his theory of gravity, please contact me by email, available at my website, by Christmas 2020. The conference will cover three topics:

1. **Continuum of geometric points.** How do we define the notion ‘zero’ pertaining to an object that must not exist “between” geometric points in a perfect continuum? It cannot be an ‘empty set’, because it cannot be a ‘set’ in the first place. What is ‘It’? The pre-geometric continuum (P) is infinitely divisible by physicalized 4D events (Q). The latter has positive mass and metric (Res extensa): Q is located on the light cone.

2. Structure of physical spacetime. Given the invariant speed of light and calibration of 4D spacetime in ‘meters of light-travel time’, how do we define the non-relational flow of time? With the exception of photons, all physical bodies (Q), standing still in their reference frames, will nevertheless “fly” in time, with different rates of time.

3. Physics of gravity. In GR, people attribute gravity to geometry, like the shape of a mountain, but how can the ‘shape’ itself act back on its “source” (mountain)? Can Bondi’s ‘news tensor’, which determines the “energy flux” of gravitational radiation, produce work on the apple? Or “gravitational waves” (GWs) and “gravitons”? Can the topological properties of spacetime (forget “curvature”) produce inertia & rotation?

NB: Can geometry produce work? Not in GR textbooks. It is like asking whether the probability in QM textbooks produces work. Of course not: read Erwin Schrödinger. The **physicalized states** of the quantum world can of course produce work. Ditto to gravity: only the physicalized states of gravity, denoted Q, above, produce work. Geometry itself can’t. We need to uncover the Platonic pre-geometric world. We need new Mathematics.

Easter 2020, 13:00 GMT
Abstract. I suggest perfect pre-geometric Platonic continuum (P), which is infinitely divisible by physicalized points/events (Q) in the action P → Q. The former (P) is not observable with light, as suggested by Plato, whereas Q is located on the light cone.

1. Introduction

In number theory, we picture the idea of real numbers as “points on an infinitely long line called the number line” (Wikipedia):

Our cognition is relational: we can think of an individual point (A) iff we can relate it to something this point is not — non-A, pictured in black (Fig. 2). Fine, but what do we see in Fig. 3? Absolutely all (absolute infinity) non-denumerable white points from the finite segment of the number line (Fig. 2). This is the perfect continuum of the pre-geometric Platonic world called ‘It’, also denoted P in the action P → Q.

I will argue that (i) ‘It’ (Fig. 3) is located “between” every individual (white) point in Fig. 2, and that (ii) ‘It’ does not belong to the denumerably infinite set of individual (white) points in Fig. 2. Namely, the uncountable cardinality of the set ‘It’ (Fig. 3) is greater than Aleph-null, and hence ‘It’ can provide the unique cutoff on the physical world in Fig. 2: the Platonic entity ‘It’ is one “point” stretched to absolute infinity. In the physical world endowed with metric (Fig. 2), ‘It’ always “disappears”, being set to “zero”, like Eliot’s cat Macavity living “inside” null intervals (x = ±ct), presenting the dimensionless ‘geometric points’ in Fig. 2, which ‘have no parts’ (Euclid) anymore.
The individual (white) points in Fig. 2 work as blank templates or “colorless canvas” for the physical (Sic!) content undergoing ‘change in time’, resembling the individual snapshots from a movie reel — without the dark strips separating the snapshots, there will be no ‘change in time’ and all 4D snapshots from the movie reel will be fused into one QM “snapshot” of infinitely many atemporal superposed states. Notice that the “colorless canvas” of bare geometric points (Fig. 2) is like the invisible colorless nails shown in Fig. 4: we see only their physical “colors” that will ‘change in time’. Yet the invisible “colorless canvas” has its own topological structure demonstrated with the unique calibration of 4D spacetime (Fig. 5). To quote E.F. Taylor and J.A. Wheeler in Spacetime Physics (1965, p. 18): “We assume that every clock in the latticework, whatever its construction, has been calibrated in meters of light-travel time.”

![Fig. 4](image1.png)

![Fig. 5](image2.png)

NB: What phenomenon “calibrates” the ideal rods and clocks (MTW p. 397) pre-build in spacetime (Fig. 5)? As Arthur Conan Doyle remarked, when you have excluded the impossible, whatever remains, no matter how improbable, must be the truth. Here, the pre-geometric Platonic continuum ‘It’ (Fig. 3), offering the only possible solution to Thomson’s lamp paradox, as shown in the operational (ε, δ) “definition” of limit.

2. The Platonic hand (P) in 4D glove (Q)

Let us examine an operator P → Q. Back in July 1997, I called the pre-geometric Platonic continuum (P) ‘the undefinable matrix’, and stressed that ‘It’ is inherently incomprehensible. In QM parlance, the Platonic continuum (P) is only “projecting” its colorful localizable 4D eigenstates Q — one Q at a time, placed only at the apex of the light cone. Hence the “projecting” operator P → Q. The physicalized partition of the Universe is just a Q-set. We cannot ‘turn around’ and look at the Platonic world (P), as Plato suggested many centuries ago. Why not? Because of the “speed” of light.

The Platonic world (P) does not produce any resistance to bodies (Q) “passing through it” (Wikipedia), just like the quantum state (dubbed John) and the quantum vacuum. There is no “space devoid of matter”, for the same reason that there can be no ‘time devoid of matter’. Light does not “propagate” in some luminiferous aether, but in the Platonic continuum (P) depicted in Fig. 3. The “absolute” reference frame is “inside”
each and every 4D point/event, camouflaged as ‘zero event’. The ‘It’ is omnipresent. Strictly speaking, ‘It’ has indefinite cardinality in \([0, \infty]\) and cannot be Cantorian set.

To wrap up, let me go back to Fig. 2 and explain the “structure” of (white) geometric points, for example, in the closed interval \([0, 1]\) shown in Fig. 6 below.

As told by Aristotle (Physics VI:9, 239b10), Zeno of Elea (490-430 BC) has formulated the famous dichotomy paradox: that which is in locomotion must arrive at the halfway stage before it arrives at the goal. In Fig. 6, we imagine \(B\) going back to \(A\), so that \(B\) can and will stop only at the ultimate limit \(B=A\) (Sic!), which denotes one single dimensionless point (Euclid), and locomotion will be impossible. Moreover, the ultimate limit \(B=A\) is UNdecidable, as demonstrated with Thomson’s lamp paradox.

The only possible solution to Zeno’s paradox is to endow every single point in \([AB]\) with pre-geometric Platonic “structure” (Fig. 3) and dynamics: the operator \(P \rightarrow Q\).

What can we make from this metaphysical exercise? Quantum gravity and cosmology, but only as conceptual theories. We need Mathematics.

Let me examine the paradoxes in the operational (\(\varepsilon, \delta\)) “definition” of limit (Fig. 6), which produce insoluble problems in understanding the properties of spacetime exactly at the asymptotic “boundaries” (if any). In my opinion, the so-called local differential geometry (Bob Geroch) is Russian poetry, to say the least. There can be nothing ‘local’ in the operational definition of ‘infinitesimal’ — you only have a recipe that, if \(B\) runs indefinitely toward \(A\) (Fig. 6), at the end of the day \(B\) can obtain some number, say, \(C\). But is \(CA\) “explicitly nonzero” or \(C=A=0\) on the number line (Fig. 1)?

The solution is very simple: every real number, depicted with (white) geometric point in Fig. 2, is particular \(Q\) from the operator \(P \rightarrow Q\). The physicalized world is \(Q\)-set with \(4+0\) D spacetime — \(P\) is squared and exactly nullified, just as the quantum state (dubbed John) mathematically disappears upon the wave function “collapse”. We see
(with light) only a temporal sequence of different-in-time “jackets” from the Q-set, Q₁, Q₂, Q₃, … , along the non-relational flow of time — all physical bodies (Q), even if at rest in their reference frames, will nevertheless “fly” in Heraclitean Time (Fig. 10). The only possible solution to Zeno’s paradox of motion is to endow the geometric point A (Fig. 6) with different-in-time Q-states placed at the beginning and at the end of the infinitesimal (Sic!) time displacement Q₁ → Q₂ denoted ∆t. Thus, at the ultimate limit B≡A (Fig. 6), B will not hit A₁, but its next temporal “copy” A₂, such that (A₂ - A₁) = ∆t. Again, P from the operator P → Q is not observable with light (Fig. 9): the pre-geometric Platonic continuum (Fig. 3) provides ‘colorless canvas’ (Fig. 4) for its colorful physicalized 4D “jackets” (Q₁, Q₂, Q₃, … ) located on the light cone and cast on the atemporal Platonic perfect continuum P.

We need the so-called hyperimaginary numbers to “insert” the Platonic pre-geometric continuum P “inside” the infinitesimal ∆t.

3. Hyperimaginary numbers: \(|w|^2 = 0\)

The real numbers (Fig. 1) may look simple: watch the explanation of ‘instantaneous velocity’ by Michel van Biezen at YouTube, particularly 2:50-3:08 from the timeline. There is no “spacetime curvature” in Fig. 7. The trajectory there is curved only as a mathematical tool enabling you to compute derivatives. Ditto to the mythical “spacetime curvature” in GR textbooks. Simple, isn’t it?

Fig. 7

Is (i) ∆t = 0 or (ii) ∆t > 0? Which is the correct answer, (i) or (ii)? Neither. As Murphy noticed, complex problems have simple, easy-to-understand wrong answers. Read the solution above. In the case in Fig. 7, we cannot show the pre-geometric continuum P “inside” the infinitesimal ∆t. To show ‘It’ (Fig. 3), we need the Platonic quantum world (P) “just in the middle between possibility and reality” (Werner Heisenberg).

Look at the electron “orbitals” in the hydrogen atom, at two different energy levels, from Wikipedia (Fig. 8). They are not bonafide trajectories, because ‘trajectories’ (Fig. 7) belong exclusively to the physical 4D world which “either is or is not” (Erwin Schrödinger). The Platonic world (P), on the other hand, is ontologically different entity (recall Kochen-Specker Theorem), as Erwin Schrödinger stressed in 1935. We may only talk about ‘quantum-mechanical wave function’, but we still do not know
how P “shows up” in the macroscopic world at the length scale of tables and chairs (Charles Wilson).

**Fig. 8**

How come nothing goes wrong with the *immensely* complicated electron “orbitals”? To fully understand the puzzle, let me show Slides 9 and 10 in *Quantum Spacetime*.

**Slide 9**

Suppose a light bulb emits photons with rate app. $1.8 \times 10^{20}$ photons per second. All photons are identical, and have particular wavelength related to the “distance” (if any) between the two “orbits” (if any) of electrons, denoted in the drawing with $h$.

How come nothing goes wrong in producing $1.8 \times 10^{20}$ identical photons per second, *ever*? According to John Wheeler (1973), the identity of particles of the same type is “a central mystery of physics.”

**Slide 10**

Only about 1% of proton’s mass can be traced to quarks (two up quarks and one down quark), whereas 99% of its mass belongs to Quantum Chromodynamics (QCD) binding energy. Imagine zillions of quarks ($u,d,s$), antiquarks ($\bar{u},\bar{d},\bar{s}$ with a bar on top), and gluons ($g$) zipping around near the speed of light, banging into each other, and appearing and disappearing from QCD vacuum (Strassler 2010): they are able to assemble proton’s mass of 938 MeV/c² with error margin of just one part in $10^{45}$ (Dolgov 2012), for at least $10^{38}$ years.

What phenomenon could create $10^{38}$ identical protons?
And how come nothing goes wrong with the calibration of 4D spacetime (Fig. 5)?

Atemporal Quantum Reality: Quantum Cosmology

Without quantum cosmology based on the quantum-gravitational matrix of spacetime, we would need some Biblical “miracle” to raise a robust Lorentzian metric within $10^{-39}$ seconds “after” the “big bang”, starting much earlier at $10^{-35}$ seconds “after” the “big bang”, when the classical (not quantum) spacetime would be about 1 cm across and a causally connected region would have been only $10^{-24}$ cm across (the horizon problem), in such way that one could later “inflate” the spacetime by a factor of $10^{78}$ and then safely keep the Lorentzian metric for at least 13.798 billion years rooted on the Planck scale at which the spacetime “points” are totally fuzzy and the principle of locality has lost any meaning.

To summarize, I will go back to the atemporal Platonic world (Fig. 9) and the non-relational flow of 4D events, as suggested by Heraclitus (Fig. 10): Nature evolves by both ‘change in space’ (coordinate time of Q) and ‘change of space’. It’s a bundle.

Thanks to the “speed” of light, we cannot turn around and look at the atemporal Platonic world (Fig. 3). The flow of Time: everything changes and nothing remains still — you cannot step twice into the same stream (Heraclitus).
Again, how is the “speed” of light (Fig. 9) hiding the atemporal Platonic world (P) (Fig. 3), in P (potential future) \( \rightarrow \) Q (irreversible past)? Recall the L (Linda) \( \rightarrow \) Q operator above and consider sequential 4D Q-states ‘here and now’, \( Q_1, Q_2, Q_3, \ldots \), along the non-relational flow of Time. For example (Slide 19 in Quantum Spacetime), you stay in front of a wall, and at \( Q_1 \) you toss a ball at the wall, in such way that the ball will bounce back and hit you later at \( Q_2 \): you will be watching all consecutive states of the ball during the entire interval \( (Q_2 - Q_1) > 0 \). But if you replace the ball with a photon, the null interval “between” its emission at \( Q_1 \) and absorption at \( Q_2 \) will be exactly zero: \( Q_2 \equiv Q_1 \) denotes one single 4D event ‘here and now’ of the ball. There will be no time and no 3D space: the infinitesimal \( \Delta t \equiv 0 \). The solution is very simple: the photon emitted at \( Q_1 \) will hit the next temporal “copy” \( Q_2 \), such that \( (Q_2 - Q_1) = \Delta t > 0 \). Even if all \( Q_1, Q_2, Q_3, \ldots \), are at rest in their reference frame, they will nevertheless “fly” in spacetime. This is the difference between time and space. Needless to say, the non-relational flow of Time is exactly nullified, leading to 4+0-dimensional spacetime. Physically, the atemporal Platonic world (P) is zero: the displacement between \( Q_1 \) and its next temporal “copy” \( Q_2 \) — ‘change of space’ — is along the nilpotent radius of the inflating balloon, matching the Heraclitean flow of Time (Fig. 10). The latter is never exposed to the physical world, or else Time will have to be relational phenomenon, with respect to the river banks ‘at absolute rest’. This is the common denominator of Theory of Relativity and Quantum Theory.

NB: Everything said above will be immediately refuted iff the reader of these lines can show arguments in support of the alternative viewpoint expressed, for example, by Bob Geroch: “There is no dynamics within spacetime itself: nothing ever moves therein; nothing happens; nothing changes.” Time as change is made only by matter. If that were true, we will face two alternatives regarding the size of the infinitesimal \( \Delta t \) : either (i) \( \Delta t \equiv 0 \) or (ii) \( \Delta t > 0 \) (Fig. 7). Tertium non datur. Option (i) leads to the insoluble Zeno’s paradox (Fig. 6) and to “the Ghosts of departed Quantities” (George Berkeley), whereas the alternative option (ii) requires some finite (not zero) interval \( \Delta t \), like the size of a pixel from digital image, separated from the neighboring pixels by a colorless area that does not belong to the (dead frozen) digital image. If so, how many geometric points (Fig. 1) can fit in a pixel or on the tip of a pin?

4. Conclusion and outlook

The famous Conference on the Role of Gravitation in Physics (January 18-23, 1957) can be traced to a nebulous report by Bruce DeWitt, dated December 7, 1955. I hope this report is better. Obviously, I could not file my questions to Sir Hermann Bondi in January 1957, and will leave them to the participants of the forthcoming GRAVITY 21 (March 26-27, 2021). If my Gravitationsfeldrelativitätstheorie triggers genuine interest at GRAVITY 21, I will elaborate on the origin of gravity and demonstrate the so-called ‘reversible elimination of inertial mass’ (REIM). Mind you, REIM is not “levitation”. It is all about modulating the rate of time under the re-interpretation of negative mass.

Munich, Christmas 2020
The Bridge, by D. Chakalov. Presented on 27 March 2021 at GRAVITY 21, March 26-27, 2021, Munich, EU.

Abstract. I suggest a hypothetical ‘bridge’, denoted $P \leftrightarrow P$, between the atemporal Platonic state ($P$) of the quantum-gravitational world (modeled as the “brain” of the universe) and the atemporal Platonic state ($P$) of the human brain. Once created, the ‘bridge’ might produce specific pattern in the human brain, which may have qualia accessible by human volition, and could also be enhanced with biofeedback training.

1. Introduction

The hypothetical atemporal Platonic state ($P$) of the quantum-gravitational world was presented in my preceding report [1]. Before launching another hypothesis about its practical applications, may I briefly explain my personal, and perhaps strongly biased, opinion on the possibility in principle to suggest in General Relativity (GR) any kind of coupling of the gravitational “field” to matter and fields placed in the right-hand side at Einstein field equations (EFE), interpreted as classical (Sic!) “source” of gravity.

This task is impossible in principle. Absurd. I will first offer a very simple analogy and then will elaborate with specific examples from GR, with minimum references.

Suppose you order a pizza, which is delivered at your doorstep, and then you bring it in your kitchen for your lunch. The pizza you have in your kitchen (the right-hand side at EFE) and the pizza cooked previously in the restaurant (the left-hand side at EFE) are identical. It is exactly the same stuff (matter & fields = pizza) due to the coupling of the pizza restaurant to your kitchen. Thus, gravity will be a bonafide physical field, and the conservation of mass-energy of the system ‘pizza restaurant & your kitchen’ will not be violated. It will be like withdrawing your cash from ATM: the total amount of money is always conserved. Only there is a problem: this is not the case chosen by Mother Nature. Which is why I suggest to separate the Platonic source of gravity ($P$) from its physicalized 4D manifestations ($Q$): $P \rightarrow Q$ [1].

This is the only possible path toward understanding gravity, in my opinion. The key issue here is the origin of Time. The current GR textbooks offer only a dead end. Why? Because physicists endorse the “intuitively obvious” opinion that the theory of gravity must be classical theory. But here’s the catch: if gravity (at the left-hand side at EFE) acts on its “source” (the right-hand side at EFE), the latter will inevitably change its energy-momentum and angular momentum, but since only matter (not some “ghosts”) can interact with matter, these changes will make gravity a physical field. There is no ‘pool’ of positive energy density, reserved exclusively to gravity, so that the latter could interact with its classical “source”. Geometry itself cannot produced work [1]. People are trying very hard to avoid (not to solve) this problem by resorting to some “vacuum solutions” in which “no matter or non-gravitational fields are present”, or use “linearized approximation” in which gravity may be veeery weak (S. Weinberg).
On the other hand, the gravitational radiation must exist, so how can we square the circle? We need a brand new theory of quantum gravity \cite{1} to understand gravity and (hopefully) explore it. We need the common denominator of Theory of Relativity and Quantum Theory.

2. Quantum-gravitational “brain” of the universe

To model the quantum-gravitational partition of the Universe as a ‘brain’, I will recall the self-acting faculty of the human brain and suggest that ‘the brain of the universe’ is governed by the same self-acting phenomenon. It is not like Baron Münchhausen. We need the additional ‘self-energy’ in QFT (Fig. 1), which Hermann Bondi called, in the context of GR, intangible energy \cite{8}. The latter shows up in the physical world only as positive mass-energy, after the re-interpretation of “negative mass” \cite{1}.

![Fig. 1](image.jpg)

The quantum-gravitational ‘brain of the universe’ (Q) can also interact with itself and by itself, via the atemporal Platonic state (P) of the entire Universe as ONE, like a ‘hand’ (P) in 4D ‘glove’ (Q). The new operator \( P \to Q \) is located “inside” every single geometric point/4D event Q, along the radius (W) of the ‘inflating balloon’ in 4+0-dimensional spacetime.

How “large” is the virtual pool of not-yet-physicalized intangible energy, pertaining to the atemporal Platonic state (P) of the quantum-gravitational ‘brain’ (Q)?

Indefinite. It ranges from “positive energy density of about 6×10^{-10} joules per cubic meter” (J. Baez) to 3×10^{47} joules of energy in less than a minute in gamma-ray bursts. The upper bound (if any) on Q’s positive energy density is unknown. How much energy (P. Steinhardt) was needed to create the Universe at The Beginning (John 1:1)?

Perhaps we have unlimited source of clean energy to resolve the upcoming climate crisis \cite{2}. And perhaps much more, if only we can create and sustain the so-called ‘bridge’, denoted \( P \rightleftharpoons P \), between the atemporal Platonic state (P) of ‘the universe as a brain’ and the atemporal Platonic state (P) of the human brain: P is omnipresent.

We need spacetime engineering \cite{3}.

3. The Bridge

In my (not humble) opinion, the semiclassical approximation to quantum gravity \cite{4} is worse than ‘spherical cow’. Many people still deeply believe that “classical spacetime should (Sic! - D.C.) emerge in an appropriate limit from quantum theory” (ibid.), despite the bold fact that the quantum theory cannot produce ‘classical spacetime’: the Platonic quantum world (P), dubbed ‘John’, does not live on the light cone. Only ‘John’s jackets’ live there, in the irreversible past (Q). Where is ‘the bridge’ \( P \rightleftharpoons P \)? Is there additional structure \cite{5} of 4D spacetime (Fig. 1)? What is physical theology?
To understand how the *atemporal* Platonic quantum world (\(P\)) and ‘the bridge’ \(P \simeq P\) are embedded (Fig. 1) in the continuum of 4D events (Q), see ‘the general rule’ [3]: the Platonic world (\(P\)), dubbed ‘John’ in Schrödinger’s cat and ‘zero’ in Macavity cat, does not belong to 4D spacetime [5]. In symbolic terms, \(1 + 0 = 1\): the probabilities for observing John’s *jackets* (Q-set) sum up *exactly* to 1, whereas the possibility to observe ‘John’ itself (\(P\)) is *exactly* zero. Why? Because we can observe *with light* only events in the irreversible past (Q) depicted in Fig. 2, from the operator \(P \rightarrow Q\) [1].

The infinitesimal (Q2 - Q1) shown in Fig. 3 is “surrounding any point” in 4D spacetime and we can compute derivatives at Q. Thanks to the Platonic world (\(P\)) from the quantization operator \(P \rightarrow Q\), the 4+0-D spacetime is *perfect* continuum, and we can “recover” the non-relational Heraclitean Time in the timelike interval (Q1,Q2). Again, the duration of the infinitesimal (Q2 - Q1) is neither zero nor finite (Thompson lamp). *Time* is *both* ‘change in space’ (coordinate time of Q) and ‘change of space’ (Sic!).

Thus, we can develop *perfectly* continual quantum-gravitational 4+0-D spacetime, in which the inherently non-local Platonic gravity (\(P\)) and non-local Platonic quantum world (\(P\)) become *perfectly* localizable at the “footprint” of \(P\), denoted Q above. Read the crux of Kochen-Specker Theorem without math, for Tom, Dick, and Harry [6]: the *atemporal* Platonic world (\(P\)) is UNcolorizable. It is ‘the bridge’ \(P \simeq P\).

What if the bridge \(P \simeq P\) can entangle the *atemporal* Platonic state (\(P\)) of the human brain with the *atemporal* Platonic quantum-gravitational world (\(P\)) as well? If true, we can expect to observe quasi-local gravitational radiation and macroscopic version of quantum tunneling. And much more [7], such as ‘reversible elimination of inertial mass’ (REIM). No, it is not “magic”. REIM is about modulating the rate of time under the re-interpretation of negative mass. Once created, the REIM bridge \(P \simeq P\) might produce specific pattern in the human brain, which may have distinctive qualia accessible by human volition, and could also be enhanced with biofeedback training.

NB: Everything suggested above will be false from the outset if the metaphysical ideas advocated by Bob Geroch [1] match the actual case of Nature. You will be the judge.

I will leave you with two video clips [7], from Steven Freyne and Wang Yifeng (Yif).
You are expected to believe these clips show some fake “magic”, because this is the mainstream stereotype in our society. Besides, you are a serious academic scholar, not interested in some weird fake “magic”. Of course you will ignore it. Good for you.

References


2. Idem, Brain-Controlled Cold Plasma (27.11.2019), p. 18 and p. 28. Available at this http URL.

3. Idem, Gravitational Energy (22.02.2020), pp. 2-8. Available at this http URL.


7. D. Chakalov, Über Die Gravitationsfeldrelativitätstheorie (20.03.2020), p. 16. Available at this http URL.


Munich, Christmas 2020
The international conference GRAVITY 21 (26-27 March 2021, Munich) urgently needs financial support by ‘the right people’. Email me at dchakalov@gmail.com for details.

I invite all physicists, interested in the origin of gravity, to send their answers to the following questions (please follow the links):

Consider two kitchen scales, A and B, on a table at rest, and two apples on them, with different weight, say, an apple with 200g on scale A, and an apple with 400g on scale B. How would you relate their “trajectories” in 4D spacetime to non-tensorial Christoffel symbols, so that the former will produce different weight?

Obviously, the apple with weight 400g on scale B will (i) resist acceleration harder than the apple with weight 200g on scale A. Obviously, something is (ii) doing work by pressing simultaneously the scales A and B on the table.

Obviously, (i) = (ii). What is it? Please expand your answers to Earth tides.

The foundational questions above do not included the unsolved issue of gravitational rotation (Richard Feynman), because it is swept under the carpet in GR textbooks.

NB: Spacetime is geometry, but can geometry produce work on matter? Yes it can, by energy non-conservation, but how the intangible energy \[ \Lambda \] becomes ‘tangible’ one?

The spacetime in GR is endowed with elasticity, namely, it can deflate and inflate. See three 4D spacetime intervals below, called Alice (A), Bob (B), and Carol (C), all of which are calibrated (Sic!) in meters of light-travel time (E. Taylor and J.A. Wheeler). A, B, and C have different RS size (p. 5 in [7]), but the “number” of geometric points in them is identical: non-denumerable. In this respect, A, B, and C are ‘the same’.

________ Alice (A) ___________

________ Bob (B) ___________

________ Carol (C) ___________

Relative to Bob (B), Alice (A) is deflated and Carol (C) is inflated. It is all relational (p. 12 in [7]). All effects of gravity are created by the rate of time. Thus, we need first to understand the origin of Time at GRAVITY 21 (26-27 March 2021, Munich).

How much ‘energy from geometry’ (\( \Lambda \)) is needed to propel up↑ the ‘elevator’ at rest?
About the author

My full name is Dimitar G. Chakalov (pronounced tcha-KA-lov, with accent on the second syllable). EU citizen, ID Card 648921850. I am independent researcher, interested in foundations of Mathematics, quantum gravity and cosmology, and physics of Life. Email dchakalov@gmail.com; website shortcut chakalov.net.

Forty-eight years, ago, in June 1972, I suddenly experienced a beautiful feeling that now I “understand” the so-called fictitious force in GR, after studying GR for nearly five months, since January 1972 (age 19). This ‘gut feeling’ gradually faded away and completely disappeared in December 1973. Never came back. I wish I could have shared my questions with Sir Hermann Bondi and his colleagues in January 1957, at the famous Conference on the Role of Gravitation in Physics (January 18-23, 1957).

In my opinion, there are many jabberwockies in GR textbooks, which I hope will be sorted out at the international conference GRAVITY 21 (26-27 March 2021, Munich). We need the common denominator of Theory of Relativity and Quantum Theory. But in the absence of mathematical formalism (the so-called hyperimaginary numbers) applicable to the Platonic world, I can only suggest conceptual solutions to conceptual problems, such as “dark energy” or “mystery matter”: why is the universe larger than a football? In QM textbooks, quantum “particles” cannot possess any classical states, neither before not after (Sic!) their observation (Erwin Schrödinger): why? Regarding GR textbooks: matter can produce geometry, like the shape of a mountain, but can the “shape” (the left-hand side at EFE) act back (John Wheeler) on its “source” (the right-hand side at EFE)? Namely, can geometry produce work? The list goes on and on.

I claim that my conceptual solutions are unique, in the sense that any other solution, with or without math, will immediately demolish my theory — Nature does not have “redundant” elements. It has unique design, which is both the only possible and the optimal one. We only have to follow the facts and assemble our Weltbild like a giant jigsaw puzzle in which every piece will effortlessly fit into its own unique place.

Can we learn spacetime engineering? Well, can you juggle three balls (p. 13 in [7])?

D. Chakalov
10 May 2020, 20:08 GMT
I elaborate on the nullified ‘additional structure’ (R. Wald) of 4D spacetime. Here are Slide 1, Slide 2, Slide 3, and Slide 4 of my 30 min talk. Bottom line is the infinitesimal ‘atom of geometry’, without which there will be no time and no 3D space ($\Delta t \equiv 0$). On the one hand, the atom of geometry has internal structure, topology, and dynamics (Slide 2 and Slide 3), but on the other — no physical stuff can be “inserted” inside it, and in this sense the atom of geometry ‘has no part’ (Euclid). The solution from first principles has been proposed by Plato and Heraclitus, and also by Aristotle. Finally, I reiterate my theory of two modes of spacetime, presented in my first talk dedicated to Hermann Minkowski’s Raum und Zeit, on 21 September 2008: local (physical) mode pertaining to ‘change in space’ (coordinate time, Slide 4) and global (Platonic) mode pertaining to ‘change of space’ (Slide 2). The latter is always nullified in the squared spacetime interval (R. Wald), leading to self-acting (Sic!) 4+0 D spacetime. Q.E.D.

We observe (with light) only colored (physical) world: matter & fields. Can ‘the grin of the cat’ react back on the (colored) cat? There is no explicit time parameter in GR (C. Rovelli). We need to unravel the origin of Time: the atom of geometry.

The local mode of spacetime, as ‘change in space’, pertains only to (colored) matter & fields (cf. thermodynamics). It alone cannot explain time asymmetry and causality.
We need the two *modes* of spacetime, as suggested on 21 September 2008, in my first talk (entitled *About Points, If Any*) dedicated to Hermann Minkowski’s *Raum und Zeit* on 21 September 1908: the *local* (physical) mode pertaining to ‘change *in* space’ (the coordinate time, *Slide 4*) and the *global* *Platonic* mode of ‘change *of* space’ (*Slide 2*).

We need to find the *Unmoved Mover* and reconcile it with the *Theory of Relativity*. We need a *breakthrough*. Welcome aboard!

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1. **About points, if any**

Facts first.

In the current Theory of Relativity, people like Bob Geroch reduce the origin of Time (*Slide 2*) *exclusively* to matter: Time is made *only* by matter and fields. *Nothing else*. To understand the grave error in this “interpretation”, let me illustrate it below.

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Detonating cord burning in one direction.
There is no “mystery matter” here.

The “dark energy” is assumed to be some unknown *physical* stuff, maybe vacuum.

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Fig. 1

Fig. 2
In the first place, there is no reference frame in which some “meta observer” could “watch” the entire universe en bloc, and time its evolution on some ‘absolute clock’ (M. Chodorowski) “outside” the inflating spacetime. Yet three people were awarded Nobel Prize in 2011 “for the discovery of the accelerating expansion of the Universe”. Nobody asked them nor any of their distinguished academic colleagues a very simple question: how did they define ‘the entire universe’? With respect to itself maybe? We can define, for example, the boundaries of the burning cord (Fig. 1), or those of a two-pint glass (Fig. 4), or the edges of a pizza, but it is mathematically impossible to define the (presumably asymptotic) boundaries of ‘the entire universe’, for the simple reason that they do not belong to ‘the entire universe’ anymore. Read below.

**DEFINITION 2.7.** Let \( A \) be a subset of a topological space \( X \). A point \( x \) in \( X \) is a limit point of \( A \) if every neighborhood of \( x \) intersects \( A \) in a point other than \( x \).

Notice that a limit point \( x \) of a set \( A \) may or may not lie in the set \( A \). Notice also that in every topology, the point \( x \) is not a limit point of the set \( \{x\} \).

**EXAMPLE 2.9.** Consider the set \( A = \{ \frac{1}{n} \in \mathbb{R} \mid n \in \mathbb{Z}_+ \} \) as a subset of \( \mathbb{R} \) with the standard topology. It is illustrated in Figure 2.3.

![Figure 2.3](image)

**FIGURE 2.3:** The set \( A = \{ \frac{1}{n} \in \mathbb{R} \mid n \in \mathbb{Z}_+ \} \).

The point 0 is a limit point of \( A \). Why? If \( U \) is an open set containing 0, then there is an interval \((a, b)\) such that \( 0 \in (a, b) \subset U \). But \((a, b) \cap A \neq \emptyset \) for every such open interval. So \( U \cap A \neq \emptyset \). Therefore every neighborhood of 0 intersects \( A \), and since 0 is not in \( A \), the intersection contains points other than 0. It follows that 0 is a limit point of \( A \).

In fact, 0 is the only limit point of \( A \). Given \( x \in \mathbb{R} - \{0\} \), we can find an open interval containing \( x \) that either is disjoint from \( A \) (if \( x \notin A \)) or intersects \( A \) only in \( x \) (if \( x \in A \)). In either case, if \( x \neq 0 \), then \( x \) is not a limit point of \( A \).

Notice the crucial idea of ‘open interval’ above. It means the following. Consider a set of ten apples; they all are ‘apples’, but have slightly different colors and shape, which makes them *individual* viz. countable objects. If you arrange all apples in a row and assign *numbers* to them, then a *closed interval* will include all apples: \([1, 10]\). But the *open interval* \((1, 10)\) does not include its endpoints, and reduces to \([2, 9]\). So, if you talk about the properties of ‘all ten apples’, you *must* define their “boundaries”. *Simple and clear.* Only you can’t: recall the Thompson’s lamp paradox (Wikipedia).

The seemingly innocent expression that “a limit point \(x\) of a set \(A\) may or may not lie in the set \(A\)” is a deep Russian poetry, in my opinion. In our case, you may not even *think* about individual viz. countable objects, because the geometric points (Fig. 5) are *not even countably infinite*. To quote from Wolfram:

> Aleph-null bottles of beer on the wall, Aleph-null bottles of beer, take one down, and pass it around, Aleph-null bottles of beer on the wall.

In mathematical notation, \(\aleph_0 - 1 = \aleph_0\): one ‘point’ makes *no sense at all*, and makes *no difference* at all. *Zilch.* The poetic expression “a point other than \(x\)” above may sound “comprehensible” only to people like R. Penrose.

I have asked (*very* politely) many prominent mathematicians to shed some light on their ideas, since my first talk on 21 September 2008, but the only suggestion came eight years ago, on 21 May 2012, from Prof. Dr. Maurice de Gosson: “Buzz off, idiot!” (Mon, 21 May 2012 18:47:46 +0200). You can’t communicate with Russians.

Mathematicians are talking apples and oranges: one of them can have *metric* (Fig. 5), while the other one cannot (Fig. 6). Look at Fig. 3 below, taken from the one above.

![Fig. 3](image)

If you think of *metric*, e.g., if the size of the interval \([0, 1]\) matches the size of a *tile on sidewalk*, you are in deep murky waters, because the error \(\varepsilon\) *must* be “zero”, but in such way that the *exact* limit at ‘point 0’ must *not* belong to closed interval \([0, 1]\), but to some mythical “open” interval \((0, 1)\). For comparison, every *tile* has a *physical* boundary, which separates it from the neighboring tiles, and there is ‘something else’ that lives in the strips *between* tiles; for example, sand. But mathematicians cannot introduce some “ambient sand” around their ‘tile’ \([1, 0]\), so they bravely use “open” intervals \((0, 1)\) and claim that the *size* (Sic!) of the ‘sand strip’ is *exactly one single geometric point* (Fig. 5), which is of course dead *false*: read about Aleph-null above.
NB: There is no metric in the perfect continuum of pre-geometric points (Fig. 6). Also, you may not count any of the non-denumerable geometric points (Fig. 5). Unless of course you’re Chuck Norris or Roger Penrose.

Now, can we think of absolutely all (whatever this means) geometric points (Fig. 5) in a [closed interval], like the ten apples above? Well, recall the ‘two pint beer’:

An infinite (actual infinity) crowd of mathematicians enters a pub. 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.

Notice, however, that the [two pint beer] is embedded in the pub, and therefore the two endpoints, fixing beer’s boundaries, belong to the pub as well. Can’t win. And the alternative idea based on ‘open interval’ above is also nonsense, because all the points in Fig. 3 — no matter how “dense” — must not hit the ultimate limit [0].

The good thing about the topological jabberwocky above is that it hints to the only possible solution: the red line in Fig. 3 is the perfect continuum of pre-geometric points (Fig. 6) from which the non-denumerable geometric points (Fig. 5) emerge. Namely, the Platonic world (Fig. 6) is the ultimate “cutoff” to all non-denumerable geometric (white) points (Fig. 5), yet the “cutoff” does not exist there. Thus, we can define the Platonic “boundaries” of a pizza, yet they do not exist ‘inside the pizza’.

Why? Because the Platonic world (Fig. 6) is the unique ‘empty set’ relative to Fig. 5.

I am always ready to explain in details my proposal and the crucial implications to differential geometry, point-set topology, set theory, and number theory, but it will be boring. Besides, no mathematician or theoretical physicist has shown any interest. They all are playing Sergeant Schultz: “I see nothing! I hear nothing! I know nothing!”
Let me just quote José Senovilla (links added): “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. Thus the necessity of a rigorous definition of the boundary of a space-time.”

The Platonic world (Fig. 6) wraps the entire physical universe (Fig. 2), although it (not “He”) is not part of the physical spacetime. It is always nullified in the squared invariant spacetime interval (R. Wald), leading to 4+0 D spacetime. Let me explain.

2. The atom of geometry

Mathematically, the Platonic world (Fig. 6) is the unique ‘empty set’. The current notion of ‘empty set’ is “both open and closed” (Wolfram), and the complement to ‘empty set’ is the UNdefinable ‘universal set’. Let me try to put law and order here.

The current notion of ‘empty set’, denoted \{\}, is inevitably relational, in the sense that it refers to something that is not included in it. For example, I can safely assume that the set of bananas, which you have stuck in your ears while watching this video, is an empty set with zero cardinality. The other reason why the textbook definition of ‘empty set’ is relational is this: the notion of ‘empty set’ refers to its complement — the ‘universal set’ which is UNdefinable in the current set theory. Why? Because such “set” (if any) “contains all objects, including itself” (Wikipedia). Got a headache?

I suggest to augment the current set theory with the Platonic world (Fig. 6) presented with the unique ‘empty set’ denoted here \{Ø\}. Notice that \{Ø\} denotes also “the set of all sets”, which includes ‘absolutely everything in the physical world’ defined with respect to the Platonic world (Fig. 6). It’s all relational, as uncle Albert used to say.

I will place the Platonic world \{Ø\} in the potential future, and all non-denumerable (white) geometric points (Fig. 5) in the irreversible past (Slide 3). I will call this new object ‘the atom of geometry’. Sure enough, it has non-trivial topology, structure, and dynamics (Slide 1 and Slide 2), thanks to the fact that the Platonic world \{Ø\} is always re-nullified in the squared invariant spacetime interval (R. Wald) — once at a time, as read with your good old clock. Hence I will introduce 4+0 D spacetime with two modes: local (physical) mode pertaining to ‘change in space’ (coordinate time, Slide 4) and global (Platonic) mode pertaining to ‘change of space’ (Slide 2). This was the crux of my first talk dedicated to Hermann Minkowski’s Raum und Zeit, delivered on 21 September 2008. The application of ‘the atom of geometry’ will (hopefully) be presented on 27 March 2021 at GRAVITY 21 held on March 26-27, 2021 in Munich. Praise the Lord and pass the ammunition!

3. Summary and outlook

Any time you read in differential geometry about open interval, open set, open ball, or open (whatever) — don’t buy it. The same applies to “local differential geometry” (Bob Geroch). The first off error made by mathematicians is to “derive” the notion of ‘geometric point’ (Fig. 5) from object with finite size, like a tile on sidewalk, and
treat it like individual viz. countable object, for example, an apple, and then try to explain the notion of ‘limit’ (Fig. 3) by instructing the “open” (whatever) to run toward the ultimate ‘limit’ indefinitely, namely, “as closely as desired” (Abraham Fraenkel), provided the ultimate ‘limit’, denoted 0 above, will be always excluded.

Sheer nonsense. The rigorous definition of ‘limit’ cannot be delivered with potential infinity, as demonstrated with Thomson’s lamp paradox. If we use actual/completed infinity (Georg Cantor) to avoid ‘counting’, we can imagine some finite ‘tile’ as the glass of two-pint beer above (Fig. 4), which leads to another, also insurmountable problem: the endpoints exactly at the ‘limit’ of [two-pint beer] will belong to the ambient environment as well. Thus, in this second case we actually reach the ‘limit’ and try to stop there, at the expense of using some schizophrenic “dual” points.

Can we square the circle? Yes we can, with the so-called atom of geometry. Notice the Platonic world (Fig. 6) denoted P in Slide 2 and Slide 3. Now we can apply the idea of Finite Infinity (FI) and blend (Sic!) the asymptotic properties of physical fields “at infinity” with their local state ‘here and now’. Hence one day we could explain ‘isolated gravitating systems’ and the phenomenon called ‘inertia’, along the lines suggested by Dennis Sciama on 19 August 1952. The locality principle is not violated: the Platonic world {Ø} (Fig. 6) is an atemporal pre-geometric “point” stretched exactly to “infinity”, and It acts as instantaneous bootstrapping web entangling all non-denumerable (white) geometric points (Fig. 5). What we can see with light is matter acting by itself, on itself. No “ghosts”, no “mystery matter”. This is the idea of biocausality, suggested in January 1990 to model the physics of the human brain. More from Erwin Schrödinger. Last but not least, we can talk about physical theology, because the Beginning (John 1:1) is not physical event: It always disappears (Slide 3), yet It is always “inside” every 4D event ‘here and now’ (Luke 17:21). Mathematically, {Ø} (Fig. 6) does not belong to the topological space of geometric points (Fig. 5).

I am always ready to defend in details the uniqueness of my proposals, but so far no mathematician or theoretical physicist has shown any interest, so I will stop here.

Briefly on my talk The Continuum of Geometric Points, scheduled on 26 March 2021: the subject may look purely metaphysical, but it is immediately relevant to the most powerful phenomenon, which some (otherwise smart) people called “dark” (Fig. 2). No, the Platonic world {Ø} (Fig. 6) is anything but “dark”. It (not “He”) provides the dynamic calibration of spacetime metric in ‘meters of light-travel time’, thanks to which ‘the grin of the cat without the cat’ can react back (John Wheeler) on matter and fields by adjusting the local rate of time. The end result is what we call gravity.

Not convinced? I invite all physicists to send their answers to the questions above.

We need two modes of spacetime, from 21 September 2008. We need Mathematics.

22 May 2020
Last update: 21 June 2020, 10:53 GMT
Text to Slide 1, Slide 2, Slide 3, and Slide 4 from of the lecture, 21 September 2020.

To better understand the infinitesimal $\Delta t > 0$ in the atom of geometry, consider two distant yet simultaneous events at which the Dragon (Slide 1) has created $Q_0$ at the Sun and also $Q_0$ at Earth. These two events may have identical temporal labels (not coordinates) $Q_0$ only in some now-at-a-distance reference frame of a transcendent tachyon. In the context of QM, think of $Q_0$ as the temporal label of EPR-correlated spacelike-separated entangled event(s) upon the “collapse” of their wave function.

Now, suppose at $Q_0$ the Sun emits light, which will reach Earth after app. 500 sec at $Q_1$. We observe at $Q_1$ the past state of the Sun, which it had app. 500 sec before $Q_1$, and are certain that at our next $Q_2$ the Sun ‘will have already had’ (sit venia verbo) a new state, which we will see at our next $Q_2$. Hence we can define the infinitesimal $\Delta t = (Q_2 - Q_1) > 0$. Yet our observation of Sun’s states is continuous: there are no “dark gaps” without light from the Sun, like the sand strips between tiles. Also, the photon itself is atemporal and does not age, because its proper time is always zero.

Are you still with me? If yes, let’s move to the atom of geometry, Slide 2 and Slide 3. The infinitesimal $\Delta t > 0$ has its own structure ($Q_2 - Q_1$), but its “duration” along the axis $W$ in Slide 2 is nullified in the squared invariant spacetime interval (R. Wald).

NB: This is why $Q_2$ and $Q_1$ are ‘distinct’ along $W$ (Slide 2 and Fig. 6). Not because the manifold were Hausdorff. Do not treat the geometric points (Fig. 5) like apples.

I will introduce 4+0 D spacetime with two modes: local (physical) mode pertaining to ‘change in space’ (coordinate time, Slide 4) and global (Platonic) mode pertaining to ‘change of space’ (Slide 2). It’s a bundle. Think of the global (Platonic) mode as an additional zeroed coordinate along $W$ of the omnipresent “point” $P$ in Slide 2.

Read above, and keep in mind that the local (physical) mode of spacetime is only the arena of retarded light & photons, with positive mass only (Sir Hermann Bondi). To understand the global (Platonic) mode, check out the experiments above. Good luck.
Text of the video lecture, entitled *Dynamics of 4+0 D Spacetime: Atom of Geometry*. YouTube, 21 September 2020, 10:30 GMT.

My name is Dimi Chakalov (pronounced tcha-KA-lov; notice the accent on the second syllable). I will talk about the elementary “atom” of spacetime, which I called ‘atom of geometry’, and will elaborate on the proposals in my first lecture on 21 September 2008, dedicated to 100th anniversary of the talk by Hermann Minkowski, entitled *Raum und Zeit*, presented on 21 September 1908.

Let me explain the so-called atom of geometry, so that you can decide whether this topic is of interest to you. What we call ‘spacetime’ is an object of our imagination, just as we can imagine some ‘ideal sphere’ as purely geometric object: we can never see an ‘ideal sphere’. We can see only a physical object with spherical shape, say, a football or an inflating balloon (Slide 2). Ditto to 3D space and 1D time: we can easily imagine three perpendicular axes in what we call 3D space, and 1D space (line) with which we model ‘time as read with a clock’. And on 21 September 1908 Hermann Minkowski united 3D space and 1D time into 4D spacetime and introduced its metric, hence completed the Theory of Relativity. Sounds simple and clear, but it is neither.

How can every geometric point follow what we call ‘time’? What is ‘geometric point’ in the first place? We imagine that what we call ‘geometric point’ is a special object that has no extension along its 4-dim anymore. How do we get to this endpoint?

Consider a physical spherical object with finite size, for example, a spherical balloon with radius 20cm (Fig. A), matching the size of a tile on sidewalk. We can imagine three perpendicular axes (x, y, z) intersecting at the center of the balloon (Fig. A).
To introduce ‘time as read with a clock’, imagine that the red circle in Fig. A is dynamical, namely, that it can be inflated and deflated. Can we deflate balloon’s radius in Fig. A exactly to zero at point 0? According to Zeno, yes we can. All red points in Fig. A will be superimposed at 0, resulting in one single dimensionless point which “has no part” (Euclid) anymore.

To make sure we are on the same page, let me explain how we think of these red points. Consider two polygons, inscribed (yellow) and circumvented (blue), shown in Fig. B above. Make a sequence (bounded and monotonic) of increasing numbers of polygon’s sides denoted n: (4,5,6, ... , ∞). It is “intuitively clear” that there exists an endpoint or ‘limit’ to this sequence, explained as “a guess (Sic! - D.C.) of the value of a function or sequence” (Wikipedia). Thus, our best guess is that the dotted segments in Fig. B above will be deflated down to exactly “zero”, as the inscribed (yellow) and circumvented (blue) polygons will have equal and “infinite” number of sides (n = ∞), and the dotted circle in Fig. B will match the red circle in Fig. A above. We simply have to stop at the endpoint or ‘limit’. Can’t go further.

Again, all this may sound simple and clear, but it isn’t. What makes the red geometric points in Fig. A above ‘distinct’? They are not like the snapshots from a movie reel, separated by dark strips (Fig. C) that make the points (balls) ‘distinct’ viz. different in ‘time as read with a clock’.

In our case, there is no ‘dark strip’ whatsoever between the red geometric points in Fig. A above. Yet all the red geometric points are also distinct and hence different in Time, although they are “separated” by ... nothing. Can we suggest a new object, which does not exist in the physical world (Fig. C), yet can safely separate all red points in Fig. A above? Yes we can: the Heraclitean flow of Time, which creates dislocation in 4D spacetime (Fig. D) with the atom of geometry. Are you interested?
Great. Let me show how to separate the three consecutive 4D stated in Fig. C and Fig. D above by *nothing*, so that they live in a **perfect** continuum, without any ‘dark strips’ (Fig. C) whatsoever. Recall Photoshop layers (Fig. E) and denote the three snapshots in Fig. D above by $Q_1$, $Q_2$, and $Q_3$ (Fig. F): $(Q_2 - Q_1) = (Q_3 - Q_2) = \Delta t > 0$.

![Fig. E, Photoshop layers](image)

![Fig. F](image)

Now flatten the images in Fig. F but, instead of sideways above, look at them in the direction opposite to the red arrow (Slide 2) in Fig. D above: what will you see? All three images will be superimposed, like superposition of quantum states (Wikipedia).
The resulting image will be *atemporal*, that is, frozen in ‘time as read with a clock’. To animate it and see the man standing still (at rest in his reference frame) and the walking cat, you need to watch it as a video clip, along your (local) time. But again, you will not see (with light) any ‘dark strips’ (Fig. C) whatever: perfect continuum.

Why? Because the *infinitesimal* $\Delta t$ is along the red arrow in Slide 2. It is not 1s, as in Fig. D above. The *infinitesimal* $\Delta t$ along the red arrow in Slide 2 *literally* re-creates (Sic!) the geometric points in the local (physical) 4D spacetime, including those of the man standing still (at rest in his reference frame) in Fig. D above. Hence absolutely all geometric points in the local (physical) 4D spacetime are being re-created (Sic!) along the Heraclitean Time, which makes them ‘distinct’ in their perfect continuum.

Both the man (at rest in his reference frame) and the walking cat are dislocated at every consecutive *infinitesimal* $\Delta t$ — both in their local (physical) 4D spacetime and in their global (Platonic) mode of spacetime. The latter, however, is always nullified by the phenomenon called “speed” of light.

This was the crux of my proposal for two modes of 4+0 D spacetime, launched on 21 September 2008 in my first talk dedicated to Hermann Minkowski’s *Raum und Zeit*: local (physical) mode pertaining to ‘change in space’ (coordinate time, Slide 4) and global (Platonic) mode pertaining to ‘change of space’ (Slide 2). Now I make a step further and suggest the so-called atom of geometry (Slide 3). Check out all slides.

In the past 12 years, since 21 September 2008, no mathematician or physicist has shown any interest. None. I will let them to simmer in their our sauce (Matthew 7:6).

Now, what could you “see” if you freeze the 4D video clip and switch to nullified “coordinates” in our global (Platonic) mode of spacetime? You will perhaps enter the atemporal Platonic world, which Plato and Heraclitus suggested many centuries ago. Check out my Gedankenexperiment on p. 31 in Platonic Theory of Spacetime.

Notice that we can develop straightforwardly Quantum Spacetime by *increasing* the pocket of *potential* Platonic atemporal quantum states (Fig. G). The latter do not live in the light cone (the local mode of spacetime). More from Erwin Schrödinger.
How about gravity? It is created by the rate of time (Slide 1). If Nature runs our local 4D video clip (Plato) with lower rate, the end result will be attractive gravity. If the clip is ran with higher rate, the end result will be repulsive gravity. Simple, isn’t it?

I will be happy to demonstrate how gravity works, with spacetime engineering. It is indeed very simple. I call it ‘the bridge’, and hope to explain it on 27 March 2021 at GRAVITY 21, March 26-27, 2021 in Munich, EU. Here is the snapshot from April 2014.

Perhaps ‘the bridge’ can guide us to a brand new world. The theory is speculative, like the dubious map used by Christopher Columbus in August 1492. But if he didn’t go west, with the insane hope to find shorter route to the Far East, how could have he discovered America?

To wrap up, I will briefly reiterate the two main phenomena: the self-acting (Sic!) physicalized 4D world, which is always “colored” by matter and fields (like colored finger nails), and the underlying “colorless” Platonic world, which is UNcolorizable and can never be observed due to the “speed” of light. Perhaps it (not “He”) is the Noumenon? We can never understand ‘Das Ding an sich’.

Let me go over the four slides. The dynamics of spacetime creation is illustrated in Fig. H, reproduced from Über Die Gravitationsfeldrelativitätstheorie, p. 11 in [7].

![Fig. H](image)

The consecutive assembled elements (binding edges) of the zip are already completed cycles \( P \rightarrow Q \) (Slide 3) of re-created 4D spacetime (Slide 1) along the atemporal axis \( W \) (Slide 2). We can see – with light – only the end result \( Q \) (Fig. C and Fig. D), one at a time, as read with a clock. We cannot see the cycle \( P \rightarrow Q \) “sideways” (Fig. F). Thus, the local (physical) 4D mode of spacetime is being re-created and assembled as perfect continuum endowed with the principle of locality: the infinitesimal \( \Delta t > 0 \) is only the end result \( Q \) from ‘the atom of geometry’ (Slide 3) along \( W \) (Slide 2). If you decide to “freeze” the Heraclitean arrow of 4D events, the infinitesimal \( \Delta t > 0 \) will have to be interpreted as either finite or zero. It looks ‘finite’, because we look at \( \Delta t \) along the assembling (flattening) direction opposite to the red arrow (Slide 2), shown also in Fig. D above. But it is also ‘zero’ (denoted \( \{0\} \), see Fig. 6), because the red arrow \( W \) (Slide 2) is always nullified, leading to \( 4+0 \) D spacetime (Slide 4). Q.E.D.
Again, the non-relational Heraclitean arrow of 4D events is embedded in the Theory of Relativity: the bare spacetime — ‘the grin of the cat without the cat’ — is “flying” with the “speed” of light (Slide 4). With respect to what? To the “dark space” below.

![Non-relational arrow](image)

**Fig. I (p. 8 in [3])**

**Fig. J**

**NB:** How much ‘energy from geometry’ ($\lambda$) is needed to propel up↑ and rotate/spin the ‘elevator’? Forget “mystery matter”. We have **gravitalized** mass and energy.

The light cone cannot show the vector $W$, and we don’t know what may cause the alteration (Sic!) of the rate time (Slide 1) along $W$, called ‘gravitation’. No, it is not “spacetime curvature”. The “curvature” is just a mathematical tool to compute derivatives (Fig. 7). Not surprisingly, GR experts are not interested and continue to play Sergeant Schultz: “I see nothing! I hear nothing! I know nothing!” How about you?

Look again at Fig. G above: the global (Platonic) mode of spacetime, pertaining to the nonliving world at the length scale of tables and chairs, has a very “narrow”, FAPP zero “pocket” of potential Platonic atemporal quantum-gravitational states — the nonliving macroscopic world has FAPP zero flexibility to choose its next state. People very often use only Newtonian gravity (e.g., NASA) and everything is sweet, because nobody dares to talk about gravitational rotation (the hypothetical affine connection is torsion-free). And if they talk about the rate of time, in GPS navigation and time dilation, they are unaware that at the length scale of the solar system the “pocket” of potential Platonic atemporal pre-gravitational states is still FAPP zero. Which creates the false idea of “classical background with a well defined value” and GR experts are still puzzled by the non-local gravitational energy (Hermann Bondi).

The human brain has much greater flexibility to choose its next state. And the brain is embedded in the quantum-gravitational Brain of the Universe. We need quantum gravity to understand and explore ‘the bridge’, as I suggested in April 2014. My efforts at mentioned on p. 4 in The Atemporal Platonic World. We need new Mathematics.
Finally, let me go back to ‘the elephant in the room’: the metric paradox. Once we introduce metric of spacetime, after Hermann Minkowski’s lecture Raum und Zeit on 21 September 1908, we face the origin of spacetime, which must have existed before the instant of creating spacetime endowed with metric. This paradox prompted Yakov Zeldovich to suggest that “long time ago, there was a brief period of time during which there was still no time at all.” (Private communication, May 1986; translation mine.) Needless to say, Yasha was joking. And the metric paradox remained unsolved until the author of these lines found its unique solution in the topology of spacetime, dubbed Finite Infinity (FI): notice in Slide 3 that the Platonic pre-geometric world always disappears. Namely, once the Universe was created, it was already eternal. We cannot reach the Beginning nor the End: this non-event is quietly residing “inside” the atom of geometry (John 1:1; Luke 17:21), at absolute infinity (Georg Cantor).

This is the first step toward physical theology. Without God as Love (1 John 4:8), we cannot practice spacetime engineering. You may of course try, but you will be going in exactly opposite direction: parapsychology. Many ‘good guys’ have tried, ever since the Roman Empire, to raise and train some “ultimate warriors” to spy on ‘the bad guys’ and eventually kill ‘em all. Only it doesn’t work. Recall Jesus in Mark 5:34: “Daughter, your faith has healed you. Go in peace and be freed from your suffering.” Jesus could not even think of gathering additional information about this woman. Or recall the conversion of water into wine at the Wedding at Cana: it was not some “miracle” but spacetime engineering, and most importantly — Jesus could not work for any government (the good guys) to hit any people (the bad guys). You just can’t. You all become an inseparable whole. Do you want to find loopholes? Read my mind.😊

The final version can be downloaded on 21 September 2020 from this http URL. No version of this report will appear in any peer-reviewed academic journal: see above.

Can probability produce work? Of course not: read Erwin Schrödinger. Can geometry produce work? Not in GR. Yet professional physicists don’t care. They live in some kind of socialism, with their secured pay check and clear path to peaceful retirement. They don’t want to learn. They don’t want to think. They are lazy good-for-nothing.

Only our kids have open mind and are ready to work. I hope one day they will get involved. As Max Planck pointed out in 1936 (link added):

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.

The sooner the better. Time is running out [2].

2 June 2020, 17:25 GMT
Questions and Answers

Q1. What do you mean by continuum?

A1: See Fig. 9 and Fig. 10 on p. 19, and pp. 36-39 above. Below is Fig. D from Plato, in classical spacetime. To understand the Quantum Spacetime (p. 18), in which the pocket of Platonic atemporal quantum states can accommodate unlimited potential (W. Heisenberg), not-yet-collapsed quantum states, see the cat in Fig. G at p. 38.

The man on the 2D screen (not the cat) is at rest in his reference frame, so he does not “consume” space (Slide 4). The red arrow above is pictured on dark background: notice Fig. I and Fig. J on p. 40. The Platonic aether is atemporal (M. Tegmark).
How is the atemporal Platonic world hidden by the “speed” of light? See the four slides (p. 34) and read p. 20 above, and also p. 31 in Platonic Theory of Spacetime. To understand how to learn spacetime engineering, read p. 43-46 therein. Good luck.

The Eskimos above may have hard time to understand why the so-called Hausdorff space is a myth. I am always ready to help (p. 34): the continuum includes a new presentation of ‘zero’ denoted $\{0\}$ at p. 33. Look at Fig. 9.1 from George Lakoff and Rafael Núñez, Where Mathematics Comes From (New York: Basic Books, 2000), p. 189:

To explain how to reach exactly $R_\infty = \emptyset$, and get back exactly to the initial point 0, you (not Chuck Norris) need hyperimaginary numbers and hypercomplex analysis to fix all geometric points (Q) from the number line, including those in the interval $[0, 1]$ above, by their common pre-geometric source (P). Interested? Please don’t hesitate.

Q2. I don’t understand your drawings. Can you explain?
A2. Let me try, like I tried before (p. 31 in *Platonic Theory of Spacetime*). Suppose you have a cube with rib 3cm. It consists of six sides and each side is a square. To calculate the volume of the cube, you multiply the ribs: 3x3x3 = 27. But imagine that cube’s rib (3cm) consists of infinitely many and infinitely small chunks called ‘points’, which have no “parts” anymore (Euclid). That’s a whole new ball game (Kurt Gödel). The “points” cannot be counted anymore, so the “number” (if any) of points building the rib (3cm) will be *indistinguishable* from the “number” of points building the side of the cube, and also the “number” of points building the volume of the cube. This is a whole new Platonic world: see Fig. 3 on p. 14 and the red circle in Fig. A above.

**NB:** There is no metric in the Platonic world. What makes the *continuum* of these red geometric points, so that they are ‘distinct’? We have two and only two alternatives.

One of them is to imagine that every red geometric point is some *individual* and *distinguishable* animal that is distinct from the “neighboring” *individual* and *distinguishable* animal, and suggest so-called Hausdorff space.

**Bad idea.** I choose the alternative option by introducing Heraclitean flow of Time: every black point, denoted $Q_n$, is distinct in Time (Sic!) from its previous black point denoted $Q_{n-1}$. If we use real-valued metric, $(Q_n - Q_{n-1})$ will be exactly “zero” (p. 9).

**NB:** All black (physical) points Q are consecutive *end results* from the Dragon chasing its tail: see Slide 1 here. The Platonic world (P) is placed in the potential future: see Slide 2 and Slide 3 on p. 34. And mathematicians are like the Eskimos pictured above. They look at the number line but cannot of course “see” the flow of Time. Capiche?
Q3. What is your theory of gravity?

A3. This question was asked by my late colleague Sawa Manoff in December 1986, at the Institute for Nuclear Research and Nuclear Energy at the Bulgarian Academy of Sciences in Sofia. He was very kind to explain privately, at his office, the crux of his essay ‘Problems of the gravitational energy and momentum in the general relativity’ (Physics and Energy, Bulg. Acad. Sci., Sofia 1980, 491-499). The problems with non-tensorial and coordinate-dependent variables are known since the inception of GR (MTW p. 467 and L. Szabados), and I asked Sawa Manoff to explain the emergence of those “fictitious forces” in GR, as if I was one of his (dumb but curious) students.

We read in Wikipedia that fictitious forces ("physics whose cause is outside of the system") are no longer necessary in GR, since they were explained with the geodesics of spacetime. False. They were never “explained”. See ‘crossing a carousel’ here.

Bottom line is the “non-tensorial” stuff in GR (p. 5). It is as if Sawa Manoff was in London and I was in Paris and we both looked at the Moon, but only he could see it. If true, the Moon will not be a real physical object but some “non-tensorial” animal. We face a similar (not identical) puzzle in QM: if the Moon was a quantum object, it can be “collapsed” into one of its 4D “jackets” only — either visible from London or from Paris. Never both. Moreover, GR cannot explain the ubiquitous gravitational rotation: the hypothetical affine connection is by default torsion-free. Forget GR. Get real.

Back in December 1986, I kindly invited Prof. Sawa Manoff to attend my seminar talk on 5 February 1987 (p. 4 in Penrose-Norris Diagram), but never heard from him. The answer to Q3 above was spelled out by William Unruh: read p. 5. I only added Time.

D. Chakalov
12 June 2020, 12:08 GMT
TIME IS RUNNING OUT!

On Friday, 5 June 2020, the Copernicus Climate Change Service (C3S) announced that “May was 0.63°C warmer than the average May from 1981-2010, the warmest May in this data record.”

According to CNN (June 5, 2020), temperatures in Siberia are 10 degrees Celsius above their normal levels. “The Copernicus figures correlate to a 1.26 degree Celsius rise on pre-industrial levels for May. Global temperatures must be kept from rising above 1.5 degrees Celsius on those levels to avoid major impacts on the climate, the United Nations’ Intergovernmental Panel on Climate Change (IPCC) has concluded.”

Read about the Rossby Waves and check out the facts on p. 28 in [2]. My proposal for producing electricity with gravitational rotation is explained on p. 18 therein. Gravity is by no means confined to the fact that apples can fall from a tree and hit your head. We need to understand and explore the non-linear transport of mass and energy by gravitational radiation: read p. 13 in [7] and pp. 9-11 in The Physics of Life. The renewable energy sources combined with nuclear power cannot fit the bill. We must combat the inevitable climate crisis and save our planet. We need a breakthrough: read p. 22 above and p. 6 in [3]. Time is running out!

D. Chakalov
6 June 2020
Last update: 14 June 2020, 11:54 GMT
For the record

In March 1994, I attended the Conference on Science and Theology (ECST V) organized by the European Society for the Study of Science and Theology (ESSSAT) in Freising bei München (March 23-27, 1994), and sent by surface mail from Munich my research proposal at unlimited clean energy to Max Planck Society. The proposal elaborated on my first paper from January 1990 — read p. 6 above. Nobody responded to my proposal from March 1994. 17 years later, in March 2011, the German government announced that it will close all of its nuclear power plants by 2022. However, coal is the largest source of electricity in Germany. Quote from Wikipedia:

On 26 January 2019, a group of federal and state leaders as well as industry representatives, environmentalists, and scientists made an agreement to close all 84 coal plants in the country by 2038. The move is projected to cost €40 billion in compensation alone to closed businesses. Coal was used to generate almost 40% of the country’s electricity in 2018 and is expected to be replaced by renewable energy. 24 coal plants are planned to be closed by 2022 with all but 8 closed by 2030. The final date is expected to be assessed every 3 years.

Sounds great, as Germany might end up with relatively small number of coal plants by 2030, in the best case scenario, “to be assessed every 3 years”. But according to James Temple at MIT (p. 5 in The Physics of Life): “At this rate, it’s going to take nearly 400 years to transform the energy system”. In 2018, the UN Intergovernmental Panel on Climate Change estimated that we have to invest every year €180 billion in renewable energy, energy efficiency, and clean transport until 2030. This is at least €2.16 trillion. Read again p. 28 in [2].

Pin down year 2030: we have just ten years to constrain and (hopefully) avoid the devastating climate catastrophe. As of today, it is still possible to save our planet, but now the task is far more difficult. Again, spacetime engineering is the only option we have to reduce emissions by 7.6 per cent each and every year from 2020 to 2030. If we fail now, by 2025 (Sic!) the cut needed will steepen to 15.5 per cent each year, which is absurd, plain and simple. Read about the UN Environment Program (UNEP) 2019 Emissions Gap Report from 26 November 2019 at this http URL. On 11 December 2019, Greenpeace EU spokesperson Franziska Achterberg warned: “A 50-55 percent emission cut by 2030 is not sufficient. Nature doesn’t negotiate. The longer we wait to make the necessary changes in our economy, the more damage will be caused and the more difficult and expensive it will be.”

We must defend our children (p. 28 in [2]). They cannot fight for their future. All my efforts since March 1994 have been like talking to a brick wall. I need your help. Now.

Time is running out! In June 2021, shortly after GRAVITY 21, the world will change.