Dedicated to our Lord and Savior Jesus Christ

The Spacetime

D. Chakalov
35A Sutherland St
London SW1V 4JU, U.K.
Website chakalov.net

Abstract

Ensuing from first principles, the theory of spacetime and its metaphysical axioms are introduced as prerequisites to physical theology and the so-called relative scale spacetime.

1. Introduction

After the announcement of Relative Scale (RS) spacetime in November 2015[1], many of my readers have been complaining that the theory is very difficult to understand. One of them boldly said, "you lost me on the second page". The fault is entirely mine, and in this paper[1] (see footnote 1 below) I will try to explain the prerequisites to the theory of RS spacetime and physical theology[2] (Sec. 6), hoping that if the reader is familiar with them, the first paper[1] will be easier to understand and study.

In the Sec. 2, I will try to explain my personal, and perhaps biased, views on what is known as 'spacetime', and in Sec. 3 will explain the notion of 'the Universe as ONE' and its unique spacetime, called 'the spacetime', upon which the RS spacetime[1] has been built. I will not repeat here the proposal about the *origin* of gravity[1] in RS spacetime (nothing to do with "curvature"[37]), leading to quantum gravity of the 'Brain of the Universe'[1], but will only try to explain the basic basics of the spacetime. Following Niels Bohr, I also wish to stress that every sentence of mine should be understood not as an affirmation but as a question.

This paper is dedicated to our Lord and Savior Jesus Christ (Sec. 6). The reason I refer to The Gospel is that the Universe as ONE includes *absolutely* everything, and the latter matches the same *absolutely* everything denoted in theology with God, as revealed in The Gospel; hence the incomprehensible '*absolutely* everything' (we call it 'Nature') is their common denominator, *sit venia verbo*. In the framework of physical theology[2], science and theology are considered *complementary* presentations of Nature, as they lead to 'the Universe as ONE' in science, and in theology to God in The Gospel, much like in Quantum Theory the underlying 'quantum phenomenon' has two *complementary* presentations as 'quantum wave' and 'quantum particle'.

Thus, Nature looks in science as the Universe as ONE, and in theology as God revealed in The Gospel. The two *ontologically* different explications of Nature are complementary, and will look equally "absolute". If Nature was explicated by one single **absolute** entity, we could ask questions about its "purpose"[34], but in the doctrine of *trialism* (Sec. 6) such teleological questions are meaningless. It is my hope that 'the Universe as ONE', as Nature is explicated in science[2], may be accessed with Mathematics[3], if the latter can overcome

[1] The latest version of 'The Spacetime', with live links, can be downloaded from http://chakalov.net.

the limitations of our cognition and logic in dealing with such seemingly "absolute" object. As to the other complementary explication of Nature as 'God in The Gospel', it depends on our *free will* to decide whether such seemingly "absolute", but in fact *complementary* explication of Nature may or may not be accessed with faith (my personal, and surely biased, opinion is explained in Sec. 6). One cannot ascribe truth evaluations to opinions delivered with faith and free will. Needless to say, our free will is also gift from God.

A gentle warning to the reader of these lines: one of the worst brainwashing religions is anti-theism. Those who practice it consider themselves "scientists", but cannot even try to think about physical theology[2], because their brains are deadly blocked. It would be like accepting 'quantum particles' but denouncing 'quantum waves'. If you, my readers, are obsessed by anti-theism but wish to understand the *origin* of geometry[7], look elsewhere.

2. What is 'spacetime'?

Fifty years ago, life was simple. I was teenager, and had clear understanding of what we call 'spacetime': an *aspect* of the physical world, such that we can imagine three perpendicular axes in space, and if we add a fourth dimension called time, we can model the trajectories of physical objects in 4D spacetime. For example, if we kick a ball, it will go up and then hit the ground, showing a parabolic trajectory (Fig. 1).

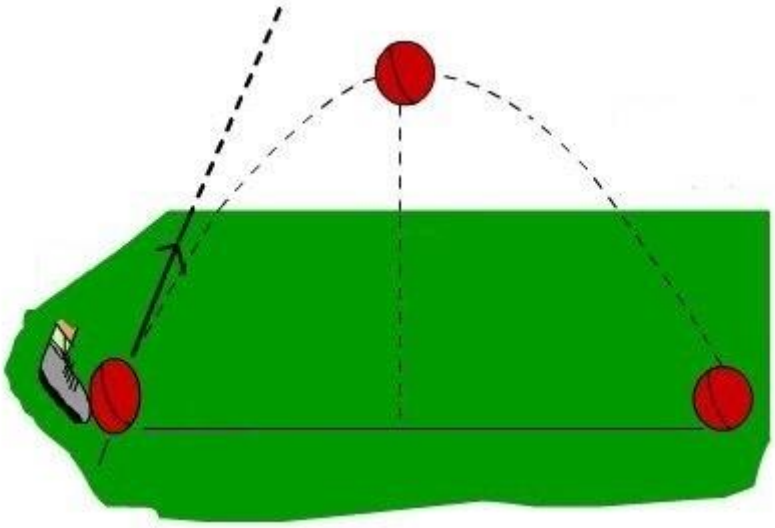

Fig. 1
Projective motion, adapted from Physics Tutorials

We can *imagine* two orthogonal spatial axes (not shown in Fig. 1), horizontal (x) and vertical (y), intersecting at a point in the center of the ball with coordinates x = y = 0. Once we kick the football, this imaginary point will produce a trajectory by changing its coordinates. Such imaginary orthogonal axes constitute 'spacetime': a *purely* geometric object (*Gedankending*) with dimension 4. Fifty years ago, I would reject the idea that a purely geometric object, obtained only with imagination, could act back on the physical stuff that is producing it: the trajectory *itself* cannot act back on the football (Fig. 1).

Many years later, as I was studying General Relativity (GR), I realized that such counter-intuitive phenomenon was indeed possible: Matter tells space how to curve, while space tells matter how to move (John A. Wheeler[4]). The situation is truly paradoxical, because

the idea of 'spacetime as geometry' strongly resembles the grin of the Cheshire cat *without* the cat (Fig. 2), as explained by Alice[5].

Fig. 2

Fig. 3

The spacetime itself is *pure* geometry (Fig. 2) and cannot be directly observed. We *always* observe the grin on cat's *face* (Fig. 3). Yet, to paraphrase John Wheeler[4], in General Relativity the cat tells its grin how to "curve", while at the same time the grin tells its cat how to "move". Their mutual determination is inherently non-linear, as depicted in the famous 'drawing hands' by Maurits Escher (Fig. 4).

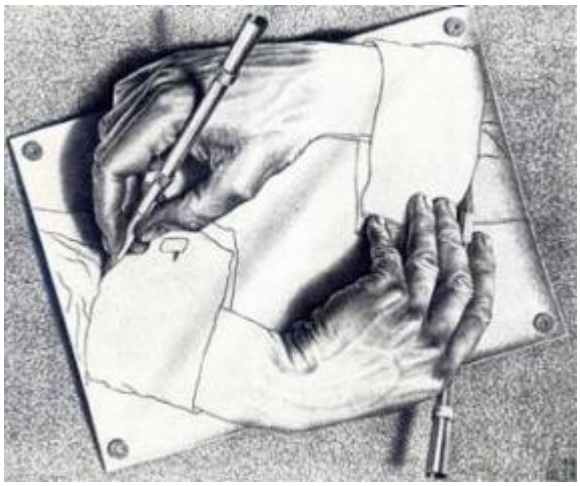

Fig. 4

At this point, at least two questions should be addressed. Q1: Which "hand" goes first? Matter (Fig. 3) of geometry (Fig. 2)? Q2: What kind of stuff could produce 'geometry'[7] in the first place? Namely, what is the *origin* of geometry?

Q1 is based on a wrong premise about temporal order "outside" spacetime: the spacetime of *physical* objects (Fig. 3) cannot be fixed "during" the non-linear negotiation (Fig. 4). Physically, such negotiation is *atemporal*[39]. Only its *final* results are physical — those at which the negotiations are *already* completed[35], once-at-a-time, yielding a spacetime with **fixed** "arrangement of stress-energy" (Wikipedia), one-arrangement-at-a-time, as read with your clock. As to Q2, I suggest that the *origin* of geometry is a special pre-geometric plenum "which has no part" (Euclid), dubbed 'the Universe as ONE' in science, and God in theology[2]. The idea is not original, because it is rooted on Plato's proposal (Fig. 5) formulated some twenty-five centuries ago.

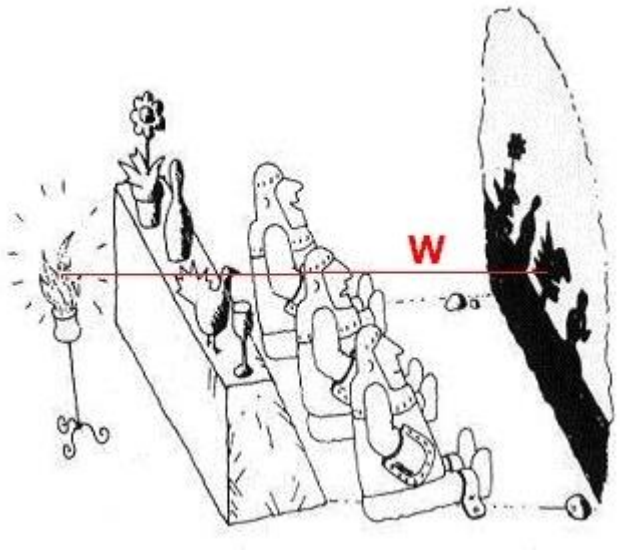

Fig. 5

The chained observers can see only a sequence of *already*-completed final results from the *atemporal* non-linear negotiations (Fig. 4) between matter (Fig. 3) and geometry (Fig. 2), and such **assembled** sequence of *physical* reality has particular property: 4D spacetime (Fig. 1). The chained observers cannot detect the *atemporal* Platonic source projecting *physicalized* 4D "shadows" (Fig. 5), which makes the spacetime of *physicalized* 4D "shadows" a *perfect* continuum: physically, there are no gaps between the successive 4D "shadows". If we picture the light source in Fig 5 as a movie projector and the world of *physicalized* 4D "shadows" as *assembled* 4D movie, we all are part and parcel of the movie, and cannot notice whether the movie operator (not shown) has decided to, say, take a coffee break and "temporarily" halt the movie. Physically, such *atemporal* "gap" (called Macavity[35]) in the physical 4D movie does not exist — it pertains to light-like intervals and every *physical* clock will read it as "zero". Yet it may have a "vertical" component along the hyperimaginary axis **W** (Fig. 5), which leads to 'the Universe as ONE' (Cases **I** –**III**) and its theological counterpart (Case **IV**): see Table **1** in RS Spacetime[1], reproduced below. We do not model the event 'here-and now' with some dimensionless point "which has no part" (Euclid), because in our theory it has complex structure and non-trivial topology (Fig. 7).

Our *cognition* is inherently relational and needs such "zero gaps", so that we can *imagine* separated infinitesimal "pixels" here-and-now (Fig. 6), hence imagine the entire spacetime manifold *en bloc*, defined with respect to 'something else' (we cannot imagine some *non-relational* object "which has no part", Euclid), only Nature is **not** built by imagination. We could also *imagine* that one can apply twice-contracted Bianchi identities to the entire spacetime and speculate how it could become gravitationally *closed* system endowed with *maximal* Cauchy surface (resembling the football field shown in Fig. 1, but without boundaries), so that the total energy *might* be "conserved"[6], but again Nature is **not** built by imagination.

If we imagine Fig. 6 below as a stone block, and a flashlight highlighting individual pixels one by one producing *transience* of time, it is suggested in GR textbooks[27,28] that 'time as *change* of color', which we experience as 'passage of time', is an illusion, because there is no such flashlight nor *global* cosmic time[30] (defined as "global function that increases along every future directed timelike or null curve"[33]) of the entire "block universe" (Fig. 6).

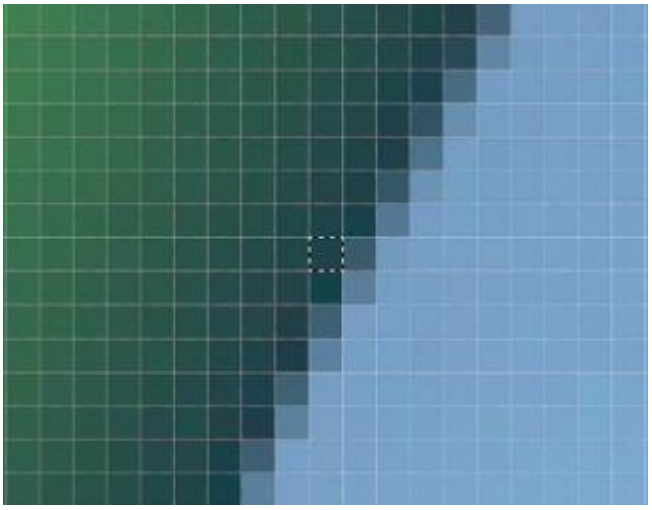

Fig. 6

But we know that the *global* cosmic time does exist[6], and we know the "flashlight" from Plato (Fig. 5). Only the self-acting operator of the "flashlight" (Fig. 7) is still unknown.

To sum up (details in Sec. 7), the *atemporal* Universe as ONE, as exhibited in science[2], is residing "between" the "pixels" of spacetime continuum (Fig. 6), and cannot be *physically* detected due to the "speed" of light. From the perspective of science & theology, **it** (not "He") is *absolutely* everywhere (Luke 17:21; 1 John 4:8). We can only hope that **it** could be revealed with Mathematics[3], *Deo volente* (Matthew 7:7).

3. What is 'the spacetime'?

To understand *the* spacetime of 'the Universe as ONE', we must include its atemporal 'operator' (John 1:1) residing "between" the infinitesimal pixels here-and-now (Fig. 6) and "beyond" the physical spacetime. But where can we unravel such unphysical "zero gap" wrapping every spacetime "point" *and* the entire 4D spacetime *en bloc*? Let's take a closer look at the proposal by Plato (Fig. 5). The task is ferociously difficult[7], because the omnipresent 'Universe as ONE' is *perfectly* protected from physical observations due to the so-called "speed" of light. If 'the ONE' was physically detectable, the theory of relativity will be demolished by such *physical* aether, and theology[2] could be reduced to science and cosmology. Thank God, this is impossible.

Before going to Plato's proposal, notice that we already have an alternative candidate for *both* "dark matter" (for example, the galaxy cluster IDCS 1426 is believed to contain roughly 90% non-baryonic "dark matter") *and* "dark energy": the atemporal 'Universe as ONE' does not emit nor reflect light. If it is also endowed with **self-action** (resembling the human brain), it will simply **act on itself** but will never *expose* itself, hence many academic scholars will consider it "dark"[35], as if it comes literally from nowhere. They will be dumbfounded by "the worst theoretical prediction in the history of physics!"[8], ignoring the obvious explanation with Aristotle's Unmoved Mover: "that which moves without being moved", in clear violation of Newton's third law.

This is exactly what the atemporal 'Universe as ONE' does, thanks to its **self-acting** faculty: the Universe is literally **acting on itself** (Fig. 7) thanks to Aristotle's Unmoved

Mover. It (not "He") is the *engine* of gravity: the **self-acting** 'Universe as ONE' placed in the *potential* future of every interface 'here-and-now' (Fig. 7). For if you picture the *physicalized* universe located in the **past** as a train, and claim that its railroad in the **future** (Fig. 7) is not straight but somehow "curved"[37,40] you cannot explain the *engine* of the locomotive, which Einstein considered "a total field of as yet unknown structure"[18]. No *physical* fields like "inflaton"[6] nor any "fundamental scalar field" are needed, as we know from Aristotle — *Das noch Ältere ist immer das Neue* (Wolfgang Pauli).

Now we can model 'the Universe as ONE' as 'the Brain of the Universe'[1] endowed with *self-acting* faculty. I will introduce the notion of 'potential reality' as *not yet physicalized* state of 'the Brain of the Universe'[1]; the latter includes the human brain and all living organisms. Notice that 'potential reality' is neither 'matter' (*res extensa*) nor 'mind' (*res cogitans*), but a **third** kind of reality "just in the middle between possibility and reality", as stated by Heisenberg[9]. It is placed in the *potential future* of every event 'here-and now', shown with zero "gap" in Fig. 6. Physically, the *potential* reality does not *already* (Sic!) exist: the "zero gaps" between the pixels in Fig. 6 are not 'physical reality', thanks to which the spacetime manifold of the *physicalized* universe becomes a *perfect* continuum called 'local mode of spacetime'. It is the 4D spacetime of *physicalized* Platonic "shadows", while the new axis **W** in Plato's allegory of the cave (Fig. 5 and Fig. 12) pertains to the so-called global mode of spacetime harboring the *potential* reality.

Hence *the* spacetime of the Universe as ONE (the Brain of the Universe) is endowed with two modes, local and global, referring to *physical* reality and *potential* reality.

Again, if we try to present the *potential* reality as *physical* reality, the latter would seem to be coming from "nowhere" and many academic scholars will consider it "dark" (see above).

All this requires new metaphysics. I will introduce new structure and topology to what is known as 'spacetime event', by replacing it with the *interface* between *physical* reality placed in the irreversible **past**, and *potential* reality placed in the potential **future** (Fig. 7).

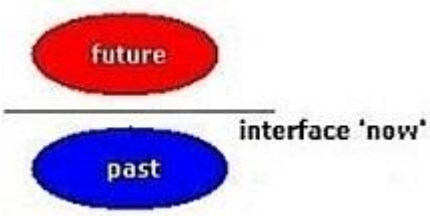

Fig. 7
Is the interface 'here-and-now' finite, zero, or 'something else'[7]?

Hence we have quantum potential reality in terms of 'the quantum state'[1], and gravitational potential reality in terms of gravitational "field". The *potential* quantum state is not *physical* observable (details from Henry Stapp[38]), because the chance to be detected is *exactly* **zero**. It is an **intact** quantum "trunk" (Sec. 6), which is neither "particle" nor "wave", does not "collapse" nor "decohere", and is not "uncertain" but *flexible*: God casts the die, not the dice (Albert Einstein). This is the only way to solve the most widely known, ever since 1911, **public secret in physics**, after Charles Wilson.

The *potential* gravitational state will be examined in Sec. 4, with examples from the so-called gravitational wave astronomy[10]. In Sec. 5, I will show the application of *potential*

reality to Mathematics, arguing that the basic metaphysical postulates in current mathematical relativity[26,27] are wrongly inferred from the seemingly "intuitive", but terribly misleading, presentation of infinitesimal "pixels" depicted in Fig. 6: complex problems have simple[11], easy-to-understand[12], **wrong answers** (Fig. 8).

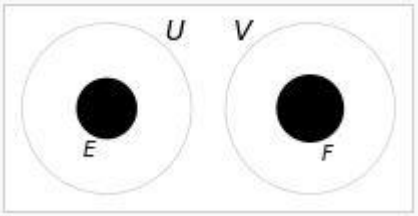

Fig. 8

Fig. 8 above, adapted from Wikipedia, shows the "intuitive" idea of 'normal space' (every paracompact Hausdorff space[11] is 'normal'), eloquently explained as follows: "The closed sets **E** and **F**, here represented by closed disks on opposite sides of the picture, are separated by their respective neighbourhoods U and V, here represented by larger, but **still disjoint**, open disks." Replace "the closed sets **E** and **F**" in Fig. 8 with any two neighboring pixels in Fig. 6, and you will obtain the same "intuitive" idea that is nothing but an *artifact* of human cognition and imagination: it is **wrong** to postulate "individualized" points **E** and **F** (Fig. 8), resembling Fig. 6, and "assume" that every point (Fig. 9) corresponds to a real number, and vice versa (Wikipedia).

Fig. 9

The real numbers (Fig. 9) correspond to *res extensa* in the irreversible **past** (Fig. 7); we need hyperimaginary numbers[3]. But first, let's focus on what we call geometry (Fig. 2).

4. What is gravitational "field"?

For reasons which I was never able to understand, people strongly insist that the genuine theory of gravity should be classical theory: gravity isn't a *force* (no "locomotive"), yet it can *accelerate* objects ***by*** sheer differential geometry[40]! If true, we have two alternatives: either the gravitational "field" is pure imagination (*Gedankending*) shown in Fig. 2, or a *physical* field, similar to electromagnetic field. Both alternatives lead to dead end[10].

Let me begin with a brief introduction. While we know that GR textbooks can explain the perihelion of Mercury and fix the GPS Navigation System, we still don't know how the gravitational energy could "cover" a *finite* spacetime region *without* being localized at a spacetime point[13]. Namely, the *physical* energy coming from 'pure geometry' (Fig. 2) can indeed produce *work* on the football (Fig. 1) in order to *tweak* its trajectory or "geodesic", but cannot be localized at *any* point from the tweaked trajectory of the football. But there can be no "non-local energy". It can only be *quasi-local*, as in the *holomovement* of fish[14]: at every consecutive *interface* here-and now (Fig. 7), every local fish is negotiating (Fig. 4) its future **next** state with the *entire* school of fish[14]. Hence every fish negotiates (Fig. 4) its *quasi-local* trajectory with the school of fish, yet the (gravitational) energy of the school of fish *en bloc* remains delocalized to "cover" a *finite* "school of fish"[13]. Thus, gravity is interpreted as *potential* reality in the potential **future** (Fig. 7), while its *physicalized* effects are placed in the **past** (that is, in the right-hand side of Einstein's field equations) where they can act as a *force*, tweaking a football (Fig. 1) or a fish[14] by producing *work*. Have our cake and eat it!

Notice also the *exchange* of energy-momentum and angular momentum between all fish bootstrapped in a school of fish[14]: it produces a *wave-like undulation*, just like in the locomotion of centipede's legs. What if quantum *and* gravitational waves are produced by similar delocalized phenomenon? Regarding the quantum waves, perhaps we have to extend Henry Margenau's latency interpretation[15] by interpreting the *latent* observables as *quantum* potential reality[9] residing in the *potential* future of the *interface* here-and-now (Fig. 7), but in such way that only one *physicalized* "shadow" (Fig. 5) enters the irreversible **past** (Fig. 7) — one-at-a-time — to become 'physical reality', **after** all *atemporal* negotiations (Fig. 4) between the potential states of all quantum "fish"[14] are completed, once-at-a-time. Thus, the quantum waves are interpreted as resulting from the *holistic dynamics* of the school of quantum "fish", without the need for any *ad hoc* "fundamental scalar field", and we may entertain the possibility that "there is a subtle crosstalk between the atomic world and the Universe in the large, which may be on the verge of being detected."[16]

But the gravitational waves (GWs) are considered *physical* waves[10], and the experts in GR insist that their theory should be *classical* theory, as stress-energy tensors can only describe non-contextual *objective* (not potential[9]) reality that must be *independent* of the "gravitational school of fish".

Well, Albert Einstein was fully aware of the problems from tensors. As he succinctly put it at his last lecture (Room 307, Palmer Physical Laboratory, Princeton University, April 14, 1954): "The representation of matter by a tensor was only a fill-in to make it possible to do something temporarily, a wooden nose in a snowman."[17] Regarding the putative "gravitational school of fish", he was tacitly warning the experts in GR that his General Theory of Relativity is far from being complete[18]:

> 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 of as yet unknown structure.

To find out why GR *cannot* be 'classical theory', let me examine its two alternatives mentioned above: either the gravitational "field" is a *physical* field capable of transporting

energy, momentum, and angular momentum (Case 1), or it is *pure* geometry, as shown in Fig. 2, due to the absence of *gravitational* stress-energy tensor[19] (Case 2). People even suggest that the gravitational field "does not exchange energy-momentum with both particles and electromagnetic field. So, it is not a force field, it does not carry energy-momentum" (Zhaoyan Wu, private communication). The proponents of Case 1, on the other hand, treat the gravitational "field" as a *physical* field, and dream of some "gravitational wave astronomy"[10]. But Case 1 and Case 2 lead to dead end. Here's why.

Case 2 requires that GWs are fictitious objects[20] that cannot transport *any* physical stuff, so if GR were *bona fide* 'classical theory', we face an insoluble problem: GR explicitly forbids any referential background spacetime, known as "aether" (Sec. 3).

To explain Case 1, consider the following experiment, depicted in Fig. 10 below.

> Imagine an empty plastic bottle on your desk, trespassed by GWs from PSR J1603-7202[21], with dimensionless amplitude $2.3\text{x}10^{-26}$, and explain the coupling of their wave strain to the plastic material of the bottle, leading to stresses[10]. How could gravitational waves produce **work** to induce stresses *and* squeeze the bottle ? Perhaps at $2.3\text{x}10^{-26}$ m ?

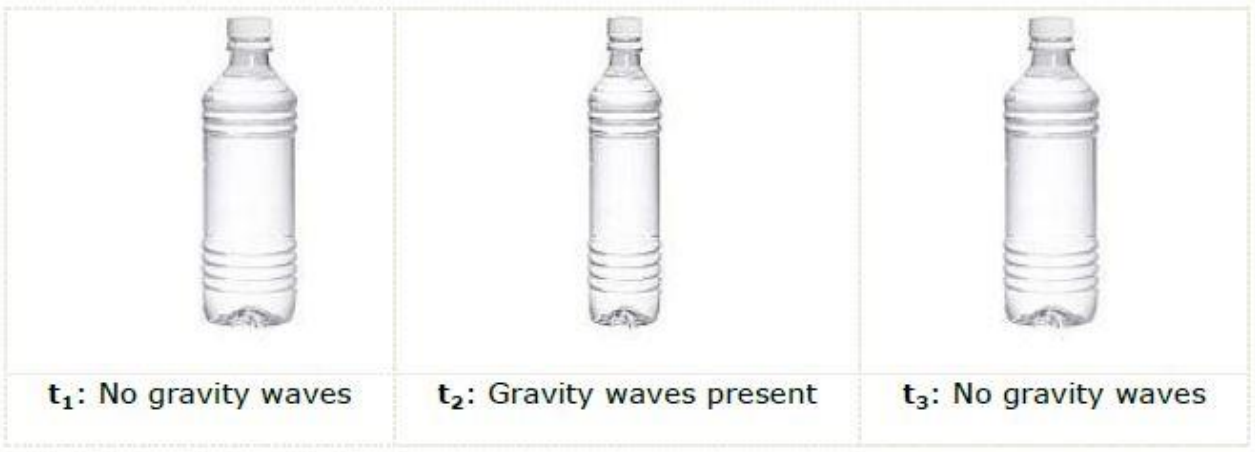

Fig. 10

Dead end, again. The situation is widely known from Quantum Theory: we know what contradictions will be reached if the wave function were physical object viz. what contradictions will be reached if it were some unphysical "imagination" or "knowledge". If we assume that the laws of Nature are *consistent*, the solution to the origin of quantum "waves" could also solve the puzzle of gravitational "waves", leading to quantum gravity. We need to unravel a new theory of gravity, starting from Einstein's "total field of as yet unknown structure", metaphorically explained as "gravitational school of fish" above.

Yes, "the gravitational field can do work on matter and vice versa" (Wikipedia), provided the gravitational "field" is *potential* reality[9,1] residing in the potential future of the *interface* here-and-now (Fig. 7). Mathematically[3], the potential reality is expected to be modeled with **two** (Sic!) opposite hyperimaginary directions of **W** (Fig. 5), positive and negative[6] (Fig. 12).

In short, the potential reality is common to both quantum-gravitational and living systems, constituting the Brain of the Universe: see Table **1** below, from RS Spacetime[1].

5. Mathematical misconceptions

There are many mathematical misconceptions in GR textbooks[11], most of which do not even make sense, like a jabberwocky. Some of them originate from pure mathematics, such as 'normal space' (Fig. 8), others from the "intuition" of physicists[22]. The first case are the misconceptions resulting from the "intuitive", and terribly misleading, *individuation* (Fig. 9) of 'points' (Fig. 8), and the second case are the misconceptions introduced by mathematical physicists 'by hand'[22]. I believe all misconceptions result from thinking only about 'physical reality' placed in the **past**, ignoring the 'potential reality' placed in the **future** (Fig. 7). Let me try to explain.

The *physical* reality, being *res extensa* (Fig. 3), conforms to Archimedes' Axiom[23] and is endowed with Archimedean topology, which can be explained as follows: if you have two timbers of different size, say, A = 3m and B = 10m, you can always find a positive integer **k**, $0 < k < \infty$, such that if you multiply the smaller A by k_l (l stands for 'large'), you will produce a timber *larger* than B, say, if $k_l = 4$, $4 \times 3 = 12 > 10$. But you can never reach some "infinitely large" timber and **stop** there. Ditto to the opposite case of "zero timber": if you multiply the larger B by k_s (s stands for 'small'), you can produce a timber *smaller* than A, say, if you choose $k_s = 4^{-1}$, the new timber will be 2.5m long ($1/4 \times 10 = 2.5$). But again, you can never reach some "infinitely small" timber and **stop** there. In this sense, the Archimedean topology is based on *potential* infinity with which one cannot *actually* reach 'infinity': the *physical* reality does not include "infinitely large" nor "infinitely small", which is why it can never **stop**. Stated differently, the *physical* reality is cast on *perfectly smooth* trajectories, and can never 'run out of points' and **stop** due to some mythical "conformal completion"[12] (details on the proposals by Penrose & Norris are available upon request).

On the other hand, the (ε, δ)-definition of limit uses actual/completed infinity (Georg Cantor, 28 February 1886). An explanation from a bartender runs as follows (Fig. 11):

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

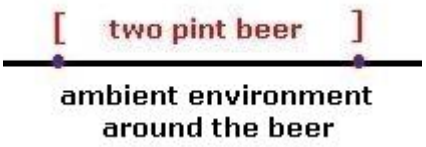

Fig. 11

Look at the two **red** endpoints in Fig. 11: do they belong to the largest beer *or* to the ambient environment around the beer? **Wrong question**. It cannot have an answer, because it is manifestly **wrong** to even think about 'points' as *individuated* objects (Fig. 9 and Fig. 8) and then "associate" real numbers with them: real numbers pertain only to 'physical reality' in the **past**, while "that which has no part" (Euclid) belongs to the potential **future** (Fig. 7). Hence we may need hyperimaginary numbers[3] to describe the dynamic *phase*[36] of quantum-gravitational "waves" (Fig. 12). Surely we **always** have *physicalized* "shadows" (Fig. 5) placed in the irreversible **past** (Fig. 7) at which the potential **future** is *already* non-existing, like Macavity[35], which is why we cannot "look" at

it, as Plato suggested many centuries ago. But without it, we cannot explain the *quantum* potential reality[9] and the *gravitational* potential reality[13] (Sec. 4). They do not have 'parts' and build up the Universe as ONE, as exhibited in science[2].

6. Physical theology

To elaborate on what was said in Sec. 1, let me stress that physical theology is *not* religion and can never become one. It offers an *interpretation* of Nature based on the doctrine of *trialism*: ONE entity explicated by its two complementary, and ontologically different, presentations delivered in science and in theology[2], and all *three* elements are needed to understand Nature as ONE. Or rather to get a bit *closer* to understanding the ONE. Stated differently, physical theology only offers an *interpretation* of Nature as ONE, which can be beneficial to people. Let me explain.

Imagine an Eskimo, who has never seen and will never see an elephant in his life, yet can make observations on elephant's trunk by two complementary devices, which can measure either properties of 'arm' or properties of 'nose'. The Eskimo can never understand the underlying ONE entity called 'trunk', because he cannot, not even in principle, find any similarities shared by the two *complementary* explications of 'trunk', 'arm' and 'nose' — they are *totally* different, like quantum particle and quantum wave, or like science and theology. Yet they are both needed[2] to get a bit "closer" to understanding their dual, and in general incomprehensible, non-relational source dubbed 'the ONE' or simply 'Nature'.

We strive to understand Nature juts like Eskimos, and should be aware that, in the framework of theology, God is first and foremost 'love': Whoever does not love does not know God, because God is love (1 John 4:8). In the framework of science, it (not "He") is placed at 'absolute infinity' (Georg Cantor), exactly "between" the **past** and the **future** (Fig. 7). Hence if we want to understand the physical world *and* improve our life, we should keep a parallel connection to God as Love (John 13:34). We are both flesh and soul. It's a package. Hence it is counterproductive, to say the least, to ignore God as Love and create 'sins', as Jesus explained (Matthew 1:21). It makes no sense to hurt our personal life and make it *miserable*. If our soul is overwhelmed with such self-inflicted problems created with our *free will*, the next time we show up in another body[34] we may wind up in a terrible situation, which **we** — no one else — stupidly *created* upon ourselves. This is the Salvation (Luke 2:11), in purely pragmatic terms. Take it or leave it. You decide, with your *free will*, which is a gift from God.

In science, the *theological* interpretation of God as Creator, being both immanent (inside us, Luke 17:21) and transcendental (outside us, John 1:1), is presented as Aristotelian Unmoved Mover endowed with **self-action**, exhibited in global cosmic time, as read with a clock (Fig. 6): *Der Geist bewegt die Materie* (Mens agitat molem, Virgil, *The Aeneid*, VI, 727). Only it (not "He") is not *Geist* but 'the Universe as ONE', being *both* "inside" the interface 'here and now' (Fig. 7) *and* "outside" it. In theology, we interpret 'the Universe as ONE' as Love (1 John 4:8). But in both cases, physics and theology[2], we face *the same* phenomenon, like an Eskimo. It's a *dual* package. The so-called "dark energy"[8] comes from the *self-action* of the Universe as ONE (Sec. 3), not from Love: the difference between an 'arm' (theology) and 'nose' (science) is beyond doubt, yet they spring from their common, and in general incomprehensible, source, called simply 'Nature'.

In short, we all are children of Nature, Jesus Christ included, only he was far "closer" to God. Hence Jesus could very well fall in love, as there could be no "ban" on love, because it is from God (1 John 4:8). Back in the old days, Jesus had to use simple metaphors and

parables to deliver the message about God, in such way that even fishermen with no education can understand it. These were his limitations: the audience knew nothing about quantum gravity and foundations of Mathematics. Nowadays we can start from physical theology[2] — it is far more straightforward, and despite the fact that physical theology employs only a tiny fraction from The Gospel, the end result is *effectively* the same, in my humble opinion. The crucial difference between physical theology[2] and religion is that the former does not offer a choice between an 'arm' and a 'nose', which would require *faith* with opposite signs, either theism or anti-theism. In my opinion, there is no room for faith in physical theology. We cannot be "agnostic" either, because we actually *know* that we are Eskimos made of flesh-and-soul. Surely we cannot *understand* "that which has no part" (Euclid), but we all will learn the answer, sooner or later[34] (better later!).

7. Summary

Let me repeat the main ideas. Ensuing from Plato's proposal (Fig. 5), I suggest that *the* spacetime of 'the Universe as ONE' has two *modes*, called local (physical) and global, pertaining to physical reality and potential reality. The Universe as ONE is assumed to possess *self-acting* faculty exhibited in consecutive **re**-creation of its spacetime (dubbed 'Arrow of Space'[1]), leading to *assembled* 4D world of *physicalized* Platonic "shadows" placed in the irreversible **past** of the interface 'here and now' (Fig. 7). To explain an instantaneous "snapshot" from the hypothetical Arrow of Space, I will ask the reader to imagine a transcendent (or transient) tachyon[24], which is *omnipresent*, in the sense that it trespasses the entire local (physical) mode of spacetime for "zero" time, as read with a physical clock. Relative to the *local* mode of spacetime, the transcendent tachyon will have "infinite" speed and will be *simultaneously* "located" absolutely everywhere (Luke 17:21) and at 'absolute infinity' (Georg Cantor) depicted with the horizontal line in Fig. 7. The *assembling* of spacetime proceeds along the atemporal axis **W** (Fig. 5): a null surface "located" on the light cone, inhabited by the transcendent tachyon as well. The **re**-creation and **re**-foliation[25] of *the* spacetime — once-at-a-time, as read with a clock — "takes place" at null surfaces along the atemporal axis **W** (Fig. 5), which is why there is no *metric* there. The latter *emerges* only within the *assembled* null surfaces, generating **four** topological dimensions of the *local* mode of spacetime (4D spacetime), like "pages of a book"[25].

Notice that we introduce geodesic-generated **null-surface** (not hypersurface[26]) and *physically* unobservable time[30] "along" null vector "orthogonal to *itself!*"[31], which pertain to an *atemporal*[39] and **self-acting** (see above) cosmological fluid dubbed 'causal field'[1]. The latter is parameterized with hyperimaginary "directions" along the atemporal axis **W** (Fig. 5), depicted with hyperimaginary *wave amplitudes* **+w** and **-w** in Fig. 12. Given the modulus of hyperimaginary wave amplitude $|\mathbf{w}|$, four types of causal field effects can be expected:

Case **I**: $|\mathbf{w}| \rightarrow \mathbf{0}$, classical physics
Case **II**: $\mathbf{0} < |\mathbf{w}| < \infty$, quantum gravity and life sciences
Case **III**: $|\mathbf{w}| \rightarrow \infty$, hyper physics (?)
Case **IV**: $|\mathbf{w}| \equiv \mathbf{0} \equiv \infty$, physical theology[2]. At the interface 'here and now' (Fig. 7), we pass through God (Luke 17:21) at absolute infinity (Fig. 12)

Table **1**

NB: Unlike in Quantum Theory, $|\mathbf{w}|^2 = \mathbf{0}$, which requires hyperimaginary numbers[3].

Notice in Table **1** that Case **III** is reciprocal to Case **I**. To use again the school of fish analogy (Sec. 4), in Case **III** every quantum-gravitational "fish" will be maximally *flexible*, being effectively entirely determined by the "school of fish". This is the *last* layer of the Brain of the Universe, which is fused with God (1 John 4:8) at *absolute* infinity depicted with the horizontal lines in Fig. 7 and Fig. 12.

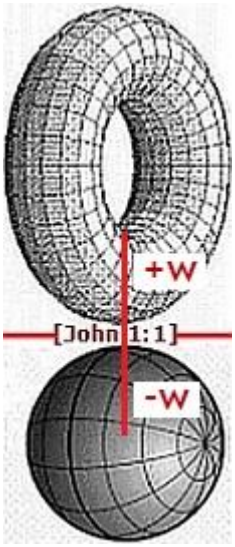

Fig. 12

In brief, the *topology* of spacetime obtains new dynamics (dubbed 'biocausality'[29]), exhibited in the so-called Arrow of Space[1]. The latter is both *completely* **re**-nullified in the irreversible **past** *and* **re**-born in the **next** potential future, at each and every *interface* here-and-now (Fig. 7). It is like climbing on a ladder, in the sense that at every *completed* step shifted in the **past**, there also is a new *potential* future (step) ahead, which will be negotiated with the entire 'school of fish' (Sec. 4) for the **next** *infinitesimal* step of the ladder, generating a *finite* interval[1] in Minkowski spacetime. Thanks to Plato's proposal (Fig. 5), the negotiation (Fig. 4) is *atemporal*, and the **re**-created *local* mode of spacetime is *perfect* continuum[32]. It is like taking snapshots of a dark room with a flashlight, and then assembling the *colored* (physicalized) images (Fig. 6) to produce a *perfect* continuum[32] without any *colorless* ("dark"[8]) room[35].

Again, one can postulate Lorentzian metric[26] and relativistic causality[22] only within the assembled 4D spacetime. In my opinion, this is the only way to present geometry as *emerging* from 'something else'[7], because the alleged "local differential geometry"[27] is false — complex problems have simple[11], easy-to-understand[12], **wrong answers**. We need Finite Infinity and *dual age* of spacetime: once created (John 1:1), it is *already* eternal, because infinitely many things have already happened since The Beginning and infinitely many things will happen until The End (Fig. 8 and Sec. **5** in RS spacetime[1]).

If you, my dear reader, feel "lost on the second page" (see Sec. 1), please keep in mind that it may be impossible to *understand* the new 'atom of geometry', as depicted in Fig. 7.

Our "intuition" will stubbornly reject the very possibility that we have to somehow "fuse" the potential and actual infinity: the *interface* 'here-and-now' is *both* completed and fixed in the **past**, *and* 'open' for the **next** potential future. It is a *dual* package endowed with **self-action**. It cannot be understood by Eskimos, like you and me (Sec. 6). It shows the fundamental *smoothness* of spacetime *manifold*: the infinitesimal displacement in 4D spacetime matches the "thickness" of the horizontal lines in Fig. 7 and Fig. 12. It is neither "zero" nor "finite", but 'something else'[7], which is explicated in science as 'the Universe as ONE', and in theology as God (1 John 4:8), as explained in Sec. 6.

In theology, the *complementary* explication of Nature as God (or 'arm', see Sec. 6) may be interpreted as the *source* of the psyche and soul, intertwined with all psychological and spiritual elements of our life, and endowing the Universe as ONE (or 'nose', see Sec. 6) with **self-acting activity**. In quantum gravity and life sciences, the *complementary* explication of Nature as the Universe as ONE (or 'nose', see again Sec. 6) has *potential* future (Fig. 7) inhabited by *potential* reality[9] capable of bootstrapping its quantum-gravitational and biological "fish" (Sec. 4); hence we model the Universe as ONE as 'the Brain of the Universe'. Since the phenomenon of qualia pertains only to living organisms at macroscopic length scale, we cannot verify with experiment or observation whether the last layer of the Brain of the Universe (Case **III** in Table **1** above) has qualia-related nature as well, presented in theology as Universal Mind and The Holy Trinity. But again, we all will learn the answer, sooner or later[34] (better later!).

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References and Notes[2]

1. D. Chakalov, Potential Reality I: Relative Scale Spacetime, viXra:1410.0194 [vD].

2. To paraphrase Albert Einstein, science without theology is lame, theology without science is blind.

3. D. Chakalov, Hyperimaginary Numbers. Manuscript in preparation, available by Christmas 2018.

4. Charles W. Misner, Kip S. Thorne, John A. Wheeler, *Gravitation*, W. H. Freeman, 1973; excerpt from p. 5 at this http URL.

5. Lewis Carroll, *Alice's Adventures in Wonderland*, Macmillan, 1865, Ch. 6 available at this http URL.

6. Paul Steinhardt explains energy conservation, 17-03-2011. https://www.youtube.com/watch?v=tjmNW3mlisE

[2] All comments and emphases in the references and notes are mine - D.C., February 4, 2016.

7. C.J. Isham, J. Butterfield, On the Emergence of Time in Quantum Gravity, arXiv:gr-qc/9901024v1, p. 25: “Space and time are such crucial categories for thinking about, and describing, the empirical world, that it is bound to be ferociously difficult to understand their emerging, or even some aspects of them emerging, from ‘something else’.”

8. M. P. Hobson, G. P. Efstathiou, A. N. Lasenby, *General Relativity: An Introduction for Physicists*, Cambridge University Press, 2006, see p. 187 at this http URL.

9. Werner Heisenberg (winter 1955-1956), *Physics and Philosophy: The Revolution in Modern Science*, Prometheus Books, 1999, cf. p. 43 and pp. 155-156 at this http URL.

10. D. Chakalov, Gravitational Wave Astronomy: **RIP**. Manuscript in preparation; abstract available at this http URL.

11. Robert M. Wald, *General Relativity*, University of Chicago Press, 1984, pp. 7-8, p. 12 (“we shall consider (…) only manifolds which are Hausdorff and paracompact”).

12. Roger Penrose, Conformal Treatment of Infinity. In: *Relativity, Groups and Topology*, Vol. 1, Ed. by B. DeWitt and C. DeWitt, Gordon and Breach, 1964, pp. 565-584; see the “definition” of the boundary *exactly* at Ω = 0 on p. 565 at this http URL.

13. László B. Szabados, Quasi-Local Energy-Momentum and Angular Momentum in General Relativity (revised on 7 December 2012), *Living Rev. Relativity* 12 (2009), 4; excerpt from p. 31 at this http URL.

14. D. Chakalov, Holomovement of Fish, 14-12-2015.
https://www.youtube.com/watch?v=0YDqxC9fzT4

15. Henry Margenau, Advantages and disadvantages of various interpretations of the quantum theory, *Physics Today* 7(10), 6-13 (1954); p. 10 available at this http URL.

16. Joan Solà, Running Vacuum in the Universe: Current phenomenological status, arXiv:1601.01668v2 [gr-qc], p. 8.

17. John A. Wheeler, Mercer Street and Other Memories, in *Albert Einstein: His Influence on Physics, Philosophy and Politics*, ed. by Peter C. Aichelburg and Roman U. Sexl, Friedrich Vieweg & Sohn, Braunschweig, 1979, p. 209.

18. *Albert Einstein, Philosopher-Scientist*, ed. by Paul A. Schilpp, Tudor Publishing Company, New York, 1951, p. 75. See also: A. Einstein, Dialog über Einwände gegen die Relativitätstheorie, *Naturwissenschaften*, **6**(48), 697-702 (29. November 1918), S. 700: “Man kann deshalb weder sagen, das Gravitationsfeld an einer Stelle sei etwas Reales, noch es sei etwas bloß Fiktives.“ (...) „dem Gravitationsfeld an einer Stelle entspricht also noch nichts physikalisch Reales, wohl aber diesem Gravitationsfelde in Verbindung mit anderen Daten.“ (“One can say that the gravitational field at a point is neither real nor merely fictitious.” (...) “nothing *physically real* corresponds to the gravitational field at a point, only to the gravitational field in conjunction with other data (Sic! – D.C.).” Translated by A. Afriat and E. Caccese, arXiv:0804.3146v7.)

19. Erik Curiel, On Tensorial Concomitants and the Non-Existence of a Gravitational Stress-Energy Tensor, arXiv:0908.3322v3 [gr-qc].

20. Angelo Loinger, On the displacements of Einsteinian fields *et cetera*, physics/0506024v2, p. 2: “No “mechanism” exists in GR, which is capable of producing GW’s. In other terms, if we displace a mass, its gravitational field and the related curvature of the interested manifold *displace themselves along with the mass*.”

21. LIGO Scientific Collaboration and Virgo Collaboration, Searches for gravitational waves from known pulsars with S5 LIGO data, arXiv:0909.3583v4 [astro-ph.HE].

22. Piotr T. Chrusciel, *Lectures on Energy in General Relativity*, February 22, 2013 (retrieved on 27 August 2015 from this http URL), Sec. A19, p. 247 at this http URL. More mathematical jabberwockies in Fig. 8 and at http URLs here, here, and here.

23. Elemer Rosinger, Special Relativity in Reduced Power Algebras, arXiv:0903.0296v2, see pp. 5-6 at this http URL.

24. Erasmo Recami, Classical Tachyons and Possible Applications, *La Rivista del Nuovo Cimento*, **9**(6) 1-178 (1986).

25. Vladimir Rovenski, *Foliations on Riemannian Manifolds and Submanifolds*, Birkhäuser, Boston, 1998, p. 1; excerpt at this http URL.

26. David B. Malament, *Topics in the Foundations of General Relativity and Newtonian Gravitation Theory*, The University of Chicago Press, 2012, pp. 162-163 and p. 252; excerpts at this http URL.

27. Robert Geroch, *Differential Geometry*, 1972 Lecture Notes, Minkowski Institute Press, Montreal, 2013, p. 105; excerpt at this http URL.

28. George F R Ellis, Physics in the Real Universe: Time and Spacetime, arXiv:gr-qc/0605049v5, see Fig. 4 at this http URL. Robert Geroch, *General Relativity from A to B*, University of Chicago Press, 1978, p. 18: “There is no dynamics within space-time itself: nothing ever moves therein; nothing happens; nothing changes.”

29. D. Chakalov, How To Bind Mind To Matter? Unpublished manuscript, January 1990. Abstract and explanatory note available at this http URL.

30. Karel V. Kuchar, Time and interpretations of quantum gravity, in: *Proceedings of Fourth Canadian Conference on General Relativity and Relativistic Astrophysics*, May 16-18, 1991. World Scientific, Singapore, 1992, pp. 211-314: “In general relativity, dynamics is entirely generated by constraints. The dynamical data do not explicitly include a time variable.” See also: Carlo Rovelli, *Quantum Gravity*, Cambridge University Press, 2004, p. 84; excerpt at this http URL.

31. James Hartle, *Gravity: An Introduction to Einstein’s General Relativity*, Addison-Wesley, 2003, cf. p. 162 at this http URL. Piotr T. Chrusciel, Lectures on Energy in General Relativity, February 22, 2013 (retrieved on 27 August 2015 from this http URL), cf. p. 226 at this http URL. Bernard Schutz, *A First Course in General Relativity*, Cambridge University Press, 2nd ed., 2009, p. 45: “An extreme example is the null vector, which is orthogonal to *itself!*”

32. Karel Hrbacek, Thomas J. Jech, *Introduction to Set Theory*, 3rd ed., Marcel Dekker, Basel, 1999, p. 269; excerpt at this http URL.

33. E. M. Howard, Causal Stability Conditions for General Relativistic Spacetimes, arXiv:1601.05609v1 [gr-qc], p. 263.

34. A man has a dream that he is traveling in a train, having no recollection how he winded up there and why. The train goes on forever, at some point it stops, some of the people around him get off, new people get in, and the train continues. The man has no idea what is the meaning of this whole train, where it goes, and why. At one point, the train again makes a stop, new people get in, but this time the man knows that this is *his* home station and he should take off, which he does. At this moment he awakes and says, 'what a stupid dream, it makes no sense whatsoever!'

35. To explain the dark room metaphor above, I will refer to the so-called energy conditions. Recall that the matter density is always non-negative (negative and imaginary mass are not *physically* detectable), but we "have no hope of ruling out objectionable global features" (Wikipedia), such as the perpetual and *unlimited* influx of positive matter density (Paul Steinhardt[6]). The situation resembles the invisible cat Macavity (T. S. Eliot), in the sense that every time the chained observers (Fig. 5) look at Macavity, he has *already* (Sic!) disappeared. As Adam Helfer put it (Are Negative Energy Densities Detectable? arXiv:gr-qc/9709047v1, p. 1), "The energy in a region, plus the energy of a device which detects it, must be non-negative. Indeed, as far as has been checked, the total four-momentum density, of the field plus the observing device, must be **future-pointing**. In consequence the semi-classical Einstein equation can at best describe negative energy-density effects only as long as no observers are present to test it: Macavity, Macavity... he breaks the law of gravity".

36. Chen Ning Yang, Square root of minus one, complex phases and Erwin Schrödinger, in *Schrödinger: Centenary Celebration of a Polymath*, ed. by Clive W. Kilmister, Cambridge University Press, 1987, Ch. 5 (available at this http URL), p. 61: "all fundamental forces are phase fields."

37. Hyun Seok Yang, Towards A Background Independent Quantum Gravity, arXiv:1111.0015v3 [hep-th], p. 2: "That is, the (flat) spacetime behaves like a metrical elasticity which opposes the curving of space. But this picture rather exhibits a puzzling nature of flat spacetime because the flat spacetime should be a completely empty space without any kind of energy as we remarked above. How is it possible for an empty space of nothing to behave like an elastic body with tension ?"

38. Excerpt from the Interview with Henry Stapp, Science and Nonduality Anthology DVD, 2-2-2010, https://www.youtube.com/watch?v=WFkaGlrBJR8

39. Arlen Anderson, Generalized Einstein theory with fundamental cosmological stress tensor, arXiv:gr-qc/9902027v1; excerpt from p. 2 at this http URL.

40. Regarding Sec. 4, check out Jolyon Bloomfield, If gravity isn't a force, how does it accelerate objects? Advanced online article, June 27, 2015, available at this http URL; excerpt at this http URL (emphasis mine – D.C.). Recall also that, in astronomy, all objects "are stationary and all the space around them is being stretched out" (Mike Jones).