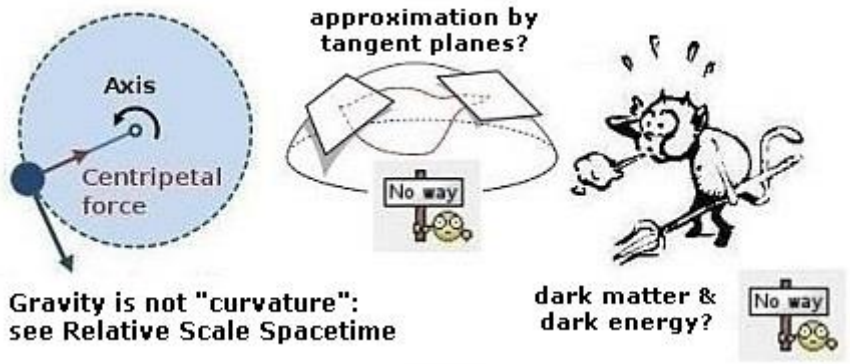
Matter is "coupled" with itself by self-action, producing gravitational "field".



The Spacetime

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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. What is 'spacetime point'?

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 introductory paper* 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.

To answer the question posed above, let me stress that in RS Spacetime[1] the metaphysical axioms about the atom of geometry, dubbed by Euclid "that wish has no part" and vaguely described as "0-dimensional mathematical object" (Wolfram), are replaced by entirely different metaphysical axioms (Sec. 8), endowing the spacetime point or 'atom of geometry' with internal structure and intrinsic topology (Fig. 7). Every spacetime point belongs to two *ontologically* different forms of reality: *physical* reality possessing Archimedean topology and governed by *potential* infinity (local mode of spacetime, marked with **blue** in Fig. 7), and Platonic (see below) *potential* reality, which does not possess Archimedean topology and is governed by *actual* infinity (global mode of spacetime, marked with **red** in Fig. 7). From the perspective of *physical* reality, the non-Archimedean *potential* reality will look like a Platonic object (dubbed 'the Universe as ONE') placed *both* at "zero" *and* at "infinity" (cf. Sec. 5 and Eq. 1). It (not "He") does not have metric (Fig. 19) and acts as a cutoff and limit/endpoint (Fig. 11) to the *finite* (neither zero nor infinite) Archimedean *physical* reality placed in the **past** (Fig. 7). It is placed in the **future** (Fig. 7) and stores "the Ghosts of departed Quantities" (George Berkeley). Just like Eliot's cat Macavity[35], it does *not* exist as physical reality[54].

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

The theory of spacetime presented here is based on Plato's Cave (Fig. 5), Aristotle's Unmoved Mover ('that which moves without being moved') endowed with self-action, and on Heraclitus' river metaphor: you could not step twice into the same river (Fig. 17). It is suggested that the physicalized "shadows" on Plato's cave (Fig. 5) are made of geometrical points ("that wish has no part", Euclid), which possess Heraclitean dynamics by exhibiting an irreversible *flow* of events, known as 'passage of time'. The latter has two topological degrees of freedom: along the projective plane of "shadows" (the vertical wall in Plato's cave), and along the orthogonal axis of their 'light source', denoted with **W** (Fig. 5). To incorporate these two topological degrees of freedom into the geometrical points constituting the "shadows", I suggest specific structure and topology of every geometrical point: it has a *physicalized* "shadow" that belongs to the irreversible **past** (cast on the projective plane of Plato's wall), as well as a Platonic source along the orthogonal axis **W** (Fig. 5), which belongs to the potential **future** (Fig. 7). Physically, the Heraclitean 'flow of events' has only two time-symmetric *remnants* cast in the **past** (Fig. 7), dubbed "precisely two components"[22] of every spacetime point/event, but these non-dynamic *remnants* contain no trace whatsoever from their 'light source' along the axis **W**: the entire physical world is made of "shadows" that are "chained" to face the wall, so we cannot turn around and look at the 'light source' along **W**, projecting physicalizable Platonic "shadows" (Fig. 5). Stated differently, the "shadows" are not linked to their 'light source' along **W** (Fig. 5), because at every consecutive "shadow" the light source is being *completely* **re**-nullified and hence would look totally "dark", as explained in the example with taking snapshots from a dark room below. Thus, the fundamental ***asymmetry*** of the flow of events, producing the passage of time, and its two components (along the projective plane on Plato's wall *and* along the orthogonal axis **W** in Fig. 5) are being perpetually **re**-nullified — once-at-a-time — and we **cannot** detect them in our *physicalized* world. If we could detect Aristotle's Unmoved Mover *with respect to which* we could define 'time'[7,30], we would gain *physical* access to an omnipresent absolute object (the river banks at *absolute* rest, after Heraclitus) endowed with Aristotelian self-action, and the theory of relativity will be demolished. We can only postulate two time-symmetric *remnants* (see above) from the flow of events, cast in the **past** (Fig. 7), without being able to detect their Platonic origin along the axis **W** in Fig. 5. Which is why some physicists believe that the spacetime were ontologically "timeless"[28]. Huge error[30].

Also, I reject the idea of spacetime as some *collection* (Fig. 6) of dead frozen[28] 4D points, called 'events' and separated by "dark strips" (Fig. 17), and suggest an entirely new kind of "separation" of these points by their **re**-**nullified** 'potential reality' (Fig. 7). We cannot even imagine a *collection* of "points" (Fig. 6) to speculate about their "curvature"[37] (Fig. 15) and "transportable" tangent planes[11]. We can only examine one 'atom of geometry' (Fig. 7) as an instantaneous "snapshot" of the axis **W** (Fig. 5), from which the topological dimensions (three spatial and one temporal) of the so-called local (shadows') *mode* of spacetime are being **re**-**assembled** along Plato's axis **W** — once-at-a-time. In short, I propose that 'the spacetime' has **dual topology**, which refers to *both* finite objects the **past** (Fig. 7) *and* "open" spacetime (Fig. 12) for brand new events (Fig. 17) in the **future** (Fig. 7). I also suggest that the **re**-**nullified** — once-at-a-time — axis **W** (Fig. 5) has an *infinitesimal* physical footprint only on the physicalized 4D "shadows" placed in the **past** (Fig. 7), while the effects of 'potential reality' (placed in the **future**, Fig. 7) can be parameterized with opposite hyperimaginary[3] components along the axis **W** (Fig. 5), explained in Table **1** below. The new type of *retarded* causality (dubbed 'biocausality'[29]) is relativistic causality, because there are no "backward in time" tachyonic[24] gaps (resembling the gaps in a movie reel, Fig. 17) in the **re**-**assembled** local mode of spacetime: Aristotle's Final Cause is 'potential reality' inhabiting the potential **future**, not the irreversible **past** (Fig. 7). The case in which the effect from the potential **future** is effectively absent corresponds to the inanimate world of tables and chairs (not the brain) shown as Case **I** in Table **1** below. Mathematical details are provided in Sec. 5.

Historically, the theory of spacetime has been evolving in three stages. The first, and most obvious, effort was undertaken by Gunnar Nordström in 1912[42], who later dropped his idea and suggested "extra" dimensions to explore scalar theories of gravity. Albert Einstein[18] took another route by suggesting a *tensor* theory of gravity, and sharply stressed that his theory is still a work in progress. The third stage toward the theory of gravity and its wave-like 'news field' is presented in Sec. **4** below. As Angelo Loinger pointed out, "All the solutions of the Einsteinian field equations having an undulatory character do not describe physical waves"[43]. The quantum "waves" are not physical either, therefore we need to describe their common origin, and of course reject the current gravitational-wave (GW) "detectors"[10]. Needless to say, our RS Spacetime[1] (see below) is also a work in progress[3]: read Max Planck here.

In 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 elaborate on the detailed proposal about the *origin* of gravity in RS spacetime[1] (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 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 'totality of all beings', known in philosophy as Monad (we call it 'Nature'), is their common denominator, *sit venia verbo*. In the framework of physical theology[2], science and theology are considered *complementary* approaches to 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' is explicated by 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 (Sic!) explications of Nature are in fact complementary, and will look to us 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[34] 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 we can overcome 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 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. Besides, our free will is also a 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).

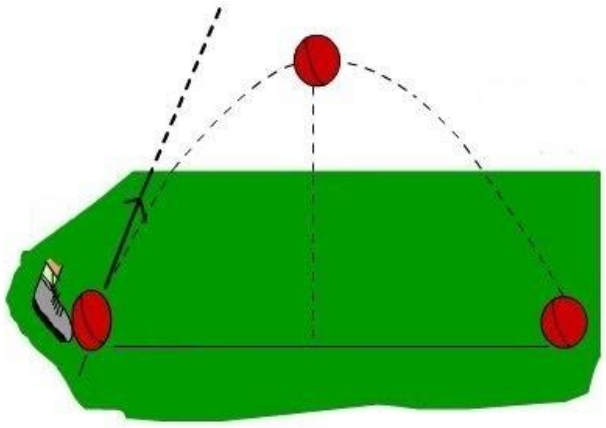


Fig. 1. Projective motion, adapted from Physics Tutorials

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).

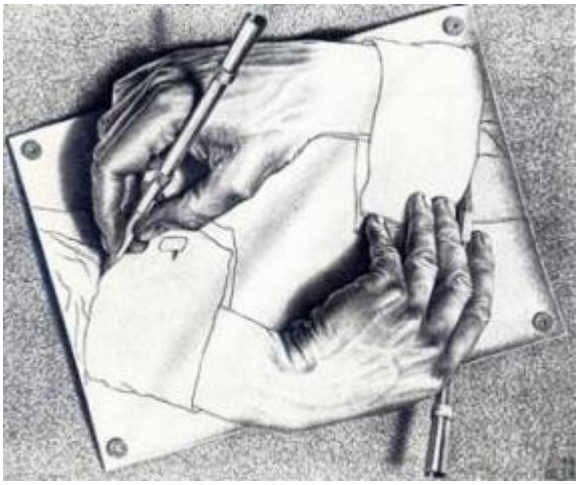


Fig. 4

Two questions. Q1: Which "hand" goes first? Matter (Fig. 3) or 'pure' 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*[38]. 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. Also, it can solve many fundamental problems (see below).

Imagine a **red flower**, a **blue flower**, and a **green flower**.
They are physicalized "shadows" emanating from the *colorless*
Platonic flower below. Physically, it has *already* disappeared[35].

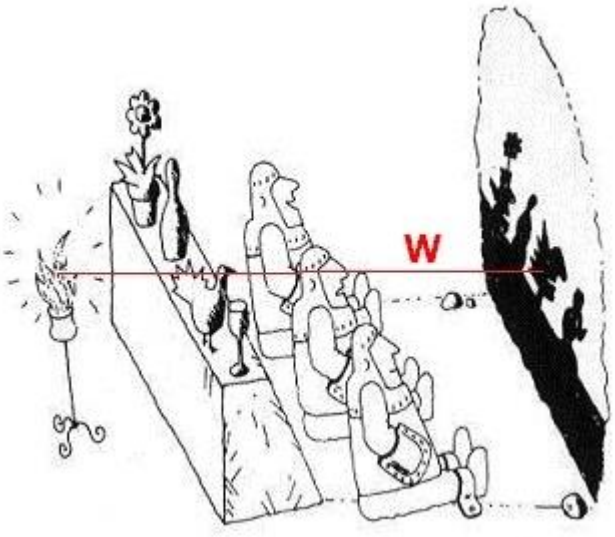


Fig. 5, adapted from on Plato's Cave

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 in some sense "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).

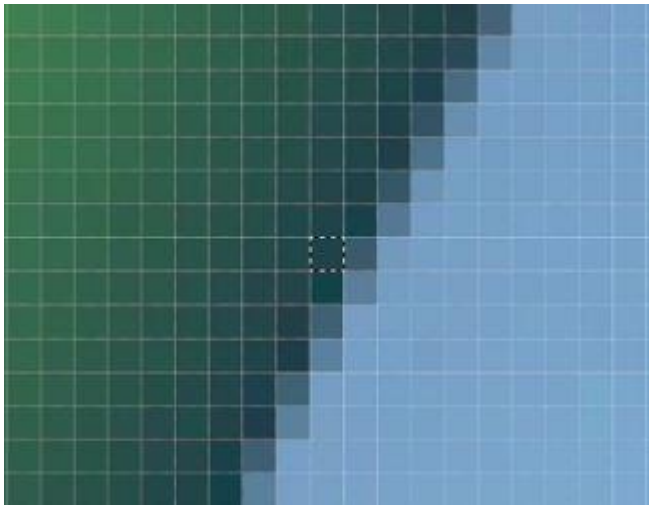


Fig. 6

Is the size of a pixel (or 'point', Fig. 1) finite (Eq. 1), zero, or 'something else'[7]?

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 **interact with itself** (Fig. 4), but will never *expose* its self-action, hence many academic scholars will consider the *observable* result "dark"[35], as if it comes 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. 4 and 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. 12.2) 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"[8] (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).

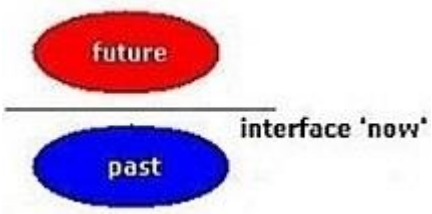


Fig. 7

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; original below).

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).

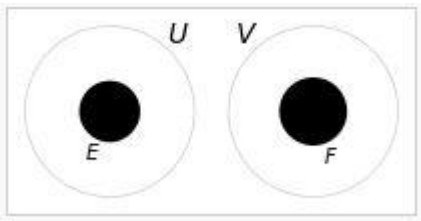


Fig. 8

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, which contributes to some "general 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 energy coming supposedly from 'pure geometry' (Fig. 2) must produce *work* on the football (Fig. 1) 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 quasi-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] (see p. 4 in ref. [10]). Thus, gravity is interpreted as *potential* reality in the potential **future** (Fig. 7), while its *physicalized* effects are placed in the **past** (currently, 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*. The fish are <u>not</u> acted by gravity. They act on *themselves* by **self-action**.

Notice also the *exchange* of energy-momentum and angular momentum between all fish bootstrapped in a school of fish[14]: this is the gravitational 'news field' residing in the potential **future** (Fig. 7). It continuously updates all fish about the *upcoming* changes of their **next** physicalized state, which will be negotiated (Fig. 4) within the entire school of fish. It operates in the *global* reference frame[38] of the "distant stars" (Ernst Mach), in which the stars are <u>not</u> moving (Fig. 13). It has two roles: (**i**) static, to fix the *inertia* (Sic!) of every quasi-local fish *without* acting on it as a physical field, and (**ii**) dynamic, to communicate all

upcoming gravitational "news" to the entire school of fish by wave-like undulations (resembling the locomotion of centipede's legs), known as GWs[10].

What if quantum and gravitational waves are produced by a common quantum-gravitational 'news field' (dubbed here causal field), or "a total field of as yet unknown structure" (Einstein)? 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 still considered *physical* waves[10], and the alleged experts in GR insist that their theory should be *classical* theory, although stress-energy tensors can only describe non-contextual *objective* (not potential[9]) reality that must be *independent* from 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 alleged 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 2.3×10^{-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 $2.3x10^{-26}$ m ?

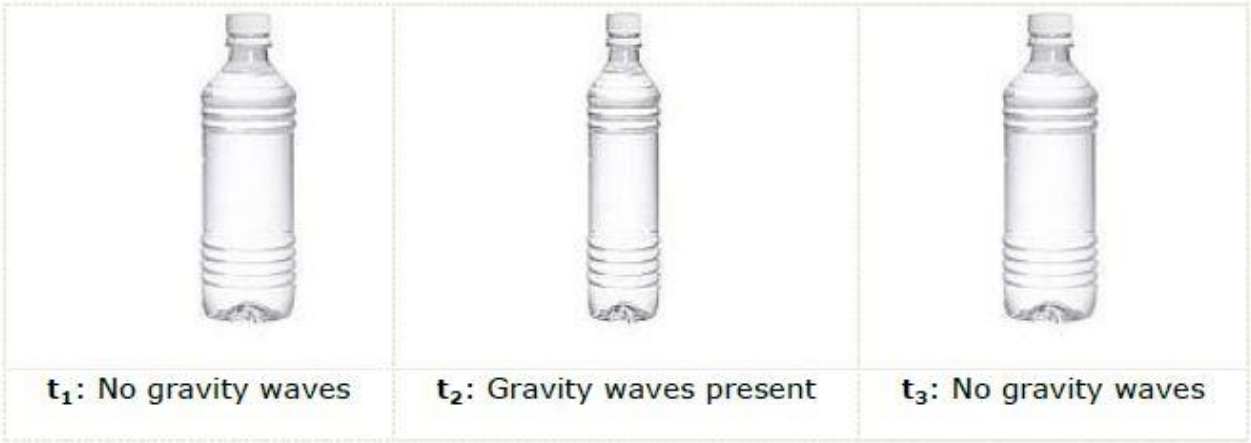


Fig. 10

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], presented with hyperimaginary wave *amplitudes*, **+w** and **-w** (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). The problems are very old: recall the issues with "fluxions" (Macavity[35]) and check out Fig. 19.

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'), $k_s = k_l^{-1}$, 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 (*actual* infinity) 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.

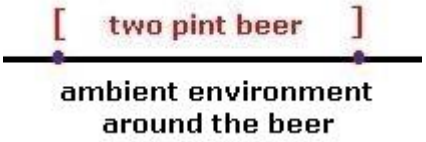


Fig. 11

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): the *potential* reality does not conform to the Archimedean topology, because it does not have ‘parts’. It is simply ‘the Universe as ONE’, as exhibited in science[2].

6. Physical theology

To elaborate on what was said in Sec. 1 (details below), 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 also 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: *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 (1 John 4:8): 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. Outline of the theory

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 perpetual **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) — "before the light" — 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 quasi-flat spacetime, see below), like "pages of a book"[25].

Notice that we introduce geodesic-generated **null-surface** (not hypersurface[26]) and *physically* unobservable time[30,35] along null vector "orthogonal to *itself!*"[31], which pertain to an *atemporal*[38,39] and **self-acting** (see above) cosmological fluid dubbed 'causal field'[1]. The latter is parameterized with opposite hyperimaginary "directions" along the atemporal axis **W** (Fig. 5), depicted with hyperimaginary *wave amplitudes* **+w** and **-w** (not scaled) in Fig. 12.2. These hyperimaginary topological waves are subject to intense investigation[3], and I expect to demonstrate that their amplitudes **+w** and **-w** (Fig. 12.2) are responsible for *rescaling* of the spacetime metric of RS Spacetime[1], leading to relative-scale "inflating" (**-w**) and "shrinking" (**+w**) of the *metric* of the local (physical) mode of spacetime[40]. Given the modulus of hyperimaginary wave amplitude $|\mathbf{w}|$, we can expect particular causal field effects, originating from the *global* mode of spacetime:

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, $|\mathbf{w}|^2 = \mathbf{0}$ in the *local* mode of spacetime: see Eq. **3** in RS Spacetime[1]. That is, the 'light source' (Fig. 5) is *physically* absent (Sec. 1).

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 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 (Georg Cantor) depicted with the horizontal lines in Fig. 7, Fig. 12.1, and Fig. 12.2.

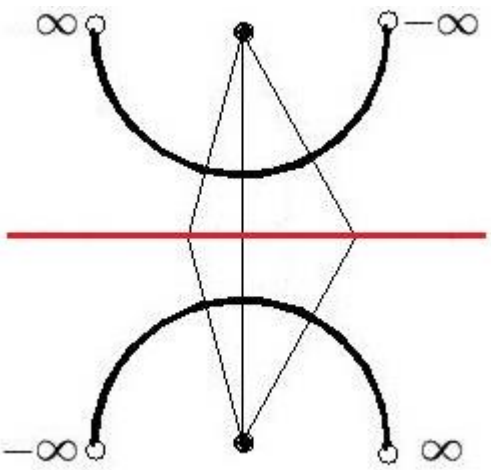


Fig. 12.1, adapted from Eric Schechter

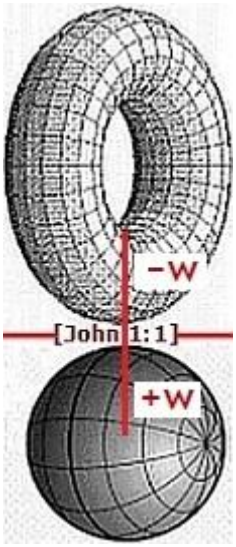


Fig. 12.2, sphere ⇔ saddle transitions

Fig. 7 and Figs 12.1 and 12.2 suggest a tentative answer to the question posed by St. Augustine in *Confessions*, Book XI: "How can the past and future be, when the past no longer is, and the future is not yet?"

In RS Spacetime[1], the local (physical) *mode* of spacetime is *quasi-flat* 4D spacetime. We replace the idea of 'asymptotic flatness at infinity' with the notion of 'compact without boundary quasi-flat 4D spacetime' endowed with **dual** "curvature" that is approaching *both* a closed sphere (Fig. 12.2) with maximal radius approaching infinity (**red** line in Fig. 12.1), *and* an open torus (Fig. 12.2) with maximal radius approaching infinity (**red** line in Fig. 12.1). The **red** horizontal lines in Fig. 12.1 and Fig. 12.2 match the horizontal line in the *interface* 'here and now' (Fig. 7) and the theological Case **IV** (Luke 17:21) in Table **1**. Hence God is "located" at *absolute* infinity (Georg Cantor) at which the hyperimaginary sphere and torus undergo sphere ⇔ saddle topological transitions[3] (Fig. 14).

People believe that the spacetime is "expanding", as shown in Fig. 13 below, but notice that the phenomenon is **non**-relational. It would be like claiming that you're speeding with 100 km/h and *accelerating* your speed[8], only you cannot refer to any *relational* object (the river banks at *absolute* rest, after Heraclitus) with respect to which you can define your speed and "acceleration" (Perlmutter-Schmidt-Riess): there is no "absolute space"[46] in GR. The *unique* reference frame used in Fig. 13 and Fig. 19 is <u>not</u> physical, yet every watch reads a fleeting "shadow" from it, one-at-a-time (see below).

How could this happen? Because in RS Spacetime[1] the unphysical *radius* of the expanding "balloon" (Ned Wright), "defined" with respect to the unique global unphysical reference frame, is being **re**-nullified at every **re**-created *interface* 'here and now' (Fig. 7). Notice also that the "balloon" stands for the hyperimaginary[3] sphere and torus in Fig. 12.2 above. Physically, we observe what is known by Hubble flow (Fig. 13), but we don't know[6] the "locomotive" of 'time from the scale factor', because the perpetually **re**-nullified Unmoved Mover, acting along the *radius* |**w**| (cf. Table **1** and Fig. 12) of the expanding "balloon" below, does not reflect nor emit light. We call it 'light vacuum' (see Eq. **3** in RS Spacetime[1]).

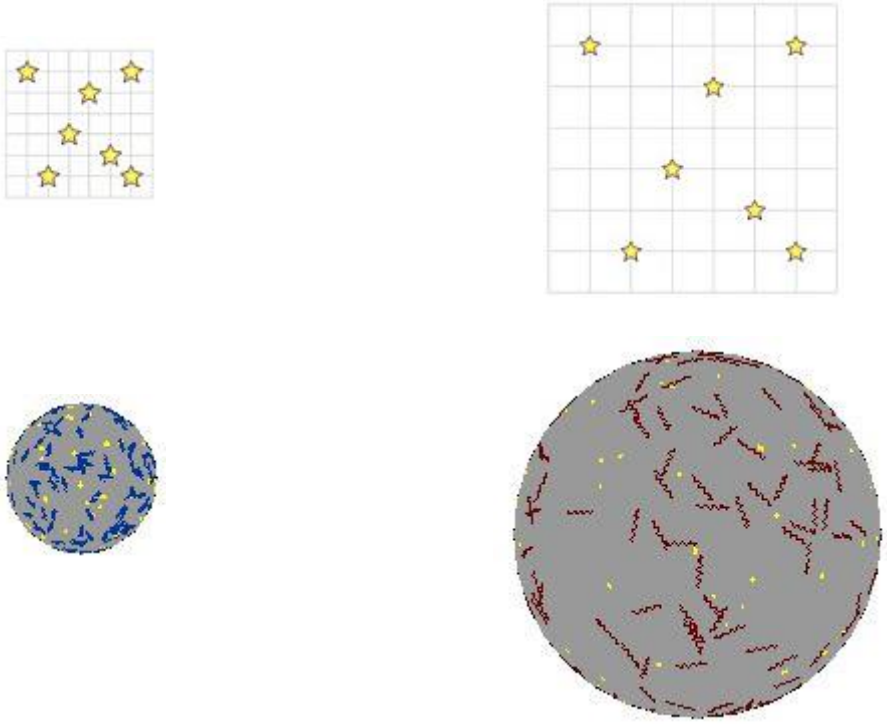


Fig. 13

The stars/galaxies are not in motion, but are "stationary" (Mike Jones[40]),
while *at the same time* the Cauchy surface is inflating **indefinitely**.

In brief, the spacetime (Fig. 12) 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 and Fig. 12.2) at which the sphere-saddle topological (Fig. 14) pass through God (Luke 17:21). It resembles 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 and Fig. 14) is *atemporal*, and the **re**-created *local* mode of spacetime is a *perfect* continuum[32].

It is like taking snapshots of a dark room with a flashlight, and then assembling the *colored* (physicalized) "snapshots" (Fig. 5 and Fig. 17) to produce a *perfect* continuum[32] without any *colorless* ("dark"[8]) room[35]: we cannot detect the *atemporal* (Fig. 4) negotiation in the 'school of fish' (Sec. 4), facilitated by the topological transitions[3] in Fig. 12 and Fig. 14 below.

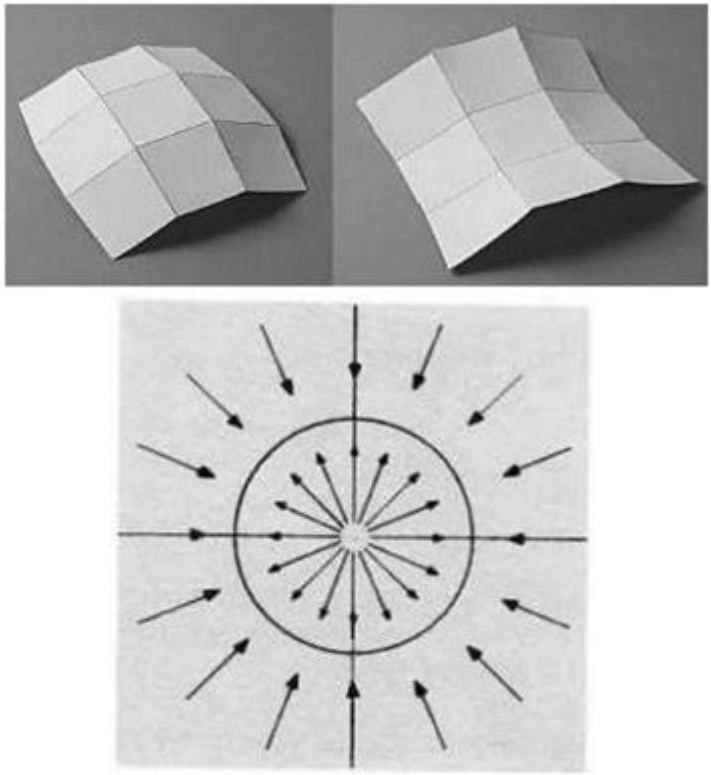


Fig. 14
Sphere-saddle topological transitions (above) and 'space inversion' resembling inversion of left rubber glove into right rubber glove (depicted with a circle).

Again, one can postulate Lorentzian metric[26] and relativistic causality[22] only within the assembled *quasi-flat* 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 (see 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", because these alternatives are *artifacts* from the type of cognition operating in Eskimos. Nature is smarter. Eskimos can only apply the doctrine of *trialism* (Sec. 6) and stress that the infinitesimal displacement in 4D spacetime *must* be 'something else'[7] explicated in science as 'the Universe as ONE' and in theology as God (1 John 4:8).

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 any 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, known in theology as The Holy Trinity. Nobody knows the ultimate limit of the physical world, as we are still in the "train"[34] for Eskimos (Sec. 6), propelled by its self-acting "locomotive", but we all will "see" it, sooner or later (better later!).

Let's go back to the issue of 'metric' by explaining Eq. 1 in RS spacetime[1], reproduced below.

$$\mathbf{1} = \mathbf{0} \times \boldsymbol{\infty} \quad \text{(Eq. 1)}.$$

How did we obtain such nonsense? By using our "intuition" based solely on classical physics, which dictates – wrongly – that the infinitesimal displacement (see above) can be *either* finite *or* zero. Surely the *limit* of a sequence does exist (Fig. 11), but how 'large' is the *last* endpoint at the very *limit*, matching the "size" of the infinitesimal displacement? If we assume that the size of this *last* endpoint can be *either* (i) finite *or* (ii) zero, we will hit insoluble problems. Case (i) leads to a *finite* minimal "pixel" (Fig. 6) or *finite* 'minimal drop of beer' (Fig. 11), and we would be able to count to infinity – *twice*, as reported by Chuck Norris. The opposite case (ii) leads to a limit of "zero", which requires to recover a *finite* two-pint beer (Fig. 11) by multiplying "zero" by "infinity", leading to Eq. 1 above. But the two alleged "alternatives", either "zero" or "infinity", are nothing but *artifacts* of our cognition. It is like Eskimos interpreting the elephant's trunk (Sec. 6) as *either* "nose" *or* "arm". But these are *complementary* presentations, just like the two types of 'infinity', potential and actual infinity. This is how the human cognition works. Nature is smarter.

Again, the 'atom of geometry' is neither "finite" nor "zero" (Fig. 6 and Fig. 20), but 'something else'[6]: a *dual* object (Fig. 7) explicated in science as 'the Universe as ONE' and in theology as God in The Gospel (Sec. 6).

Notice also that the textbook "explanation"[4] of gravity, depicted in Fig. 15, is **wrong**[37].

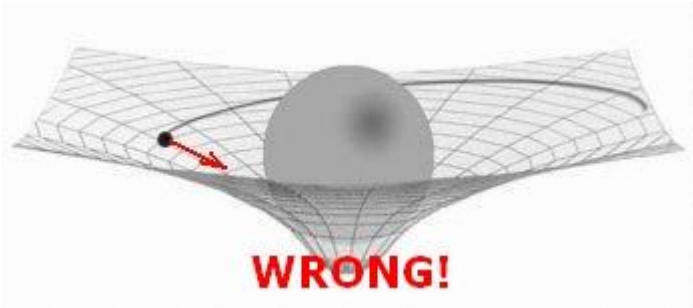


Fig. 15

The alleged "elastic body with tension"[37] is a myth. Besides, you cannot explain gravity *with* gravity, for the same reason you cannot explain heat with some tiny little hot particles. You **must** *reduce* gravity to 'something else' that builds up particular "distortion" of spacetime, which Einstein happened to call gravity, just as we reduce heat to 'something else' (kinetic energy), which does not have 'temperature'. You also know bloody well that in GR the notion of 'mass' has **not** been defined. If you claim that "there is a real physical process which is responsible for radiating gravitational energy to infinity" (Sean Hayward), you have to install gravitational-wave "mirrors" *exactly* at null-and-spacelike "infinity". You will need some Biblical "miracle" to define mass in GR. Forget it.

You need 'something else': the *intangible* (Sir Hermann Bondi) form of energy, which is **not** tensorial quantity ("pseudo-tensorial" is an oxymoron). It is a global, non-local, and *physicalizable*, but not yet physicalized, form of energy residing in the **future** (Fig. 7), from which it passes into the **past** (Fig. 7) to become *physicalized* form of energy in the right-hand side of Einstein's field equations: one [$\mathbf{t_{\mu\nu} = 0}$] at a time, as read with your clock (Sec. 4). And if you ask the tantalizing question, 'intangible energy of … what?', recall Plato's proposal (Fig. 5) and the explanation from Heisenberg[9]. To cut the long story[38] short, we reach the reference frame of Fig. 13 and 'the eye of the Universe'[1] (Fig. 16).

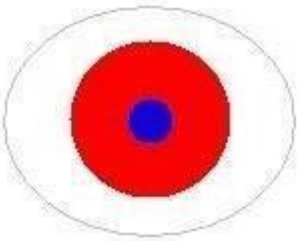


Fig. 16
Colorless **non**-reality $\mathbf{0_i}$, complementing the colored (**blue** and **red**) reality

The two forms of *reality*, physical (**blue**) and potential (**red**), are complemented by the *colorless* **non**-reality known as the Noumenon (*Das Ding an sich*) or the Monad without windows. It does exist, but as **non**-reality: see Case **IV** in Table **1** above. It is 'the unknown unknown' that has *not* been explicated so far as *colored* reality. It is not an 'empty set', because it is *not* a 'set' in the first place, and cannot become one. Unlike an empty *set*, which denotes *something* (either **red** or **blue**) absent, it denotes the *absence* of 'absolutely everything', and therefore it is not 'reality', but its complementing **non**-reality. It is the source of 'absolutely everything' (John 1:1), and can *never* be exhausted, not even during an eternal, with respect to a clock, *physicalized* universe (Fig. 19 and Cases **I-III** in Table **1**).
I call this Noumenon or 'ultimate Monad without windows' *light vacuum*, denoted with $\mathbf{0_i}$. It refers to the light source in Plato's proposal (Fig. 5), viewed as *absolute* vacuum, as $\mathbf{0_i}$ *cannot* be a 'set' in principle. It is the opposite to Quine atom, as it does not contain "itself".

The current GR textbooks cannot define 'geodesic' under energy *non*-conservation[6] due to perpetual influx of positive energy densities from the "dark" you-name-it[8] endowed with self-action: people don't know how to *reformulate* the geodesic equation by introducing the *crucial* condition $\nabla_\mu T^{\mu\nu} \neq 0$ at all geodesic points. As Sean Carroll acknowledged, "in general relativity spacetime can give energy to matter, or absorb it from matter, so that the total energy simply isn't conserved." My proposal is explained in Sec. 4: one [$\mathbf{t_{\mu\nu} = 0}$] at a time, as read with your clock.

Notice that if we examine four consecutive, brand new, **re**-created states of the Universe (Fig. 17), the state 4 **cannot** be obtained from state 1 by unitary "evolution" based on two time-symmetric *remnants* (Sec. 1). Hence we bluntly ignore the lesson from Plato (Fig. 5) and have **insoluble** problems[8,30]: see Carlo Rovelli.

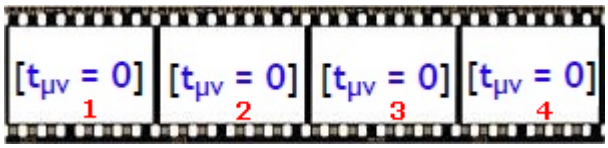


Fig. 17, after M. Montesinos

To explain how the *light vacuum* can "give energy to matter, or absorb it from matter" (Sean Carroll), imagine the following situation, analogous to "give energy to matter".

You are in front of a cash machine (ATM) and wish to withdraw €300 (**BC**, see Fig. 18) from your bank account, in which you have **X**-amount EURs (**X**>**BC**). The total amount **X** of your money will be conserved, as part of it (€300) will only change its location within the 'closed system'. But now imagine that all the money in your bank account are not physical reality but *potential* reality[9] pertaining to the entire 'school of fish' (Sec. 4): your €300 is converted from potential (*physicalizable*) money into physical (*physicalized*) money at the *instant* of withdrawal. Doing business with such "dark"[8] bank is always straightforward, only you *cannot* know how much potential (physicalizable) money you may, or may not, have in your account, because the "total amount" of *potential* money is *not* definable. Physically, you can only observe 'money *differences*' (or energy differences), as depicted in Fig. 18.

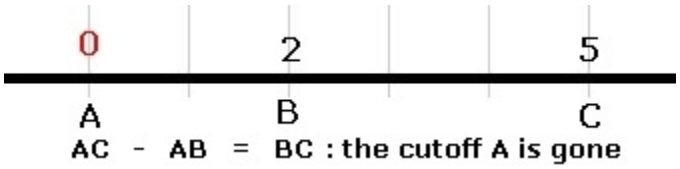


Fig. 18

Moreover, your €300 (shown with **BC**) has been *physicalized* by your "dark"[8] quantum-gravitational bank with astonishing precision. In the case of proton's mass, the acceptable error margins for similar "withdrawal" (analogous to "give energy to matter") is one part in 10^{45}, and for the fine-tuned Universe the precision could be one in 10^{500} (forget about "multiverses"). But it will be totally **wrong** to interpret the "amount" of potential[9] "money" as *physical* reality[8]. The only physical stuff is your *physicalized* €300 in your wallet. The amount of "cash withdrawal" can only be a *finite* quantity, never zero nor infinitely large. It could be terribly small, having *physicalized* mass density of app. 7×10^{-27} kilograms per cubic meter (John Baez), and, given a cutoff at Planck length, it can also be unimaginably large: "10^{96} kilograms per cubic meter!" (John Baez).

However, there is no such thing as "total amount" of *physicalizable*[9] money in the "dark"[8] bank: **[0, ∞]** is indefinable, because it springs from the *light vacuum* — the ultimate Monad without windows depicted with a *colorless* **non**-reality in Fig. 16 above. This is why we proposed 'dual age of spacetime' above: there is no "total amount" of *light vacuum* (Fig. 5) in the first place (compare it with Fig. 11). It is *indefinable* and *undecidable*, because it is not a 'number'[45] but 'the Universe as One': one single "point" (Fig. 7) stretched to *actual* infinity. It is the solution to Aristotle's Paradox of Space, being a pre-geometric plenum which "wraps up" our cognizable world: a *colorless* **non**-reality that acts as a "boundary" (Fig. 16) and "cutoff" (Fig. 19) of the *colored* reality, **physical** and **potential** (Sec. 4). It is amalgamated with the potential reality placed in the **future** (Fig. 7), and there is no *metric* there, just as there is no metric in our cognitive world: there is no different 'size' of the *idea* of a tree and that of a mountain, no physical 'distance' between them, although they are completely different. Yet despite the fusion of the *colorless* **non**-reality with the **potential** reality (Fig. 16), they are ontologically different, because the former *cannot* be presented with a 'set', being 'light vacuum', Aristotle's Unmoved Mover ('that which moves without being moved'), Case **IV** in Table **1**, and "trunk" to all Eskimos (Sec. 6) reading these lines.

Otherwise we cannot explain the existence of 'time', as read with a clock: the time must have a **cutoff** at the Beginning and at the End to make it an 'interval' (Fig. 18), yet these "two", but in fact **one**, endpoint(s) must not be accessible *from within* 'the spacetime'. We can set **AB** in Fig. 18 to match the "inflation" in Fig. 19 below, but since we *always* observe temporal and spatial **differences**, the "duration" (if any) of **AB** will be *indefinable* and *undecidable*, as the cutoff at **A** will disappear (Fig. 18): the Beginning and the End do not belong to the physicalized world (**BC**), and cannot be derived from it as a 'limit' (Fig. 11). Philosophically, the problem is best explained with Thomson's lamp paradox. In mathematical relativity, we have a striking example with so-called *incomplete and inextensible* curves[47], which bear the same alternative properties: the endpoint and cutoff at **A** *must* exist, yet it must *not* be present[30] within the spacetime interval defined with such "endpoint" **A** either.

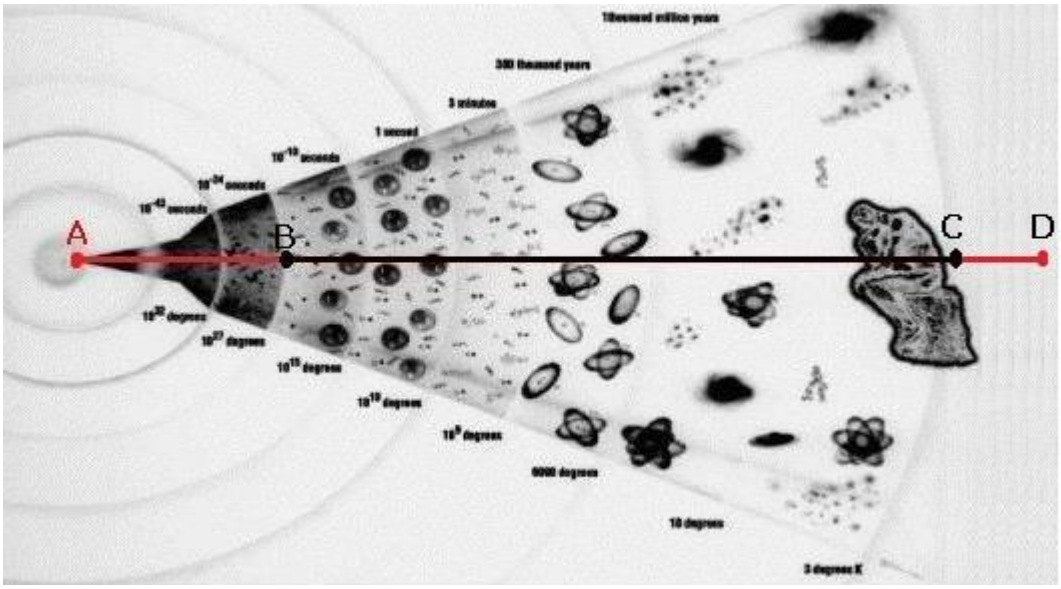


Fig. 19
The closed interval [**BC**] (Fig. 18) is the physicalized word (Fig. 7) with metric

Here **B** is already (Sic!) a physical point in the **past** (Fig. 7). It is presented with [epsilon] tending (present continuous) *asymptotically* toward the Beginning at **A** placed at **actual**

infinity, $\epsilon \to 0$, and [**AB**] is the infinitesimal used in calculus. No *metric* can be postulated "within" the infinitesimal [**AB**], which is why we cannot determine how "close" **B** might be to **A**. Mathematically, [**AB**] and [**CD**] (Fig. 19) are *indefinable* infinitesimals. Namely, point **B** would be just as "close" to the Beginning at point **A** as point **C** would be "close" to the End at point **D**, whereas in the *global* mode of spacetime **A** ≡ **D** (cf. Case **IV** in Table 1, Luke 17:21, and Fig. 16): dual age cosmology.

But how come the physicalized word **[BC]** (Fig. 19) cannot *actually* reach its Beginning & End? Why the "expanding" **[BC]**, defined in the reference frame of 'fixed stars' (Fig. 13), cannot "eat up" [**AB**] and [**CD**]? Because the Arrow of Space[1], which is empowered by Aristotle's Unmoved Mover (Sec. 1) and builds up 'the spacetime', will cease to exist if the infinitesimal "distance" **ε** between the **past** and the **future** (Fig. 7) is nullified by **A** ≡ **B**.

The situation can be explained with closed and open intervals: **A[ε (B...C) ε]D** . Here **ε** denotes the infinitesimal [**AB**] ≡ [**CD**], which does *not* have metric, hence the physicalized "shadows", endowed with metric, cannot turn around and "look" at it (Fig. 5).

The problem with the "size" of the limit/endpoint **ε** is known since the time of Zeno and Aristotle: the "trip" cannot even *begin* at **A** (Fig. 20), if [**AB**] was a "pixel" with **zero** size (Fig. 6); see also the discussion of Eq. 1.

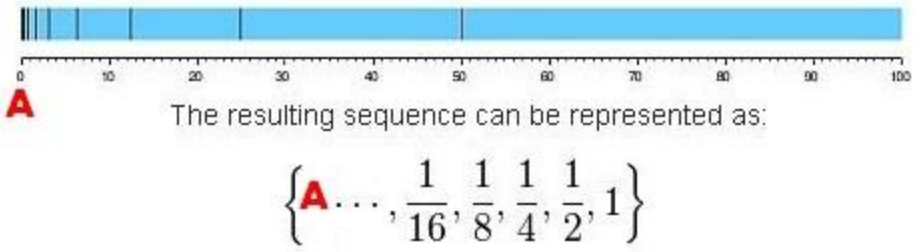


Fig. 20, adapted from Wikipedia; see also Bryan Bunch[16] and Fig. 11

Yet without the cutoff at **A** (viz. [**AB**] ≡ [**CD**] in Fig. 19), we cannot define any spacetime interval **BC** (Fig. 18), although the same cutoff and final endpoint will always "disappear"[35] (Fig. 18): recall Plato (Sec. 1) and the explanation with closed and open intervals above.

On the other hand, the physicalized word **BC** (Fig. 19) is perpetually **re**-created, and at every interface 'here and now' (Fig. 7) it is always 'brand new' (Fig. 17), exhibiting a genuine Heraclitean dynamics: you could not step twice into the same river, because ever-newer waters will flow on your new steps. Again, the "direction" of the Heraclitean 'flow of events' in *not* relational (Sec. 1), as it matches the "direction" of Einstein's elevator, shown with a **red** arrow in Fig. 21.1 below.

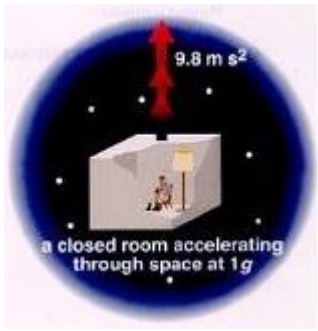


Fig. 21.1

Fig. 21.2

The **red** arrow in Fig. 21.1 is the "direction" at which the physicalized word **BC** (Fig. 19) obtains its "inertia". Unlike the physical directions in 4D spacetime, shown in Fig. 21.2 above, the **red** arrow in Fig. 21.1 points simultaneously to all physical directions in 4D spacetime. We call it 'flow of time' or Arrow of Space[1]. It does not have a *physical* (hence "dark"[8]) origin, because it is driven by Aristotle's Unmoved Mover. It does not obey Newton's third law (Fig. 21.2). It has only two totally powerless time-symmetric *remnants* (Sec. 1) placed in the time-symmetric **past**: there is no "arrow" there.

One can talk about an *arrow* in the flow of time in the sense that the **re**-created **past** is *always* chasing its **next** **re**-created **future** (Fig. 7), shown metaphorically as the Dragon chasing its tail (Ouroboros) in Fig. 22. Any time the Dragon catches its tale in the **past**, the **new** state of the tail (Heraclitus' river) is *already* shifted ahead in the **future**, *ad infinitum*.

Fig. 22
The enclosed words mean 'The All is ONE'

NB: Notice that the two forms of reality, *physical* in the **past** (Fig. 17) and *potential* in the **future** (Fig. 7), are both "connected" in the **past** *and* "separated" in the **future**. This is the *arrow* in the flow of time, after Heraclitus' river, and the crux of so-called biocausality[29]. Again, the dynamics of the flow of time is *perfectly* hidden (Macavity[35]) by the so-called "speed" of light, and the resulting local (physical) mode of spacetime is *perfect* continuum: the **re**-created physical universe**s** (Fig. 17) are "stacked" along the hyperimaginary axis **W** (Fig. 5), and are "separated" by 'light vacuum' (Fig. 16). Since the driving "force" is the *activity* of Unmoved Mover endowed with self-action (Sec. 1), we can only observe a self-acting **re**-physicalized universe — one-at-a-time, as read with a clock. To use Sir John Eccles' metaphor[48], the Brain of the Universe (Table 1) is a self-acting "piano" (or "nose"), which is played by its "piano player" (or "arm") *via* their common source (or "trunk", Sec. 6).

The flow of time is an immensely powerful phenomenon which "inflates" (Fig. 13) the local (physical) mode of spacetime, shown with **(B…C)** above. Although the spacetime points between **B** and **C** are not countable[45], if we examine **(B…C)** *en bloc*, it has Archimedean topology and can evolve in size, as seen from the perspective of the reference frame of 'fixed stars' (Fig. 13), in which we estimate the "age" of the universe and its "size" (Fig. 19) and can imagine there some global 'inertial observer' (Fig. 21.1).

Can we reconcile the non-Archimedean infinitesimal, [**AB**] and [**CD**], with the finite physical world **BC** equipped with metric (Fig. 19)? Can we have our cake and eat it? Yes we can, with dual age cosmology and physical theology (Table **1**).

Once created by God (John 1:1), the physicalized world, **B** ⇒ **BC** (Fig. 19), is *already* eternal, as **BC** is wrapped by the so-called light vacuum: **0** < **BC** < ∞. This is *the* miracle of Nature, which is beyond human comprehension. We can only try to grasp it like Eskimos, keeping in mind that in physical theology[2] the so-called light vacuum may be what we call 'nose' or 'the Universe as ONE' — not the incomprehensible "trunk" (Sec. 6). The same tallies to God as 'arm' (Sec. 6). Yet the 'arm', not the 'nose', can act on itself, being the Unmoved Mover: Der Geist bewegt die Materie (*Mens agitat molem*, Virgil).

Hence God (John 1:1) can create the Universe with the *minimal* withdrawal of, say, €1[8], matching the non-zero "size" (Fig. 7) of point **B** in Fig. 19. The Beginning can be *very* quiet, without any "big bang", and the Universe can evolve from such *minimal* "€1 Zygote" in a way resembling the human development. It will undergo **non**-unitary changes, as brand new things can *emerge* from the light vacuum in terms of brand new *physicalizable* potential (**red**) reality, which will in turn lead to brand new physicalized (**blue**) reality (Fig. 16). And if your *physicalizable* money shrink from **X** to **Y** (**Y<BC**, see Fig. 18), you may think that the "amount" of your money has *not* been "conserved" (Carl Hoefer) and suggest some GWs[10] that might have "carried it away" (which could bring you a Nobel Prize), but you will be deadly **wrong**, because there is no "conservation" in the first place: the spacetime can *absorb* energy from matter **as well**. The "missing" energy simply goes back in the global[13] 'school of fish' (Sec. 4): the *global* mode of spacetime "wrapped" by the light vacuum.

We certainly observe fleeting physicalized "shadows" of quasi-local 'time' and fleeting physicalized "shadows" of quasi-local 'space' (Sec. 4), as these physicalized "shadows" constitute the observable local (physical) mode of spacetime with *assembled* four topological dimensions (three spatial and one temporal) and Lorentzian metric[22]. Likewise, we observe physicalized "shadows" of '*the* quantum state' as 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 (Einstein). Sure enough, the metric of these quasi-local quantum-gravitational "shadows" (Fig. 5) is not absolute but relational[1].

This is the lesson from Plato, Aristotle, and Heraclitus (Sec. 1) in modern parlance. If you disagree, try to define 'time'[30] and mass-energy in GR and solve the most widely known, ever since 1911, public secret in physics here.

Not surprisingly, many people *seriously* hate the cosmological scenario above: check out Max Planck. But the current theoretical physicists will need some Biblical "miracle" to raise a robust Lorentzian metric within 10^{-30} seconds "after" the "big bang", starting much earlier at 10^{-35} seconds "after" the "big bang", when the spacetime were just 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 "inflate" the spacetime by a factor of 10^{78} and then *safely* keep the Lorentzian metric for at least 13.798 ± 0.037 billion years rooted on the Planck scale at which the spacetime points have become *totally* fuzzy and locality has lost *any* meaning[41].

Let's go back to Fig. 12: during the *atemporal* "breathing" of the Universe[1], modeled with hyperimaginary[3] sphere-torus transitions (Fig. 14), all spacetime points *simultaneously* pass through the horizontal lines 'here and now' in Fig. 7 and in Fig. 12, called God (or 'arm', see Sec. 6) and "located" at absolute infinity (Case **IV** in Table **1** above).

In physical theology[2], the pictures of God as an 'arm' and 'Universe as ONE' as 'nose' (Sec. 6) are *unverifiable*. From the perspective of the *physicalized* world **BC** (Fig. 19) endowed with Archimedean topology, the 'trunk' (Nature) is *simultaneously* at zero and infinity (Eq. 1). Also, if Nature was designed only with potential infinity, there will be no 'limit' above, but an *endless* run toward it. If Nature was designed only with actual/completed infinity, the *physicalized* world will be short-circuited to its Platonic source (Fig. 5), shown as ambient space around 'the largest beer' in Fig. 11. In short, we need to keep the 'arm' and the 'nose' (Sec. 6) as equally "absolute" (Sic!) entities.

Again, Nature is not a 'set', because we *cannot* form a set from 'colored reality' and 'colorless **non**-reality', as depicted in 'the eye of the Universe' (Fig. 16): there will be *indefinable* propositions (resembling Gödel's incompleteness theorems) in such 'set of all sets', which will make it *absolutely* undecidable. We can neither prove nor disprove the *existence* of Nature. The doctrine of *trialism* (Sec. 6) and the notion of absolute infinity are beyond human comprehension[34]. We can only hope that one day they will be described (not explained) with Mathematics[3], *Deo volente* (Matthew 7:7).

There is no sense to play Sergeant Schultz: "I hear nothing, I see nothing, I know nothing."

God is within you (Luke 17:21), along with the Universe as ONE. We just call it 'Nature'. It (not "He") is indeed a genuine *miracle* that is beyond our comprehension. Everything else can be explained with physical theology (Sec. 6) and Table **1** above, including the birth of Jesus of Nazareth and his resurrection: Jesus came from God as Love (1 John 4:8), and when he was ready to go home (Good Friday), he just took a shortcut to his "home station", without leaving his "jacket" in the train[34]. This is not a 'miracle', because every "jacket" can dissolve back to the light vacuum (Fig. 16) or to 'the school of fish' (Sec. 4). Not to mention natural healing (Mark 5:30) and converting water to wine (John 2:6-9) by spacetime engineering[44]. If one day we gain full access to the potential future (Fig. 7), we should be able to practice spacetime engineering as well, provided we are empowered by God as Love (1 John 4:8). We do need natural healing and unlimited energy sources[6], and much more[44].

8. Summary

Let me finish this paper with a brief summary of the main ideas and proposals.

The current theory of spacetime employs only one form of 'reality', and that is the *physical* reality as '*objective* reality out there'. The *potential* form of reality[9] cannot fit in what physicists[26,27] call 'spacetime'. In the current, and essentially incomplete, formulation of GR the *potential* gravitational reality is presented as "non-tensorial" objects, e.g. the Christoffel symbols. Mathematically, the geometrical points are presented as some individuated objects (Fig. 8 and Fig. 9) constituting a real line, which leads to insoluble problems with the *set* of such "points" and its *undecidable* cardinality[45,32]. All this is not some highly exaggerated approximation, like the famous 'spherical cow', but an essentially incomplete model of spacetime based solely on the *physical* form of reality: the missing 'something else'[7] is the *potential* form of reality[9] known for many centuries (Fig. 5). It is *perfectly* protected from physical observations by the "speed" of light[54]: see Eliot's cat Macavity[35]. If it were *physical* reality, it will have to be "dark"[8] and will have to "travel" faster than light[24], being always "before the light".

To explain the limitations from '*objective* reality out there', notice that it can only be observed in the **past** (Fig. 7). Example:

If you look at the Sun, you will see its state 'out there', which has been *objective* reality app. 8 minutes and 18 seconds prior to the instant 'now' of your observation, as recorded with your wristwatch. At *exactly* the same instant 'now', the Sun **is** also an '*objective* reality out there', which you can observe after app. 8 minutes and 18 seconds. Briefly, '*objective* reality out there' is a **fact** recorded in the irreversible **past** (Fig. 7). Due to the "speed" of light[54] (valid for already-assembled local mode of spacetime equipped with 'locality'), we cannot observe *physical* objects separated by *finite* distances instantaneously[38]. Fine, but Quantum Theory is not limited to such non-contextual[50] (that is, independent of the measurement arrangement) '*objective* reality out there': read Erwin Schrödinger. So if the *potential* quantum reality[9] were *physical* reality from classical physics, it will again have to trespass any finite distance instantaneously[38]. But it isn't, so it doesn't have to do it. Ditto to the gravitational energy *density* at a spacetime "point"[13]: if it were *physical* reality from classical physics, it will have to be "non-tensorial", like the Christoffel symbols. But it isn't physical but an **intact** potential reality located in the **future** (Fig. 7). It is like one "point" stretched to *actual* infinity. There is no metric there, just like there is no distance between the *idea* of a tree and the *idea* of a mountain. There is no inertia there either[9].

What we call 'spacetime' is not some mathematical tool. For example, we use differential equations to describe the orbits of planets of the Solar System as a mathematical tool. Planets don't engage in calculus. Also, what we call 'spacetime' is not some object that can exist *without* matter, like some *bare* spacetime (Fig. 2): the spacetime "points" are defined by their physical "content" supplied by matter. On the other hand, matter cannot exist without spacetime as geometry. How do we disentangle the union of matter and geometry (Fig. 4), to find out which is what?

Let me suggest a simple (and certainly not original) metaphor: think about matter as nail varnish, provided that the 'chained observers' (Fig. 5) can see *only* colored nails (Fig. 23). The **intact** 'bare nails' have exactly zero chance to be found as physical (colored) reality.

Fig. 23

The Platonic "shadows" are *always* colored by matter, so we cannot see some *colorless* 'flower *per se*' (Fig. 5) or bare *colorless* 'nail *per se*', although the latter are not identical to the colorful matter (nail varnish, Fig. 23): you cannot paint a picture without an invisible *colorless* canvas. The latter is shown on Fig. 21.1 and Fig. 7: the **non**-relational Universe as ONE, which all Eskimos see it as "nose" (Sec. 6). It is being *multiplied* (Sic!) to cast its physicalized "shadows" in the **past** (Fig. 7), endowed with Archimedean topology (Fig. 6).

The physical world in the **past** ultimately needs non-Archimedean *potential* reality placed in the **future** (Fig. 7), because only the latter can define 'one second' (see below). The Archimedean world alone, made of 'nail varnish' (Fig. 23), cannot. It would be like defining the smallest yet finite 'pixel' (Fig. 6) as Planck "time", and reproduce 'one second' by

multiplying $10^{-44}x10^{44} = 1$: check out the discussion of Eq. **1** above. The non-Archimedean *potential* reality is like the "memory" of the Universe (check out the discussion of Fig. 7 above), in the sense that it stores the Platonic images of elementary particles (say, the proton *per se*), much like we keep in our memory an image of 'flower *per se*', which can be explicated as physicalized "shadows" with different colors (Fig. 5). This Platonic feature of being 'the same' is needed to keep the genidentity of particles and "the miraculous identity of particles of the same type"[51]. In this sense, the quantum vacuum keeps the Platonic images of all elementary particles ready to be physicalized as virtual particles; recall also the discussion of proton's mass at Fig. 18 above. Hence if some brand new Platonic image is created by the light vacuum (Fig. 16), it will *enrich* the physicalized universe by brand new "shadows". As Peter Weiss[52] explained, "the W boson and the Z boson had no mass when the universe first exploded into being", yet later "the inherent possibility (stored in the light vacuum – D.C.) for W and Z bosons to become massive was realized." If we run this *creatio ex nihilo* evolution backward in time, the physicalized universe will be gradually losing its physical content by shifting it back to the light vacuum, and hence its creation at **B** (Fig. 19) can be *perfectly* quiet. No need to worry "why the very early universe was in a very low entropy state" nor to suggest that "it came into existence in a very special state"[53]. We don't accept Biblical "miracles".

From the perspective of the physical world, the **non**-relational Universe as ONE (Fig. 7) would be placed *simultaneously* at zero and actual infinity (Eq. 1), but notice that 'the Universe as ONE' does not have metric. It is needed to define 'limits' in the Archimedean world of "shadows", without *actually* reaching them. It shows up as 'infinitesimal' (Fig. 19) or the dark strips *between* the snapshots from a movie reel (Fig. 17) or *between* the pixels (Fig. 6). It *cannot* be reached from the physical world, or else the physical (colored) and potential (*colorless*) worlds will be short-circuited, as in Fig. 11, and we will *actually* hit **A** (Fig. 19).

It's a bit like this. You enter a tunnel with diameter, say, 3m. As you walk inside the tunnel, you realize that the diameter of the tunnel shrinks by 0.1m every 10m of your trajectory, so at some point **B** (Fig. 19) you cannot move further (analogous to Planck "length"), but you claim that the tunnel must have a limit at which its diameter *should* be "zero", so you bravely calculate the entire tunnel (Fig. 11) and claim that you know its global properties, ranging from its current (and expanding, see Fig. 13) diameter to its endpoint **A** (Fig. 19).

Again, we cannot see the **non**-relational Universe as ONE or "nose" (Sec. 6) due to the "speed" of light (Sec. 7): it is always "before the light", like Macavity[35]. All we can notice is that our physicalized 4D "shadows" have been acting on themselves by *self-action* (Sec. 4), ranging from Case **I** (Fig. 1) to Case **III** in Table **1**. Hence the entire "nose" (Sec. 6) can be modeled as Brain of the Universe[48,49], which evolves *indefinitely* (Fig. 22) along the *time-symmetric* physical remnants called "future" and "past" ([22], p. 247), but can never *actually* reach 'the end of the tunnel' **A** (Fig. 19). Which is why 'the spacetime' has dual age: *both* finite in the **past** *and* indefinable in its **future** (Fig. 7): see the Dragon in Fig. 22.

To sum up, I suggest that the *multiplication* of the **non**-relational Universe as ONE (Fig. 7) is the end result from hyperimaginary[3] sphere ⇔ saddle transitions (Fig. 12). The latter define quasi-flat 4D spacetime (Sec. 7) of Archimedean "shadows" with infinitesimal "thickness" **dt** along the hyperimaginary axis **W** in Fig. 5. To include the *complementary* presentation of Nature as "arm", as seen by Eskimos (Sec. 6), I suggest that at every infinitesimal **dt**, read with a physical clock, Case **IV** in Table **1** undergoes an atemporal and self-acting transition:

(John 1:1, Luke 17:21, 1 John 4:8) = ONE (1 = 1x1) ⇔ **1** = **0** x **∞** (Eq. 1).

The right-hand side of Eq. **1** is symbolic presentation of the 'limits' (Fig. 19) obtained only as 'differences' in Fig. 18. We cannot "turn around" and see our light source (Fig. 16), as Plato explained (Fig. 5). Yet we all will "see" our light vacuum, sooner or later[34] (better later!).

Last but not least, notice that in Fig. 16 the nail varnish (Fig. 23) is marked with **blue**, while the **intact** colorless 'bare nails' are marked with **red**: they are two forms of reality, while the so-called light vacuum is **non**-reality (ibid.). The potential (**red**) reality has exactly zero chance to enter the physical (**blue**) reality, being *always* shifted in the **future** (Fig. 22): read the discussion of Fig. 7 above, and recall the Kochen-Specker "uncolored" states[50].

Regarding the gravitational radiation[10], notice that the metaphoric 'school of fish' (Sec. 4) is not based on some "fundamental scalar field". Since the bootstrapping of all 'fish' by energy-momentum and angular momentum exchange is performed by their atemporal **intact** delocalized *potential* states (read again the discussion of Fig. 7 above), the question 'why is the universe larger than a football?' is irrelevant. The intermediate bosons facilitate the negotiation of all 'fish', but there ain't no "fundamental scalar Higgs bozon". The whole Higgs bozon saga is like "proving" an essential component of the ultraviolet catastrophe, although both lead to *reduction ad absurdum*: the universe is *much* larger than a football.

I am eagerly expecting the discovery of a new family of bozons, including those with **spin-2**, at 14 TeV, hopefully in 2018. Such discovery will make the tantalizing question 'why is the universe larger than a football?' even more urgent, and maybe the talibans at CERN will reexamine their "standard model" by solving the most widely known public secret in physics, ever since 1911. Highly unlikely, I'm afraid. As Johann Makowsky pointed out (*The Jerusalem Post*, 19 April 1985), "Overfunded research is like heroin: It makes one addicted, weakens the mind and furthers prostitution."

Regrettably, my theory of spacetime is still at conceptual stage, ever since 1990[29]. Without Mathematics, we cannot move further[3] to uncover the *unlimited* treasure that might be hidden in the non-Archimedean *potential* reality 'outside the train'[54]: natural healing, unlimited energy sources[6], and perhaps *much* more[44].

I will greatly appreciate the support of all mathematicians interested in the foundation of Mathematics: *Raffiniert ist der Herrgott, aber boshaft ist er nicht* (Albert Einstein).

Yes we can (Matthew 7:7).

Acknowledgments

I thank the Eugene Higgins Professor Emeritus of Physics and Natural Philosophy Henry Margenau for his interest in my earlier work[29] and encouraging letter from June 1990, and my father Gocho G. Chakalov for his moral and financial support. They left the spacetime long time ago and are now with Jesus (Fig. 16).

D. Chakalov
Easter 2016

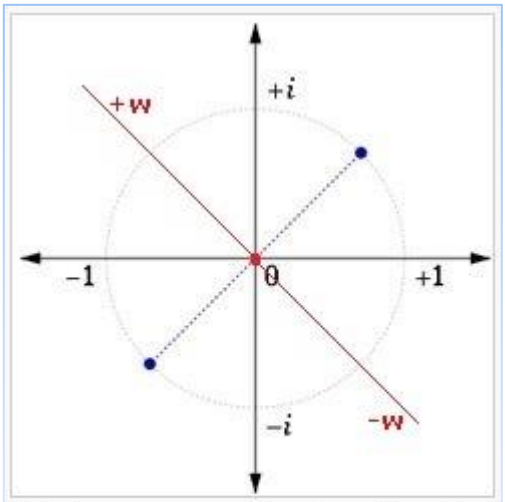
References and Notes[†]

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

[†] All comments and emphases in the references and notes are mine - D.C., Easter 2016.

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. Regarding Table **1** above, compare Fig. 12.2 with the drawing below, adapted from Wikipedia.



The two square roots of i in the complex plane (Wikipedia)

The hyperimaginary axis **W** (Fig. 5) is orthogonal to the complex plane of real and imaginary numbers, and provides two degrees of freedom, **+w** and **−w**, to the hyperimaginary amplitudes of two atemporal topological waves pertaining to 'potential reality' located in the **future** (Fig. 7). The atemporal topological waves are produced by sphere ⇔ saddle transitions (see above), which trespass God (John 1:1) at absolute infinity located at the *interface* 'here and now' (Fig. 7 and Fig. 12) at which the potential **future** is completely nullified and "collapsed" on the **red** point **0** in the drawing at left, and shifted to the **past** (Fig. 7): from $|\mathbf{w}| \neq \mathbf{0}$ (**future**) to $|\mathbf{w}|^2 = \mathbf{0}$ (**past**), one-flash-at-a-time, as read with a clock.

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

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. To explain the "dark" puzzle, suppose you have only one drop of petrol ("1€") in the tank of your car, but you bravely run the car and push the accelerator. As your car accelerates, you obtain more and MORE petrol in the tank, and at the instant you are reading these lines, the "dark" petrol has increased to nearly 68.3% from the total petrol in the tank. Such perpetual energy non-conservation[6] is not permitted in the geodesic hypothesis (Alan Rendall), as the current GR textbooks need to postulate energy conservation ("hence particles follow geodesics") to suggest geodesic motion based on non-tensorial Christoffel symbols.

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**. Online paper 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, available at this http URL.

15. Henry Margenau (26 March 1954), 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. Bryan Bunch, *Mathematical Fallacies and Paradoxes*, Dover, 1997, pp. 195-196 at this http URL.

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]. LIGO Scientific Collaboration and Virgo Collaboration (944 academic scholars), Prospects for Observing and Localizing Gravitational-Wave Transients with Advanced LIGO and Advanced Virgo, arXiv:1304.0670v3 [gr-qc], Sec. 5; check out ref. [10] above.

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, and the "nondynamical time parameter" which Bill Unruh and Bob Wald failed to uncover in October 1989 (William G. Unruh and Robert M. Wald, Time and the interpretation of canonical quantum gravity, *Phys. Rev.* D 40 (1989) 2598-2614).

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? 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. Henry Stapp's interview (excerpt), 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).

In other words (Sec. 6), the *physicalized* universe (Fig. 5) resembles an unbroken ring with *unphysical* circumference, because the "circumference" is nowhere and the "center" (Fig. 7 and Fig. 12.1) is everywhere (Luke 17:21).

Very old idea. We only suggest that the "stretching" of space toward the Large and the opposite "squeezing" toward the Small is not absolute but *relational*, leading to Relative Scale (RS) spacetime[1]. Namely, the coefficient **k**, used to explain the Archimedean topology above, is replaced with a new RS parameter denoted with **R**, from 'rate of the *flow* of time': see Eq. **2** and Fig. 14 in RS spacetime[1]. The idea is to match the RS size of a macroscopic cat (Fig. 3) with the RS size of a proton and the RS size of a galaxy: the proton and the galaxy will possess 'the same albeit altered' size in their respective RS spacetime domains. Yet *relative* to a macroscopic cat, the proton will *indeed* be terribly small, while the galaxy will *indeed* be hugely large. How? By endowing the spacetime metric with "elasticity", so that 'one meter' can be "inflated" toward the Large and "shrunk" toward the Small by *altering* **R**: 'the right meter' does *not* exist. It's all relative.

Hence gravity can be produced by *the same* global phenomenon (Arrow of Space[1]) that generates 'the spacetime', only applied at local level (cf. RS spacetime[1], Eq. **2** and Fig. 14 therein). For example, "inflating"[8] gravity (Hubble flow) and "attractive" gravity (e.g., galaxy cluster IDCS 1426) in *dynamic* equilibrium, without any *physical* stuff to mediate gravity[8]: see Albert Einstein[18] above. The same global phenomenon produces quantum world in the opposite direction toward the Small, without gravitational "field": Case **II** in Table 1. This is the only way to unite Quantum Theory with General Relativity by quantum gravity: no quantum effects in astrophysics and no "gravitons"[10] in the quantum world.

41. Sergio Doplicher, The Principle of Locality, arXiv:0911.5136v1 [math-ph], p. 21.

42. Gunnar Nordström, Relativitätsprinzip und Gravitation, *Phys. Z.* 13, 1126-1129 (1912).

43. Angelo Loinger, Non-existence of gravitational waves. The stages of the theoretical discovery (1917-2003), arXiv:physics/0312149v3 [physics.gen-ph].

44. Best Top 4 Teleportation in the world, published on August 15, 2014 at this http URL. Lightspeed Teleportations, published on December 3, 2012; watch a video clip (33Mb, mp4 format) from this http URL. A demonstration of REIM by Steven Freyne is available at this http URL. No, it isn't "magic" but spacetime engineering: "Any sufficiently advanced technology is indistinguishable from magic" (Clarke's third law). Of course, people always have the choice to disregard these and many other facts as "illusions", as insisted by their governments, but this is a different thread.

45. Kurt Gödel, What is Cantor's Continuum Problem? *The American Mathematical Monthly*, **54**, 515-525 (1947), cf. p. 515 at this http URL.

46. Michal Chodorowski, A direct consequence of the expansion of space? arXiv:astro-ph/0610590v3, pp. 1-2: "On a physical level, it suggests that the EoS is a geometric effect, so space itself is absolute. Then, though abolished in SR, in cosmology **absolute space** reenters triumphally the cosmic arena, endowed with an additional attribute: expansion. (...) One may argue that the concept of expanding space does have an appealing visualization: the surface of an inflated balloon, with dots on it representing galaxies. However, when interpreting this picture as an illustration of the EoS, there is a problem. Really moving galaxies have kinetic energy; do so those entirely driven by the expansion of massless space? The answer is not clear, the more that the latter are often claimed to be 'effectively' at rest, i.e., relative to the cosmic microwave background."

47. José M.M. Senovilla, Singularity Theorems in General Relativity: Achievements and Open Questions, arXiv:physics/0605007v1, pp. 5-6: "And this is the basic definition of singularity (Geroch, 1968; Hawking and Ellis, 1973), the existence of *incomplete and inextensible* curves. That is to say, curves which cannot be extended in a regular manner within the space-time and do not take all possible values of their canonical parameter. (...) 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."

There is a big can of worms in the idea of "the boundary of a space-time": follow the link at "somehow". The critical 'error margin' (see above) is the infinitesimal [**AB**], which can FAPP be considered "zero" only in classical physics[1]:

Walter Wyss, The energy-momentum tensor in classical field theory, Concepts of Physics, Vol. II, 295-310 (2005), p. 304.
http://merlin.fic.uni.lodz.pl/concepts/2005_3_4/2005_3_4_295.pdf

6 Equations of motion and conservation laws

The equations of motion are given by demanding that the action Eq. (1) is stationary, i.e. has a critical point under variations where on the boundary of the integration domain $\delta x^\mu = 0, \delta_* \phi = 0$ and $\delta_* \phi_\mu = 0$.

In GR (Fig. 4), there is no "background" spacetime with dead fixed metric, which is why the notion of 'time'[30] cannot *in principle* show up in the metric "field" (Carlo Rovelli), which is why we cannot *in principle* speculate about a *finite* time interval during which the *total* energy of any gravitational system can be "conserved". It can be FAPP "conserved" only at a single "snapshot" (see above) — once-at-a-time — but not during a *sequence* of such "snapshots" (Fig. 17). The crux of the issue is the 'error margin' **ε** above (*erreur*, Augustin-Louis Cauchy), located "between" open and closed intervals, **[ε (...) ε]**: the *infinitesimals* **[AB]** and **[CD]** depicted in Fig. 19 and shown as two **red** endpoints in Fig. 11. As George Berkeley stressed, any error, no matter how small, is not acceptable in Mathematics (*In rebus mathematicis errores quam minimi non sunt contemnendi*). Again, the *infinitesimal* **ε** does not possess 'metric' (Sec. 1), so it cannot be a finite object (Fig. 6 and Eq. 1) but 'potential reality' located in the **future** (Fig. 7). Mathematically, it is the *colorless* (Fig. 16) object "between" the set members in Fig. 9, thanks to which such 'set of points'[45] can assemble a *perfect* physicalized continuum[32] called *local* mode of spacetime — once-at-a-time, as read with a physical clock. Perhaps the *infinitesimal* (Fig. 19) is accessible by the human brain, if the latter can establish a *topological bridge*[3] between brain's potential states and those of quantum-gravitational world[44] (Case **II** in Table **1**), but this is a different thread, related to the 'news field' (Sec. 4) of gravitational radiation[10].

Details on the red herrings by Penrose & Norris are available upon request. More in 2018[3].

48. Karl Popper and John C. Eccles, *The Self and Its Brain: An Argument for Interactionism*, Routledge, 1984, p. 495: "The self in a sense plays on the brain, as a pianist plays on a piano or as a driver plays on the controls of a car." I think Sir John Eccles was 'not even wrong', because the opposite viewpoint, adopted in Marxist-Leninism and "scientific" materialism (the brain is the "hardware" and the mind is its software performing neural computing), is *also* wrong[29]. Detailed explanation of Fig. 22 in *The Brain of the Universe* (manuscript in preparation).

49. Ulric Neisser, *Cognition and Reality. Principles and Implications of Cognitive Psychology*, Freeman, 1976, Fig. 2, p. 21, and Ch. 4; N. A. Bernshtein, *The co-ordination and regulation of movements*, Pergamon Press, 1967, 196 pages.

50. Helena Granström, Some remarks on the theorems of Gleason and Kochen-Specker, arXiv:quant-ph/0612103v2, p. **2;** C.J. Isham, J. Butterfield, Some Possible Roles for Topos Theory in Quantum Theory and Quantum Gravity, arXiv:gr-qc/9910005v1, see an excerpt at this http URL.

51. John A. Wheeler[4], p. 1215: "No acceptable explanation for the miraculous identity of particles of the same type has ever been put forward. That identity must be regarded, not as a triviality, but as a central mystery of physics."

52. Peter Weiss, Constant Changes, *Science News*, October 2, 2001.

53. Robert M. Wald, The Arrow of Time and the Initial Conditions of the Universe. Talk given at Seven Pines "Arrows of Time" meeting, December 2004, arXiv:gr-qc/0507094v1.

54. In early September 2011, I tried to explain the "speed" of light and the so-called global mode of spacetime to a good friend of mine, Stavros, as we were relaxing at Iraklitsa beach near Kavala, Greece. I don't have a photo, but I suppose we looked pretty much like the two guys below.

Imagine, I said to Stavros, that you and I are in a train (the local mode spacetime) that runs toward the **future**. Physically, we cannot "see" the future, because we observe the physical world only in the *opposite* direction toward the elapsed **past**. Why? Because of the "speed" of light: it *always* takes some finite amount of time to see me sitting **next** to you, just as it takes some eight minutes to see the **past** state of the Sun. Now, suppose I can jump off the train and move to the global mode of spacetime (the causal field): I will have all the time (indefinite) to watch you, the train, and its entire **potential** railroad ahead, because *your* time (not mine!) will be dead frozen, like the proper time of a photon. So I use just one instant of *your* frozen time, and enjoy the entire (atemporal) **global** time available to the train. But when I come back and sit **next** to you after my "long" walk, you won't notice that I've been out for a walk: to *your* eyes and wristwatch, I will **always** remain *right here* on the chair **next** to you. You can't see me leaving for a walk "outside" the local (physical) mode spacetime (the train). All you can notice is that I've been EPR-like correlated with all beautiful girls here on the beach, like *that* fish on the sand was correlated in its school of fish before it was caught. And if I have brought you *this* drink from my walk "outside" the train, **you** will see it as surfacing helter-skelter and will of course try to trace it in the *history* of our talk ... but you can't find it there and will have to pronounce it "dark". Capiche? Cheers!

Well, my good old friend Stavros couldn't grasp the idea. It was a hot day and there were too many beautiful girls on the beach to think about cosmology and relativistic causality. So let's try something really simple: you hold a drink in your hand, which has atemporal quantum-gravitational *potential* states. Your brain also has such atemporal potential states, which you *entangle* with those of your drink by an atemporal topological **bridge**, and now you can tweak them all, much like you move your body by self-action. Physically, you will be tweaking phase fields, which is an effortless task. This isn't some "magic" but Spacetime Engineering 101. With some luck, we could learn to explore the quantum vacuum and scrap all nuclear power plants well before 2022. Perhaps all we need is Mathematics. Yes we can (Matthew 7:7).

And since we are talking about the infinitesimal harboring the atemporal walk "outside" the train, see below an outline of Finite Infinity and explanation of Cauchy's idea of 'limit', presented in RS Spacetime. The two types of infinity, potential and actual, are explained as follows:

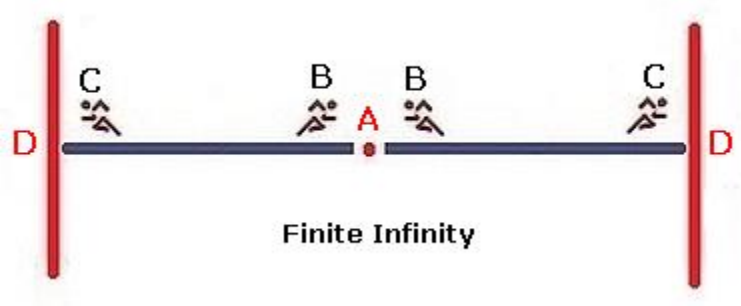
The statement $\lim_{n\to\infty} 1/n = 0$ asserts nothing about infinity (as the ominous sign **∞** seems to suggest) but is just an abbreviation for the sentence: $1/n$ can be made to approach zero as closely as desired by sufficiently increasing the integer **n**.

Abraham Adolf Fraenkel, *Abstract Set Theory*, North Holland, 1976, p. 6.

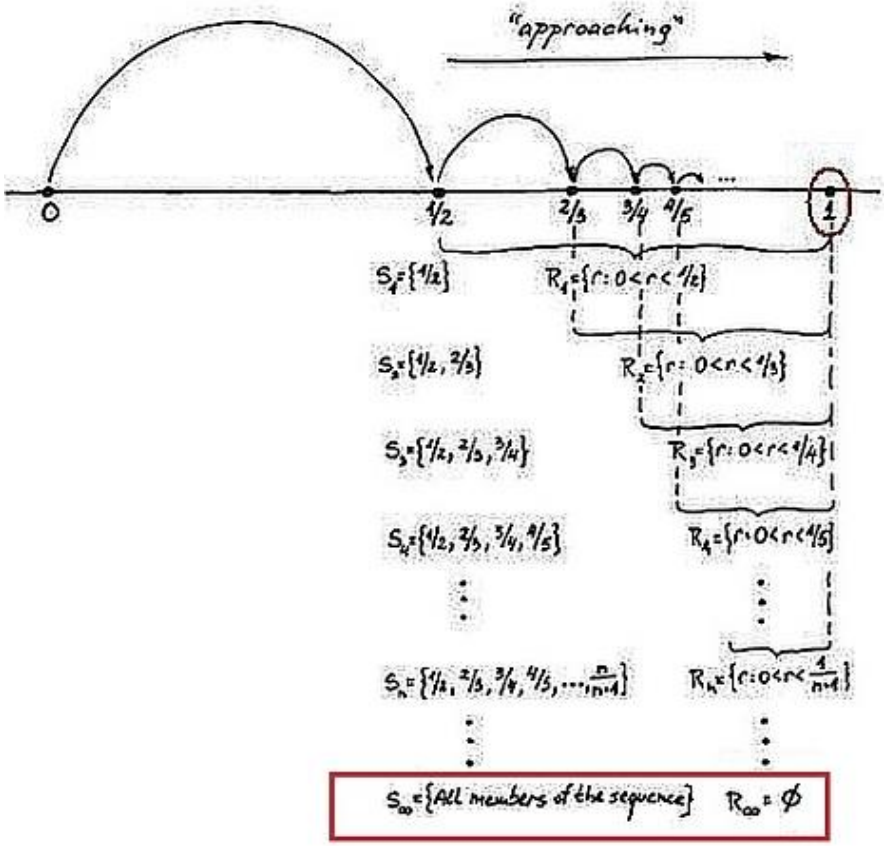
Buy the actual infinite we have to understand a quantity that is not variable but fixed and defined in all its parts, really a constant, but also exceeding every finite size of the same kind by size.

Letter by Georg Cantor to Albert Eulenburg, 28 February 1886
(Quoted after W. Mückenheim, *Transfinity*: *A Source Book*, 14 March 2016, p. 9.)

The *union* of potential and actual infinity, called **Finite Infinity**[1], is depicted below.



BC is the physicalized world with Archimedean topology, shown in Fig. 13 as inflating **4D** balloon surface. The resulting "time" runs in both directions (Janus), toward **A** and **D**; **A** ≡ **D** does *not* belong to **BC** (Fig. 19). The 'time from space' (**B**→**A** U **C**→**D**) is orthogonal to **+w**/**-w** in Fig. 12.2.

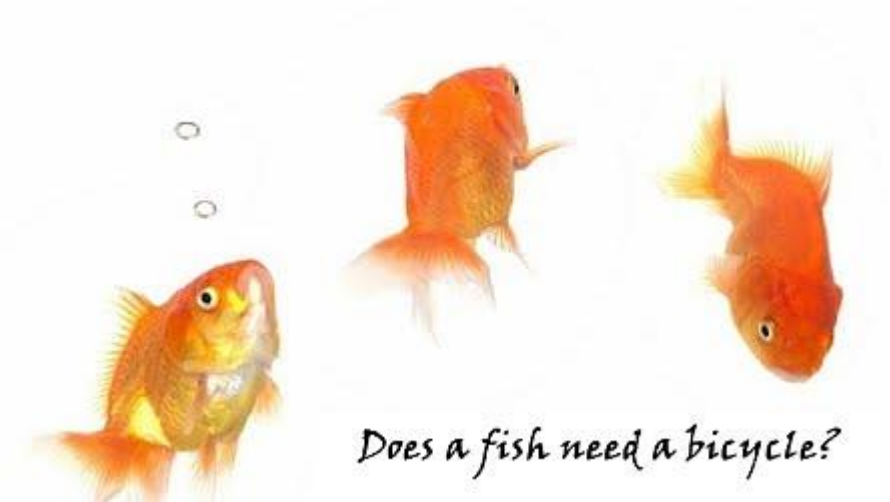


Exactly at point **1** from the real number line, "the Ghosts of departed Quantities" (George Berkeley) have disappeared: $R_{\infty} = \emptyset$. Just like Eliot's cat Macavity, they do *not* exist as physical reality but as an **intact** *potential* reality: $\mathbf{0} < |\mathbf{w}| < \mathbf{\infty}$ (Table **1**). In the physical world, the Platonic "dark room" is *completely* nullified by the condition $|\mathbf{w}|^2 = \mathbf{0}$, leading to a brand new **re**-physicalized 4D universe, once-at-a-time. Thanks to the Heraclitean river depicted as the Dragon chasing its tale, point **1** above has internal structure: both closed and completed ($\mathbf{A} \equiv \mathbf{B} = \mathbf{0}$ in Fig. 19) in the **past** and "open" ($\mathbf{AB} = \varepsilon > \mathbf{0}$) in the potential **future**, hence the topology of every *finite* interval is both **closed** and **open**: dual age cosmology. There is no other solution to the problem of 'limit'. It is indeed *exactly* reached in its **past**, but at *the same time* it belongs to a brand new potential **future**: see Fig. 22 above.

The fundamental Heraclitean dynamics is present at *every* geometrical point, which is why I suggested the so-called hyperimaginary numbers. We urgently need to amend the number theory with hyperimaginary numbers, because the current set theory and point set topology simply do not make sense. We need new Mathematics. Since January 1990, I tried to contact many, perhaps hundreds, renowned theoretical physicists and mathematicians, but they always responded with dark silence. Obviously, Max Planck was right:

> 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.
>
> Geheimrat Max Planck
> (Max Planck, *Philosophy of Physics*, Norton, New York, 1936, p. 97.)

Under these conditions, there is nothing more I can do. I am already old (soon will be 64) and tired of talking to a brick wall. Can't wait another 20+ long years to eventually meet some young mathematician interested in the foundations of Mathematics. Luckily for me, I have modest personal needs and expectations, and can enjoy my life without the mathematical theory of RS Spacetime and its vast applications of what people consider "magic". I'm fine.



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