

## Hyperimaginary Numbers

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### Abstract

The idea of *hyperimaginary numbers* is suggested as the first step toward the mathematical basis of *res potentia* (Plato), presented in the right-hand side of the evolution equation  $|\mathbf{w}|^2 = |\mathbf{m}|^2 + |\mathbf{m}_i|^2$ . The real and imaginary (*tachyonic*) components in the right-hand side are always balanced, leading to  $|\mathbf{w}|^2 = 0$  – the *physicalized* world is made of *positive mass-energy* only,  $|\mathbf{m}|^2$ , which is always balanced (not “*conserved*”) by equal amount of  $|\mathbf{m}_i|^2$ , once-at-a-time, ever since The Beginning (*John 1:1*). God is interpreted as mathematical (hyperimaginary) object residing “inside” the 4D instant here-and-now (*Luke 17:21*), and conceptual solutions to fundamental problems in *point-set topology*, *set theory*, and *number theory* are briefly described.

The full manuscript will be available only on Christmas 2016, upon request.

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### 1. Introduction<sup>1</sup>

Let me offer a simple experiment to verify the connection of your *brain* to the Platonic world<sup>1</sup> dubbed *res potentia*. If compared to the physical time read by your wristwatch, *res potentia* would look *atemporal*, in the sense that “its proper time would stand still”<sup>2</sup>.

<sup>1</sup> The latest version of *Hyperimaginary Numbers* ([hi\\_numbers.pdf](http://hi_numbers.pdf)) can be downloaded from [chakalov.net](http://chakalov.net).

Now the experiment. Consider the *meanings* explicated with these four sayings:

1. You can't hide a piece of broccoli in a glass of milk.
2. Who has no horse may ride on a staff.
3. Don't wear polka dot underwear under white shorts.
4. Faute de mieux, on couche avec sa femme.

If you can understand the meanings of these sayings, which of them presented similar meanings? My answer is 1 & 3 and 2 & 4.

Surely every word can be “[encoded](#)” in your [brain](#), but **not** its *meaning*. The latter cannot be “[encoded](#)” in the brain made of atoms<sup>11</sup>, and therefore cannot be “computed” from the neural presentations of the *symbols* used in the sayings above (more in [HBP.pdf](#)). These *meanings* (not [words](#)) are *invariant* in all human brains, despite the neural differences between all brains. They do **not** evolve in the physical time<sup>3</sup> read by your clock, do **not** decay, and are **not** governed by the laws of thermodynamics. They spring from some kind of ‘cognitive vacuum’, which belongs to the hyperimaginary *res potentia*. Yes, *res potentia* can act (**Sic!**) on the brain<sup>10</sup>, but – **no**, it is not mind or consciousness or anything we label with *res cogitans*: check out the doctrine of *trialism* on p. 64 in [gravity.pdf](#) and notice that *res potentia* (also known as Zen<sup>26</sup>) belongs to the [quantum vacuum](#) as well.

Hence we postulate a *dual* cognitive-and-quantum vacuum as the area of spacetime engineering (tweaking [the least action](#); see [Sec. 4](#)), and suggest that the mathematical description of this *dual* vacuum should involve so-called *hyperimaginary numbers* collapsed to “points” from the [number line](#).

Before we explain the *evolution* equation<sup>6</sup> based on hyperimaginary numbers (see [Sec. 3](#)), let me set the record straight: we do **not** talk here about psychology and religion, but about a new form of Platonic reality<sup>1</sup> called *res potentia* (check out again p. 64 in [gravity.pdf](#)), thanks to which the *physicalized* universe can be modeled as the “brain” of the Universe. Not the “mind” of the Universe, as suggested in 1927 by Sir Arthur Eddington with his famous statements “[the stuff of the world is mind-stuff](#).” The distinction between the “brain” and the “mind” (if any) of the Universe is crucial. Let me explain it by referring to the speech by Max Planck at Florence, Italy, in 1944:

There is no matter as such! All matter originates and exists only by virtue of a force which brings the particles of an atom to vibration and holds this most minute solar system of the atom [together](#). We must assume behind this force the existence of a conscious and intelligent Geist (bewußten intelligenten Geist). This Geist is the matrix of all matter.

We can talk about ‘the matrix of all matter’ if and only if that such matrix is understood as an *enclosure* within which the quantum-gravitational world originates as **re**-created *physicalized* world – once-at-a-time, as read with a clock. This matrix is the “[brain](#)” of the Universe. It is not “mind” or anything labeled with *res cogitans*, but Platonic *res potentia* explicated from what shows up in the inanimate physical world as “[vacuum](#)” and “[aether](#)”.

Let me explain *res potentia* with a simple example of the *matrix* for a photon (later I will explain the matrix for a proton<sup>4</sup>), stressing that the matrix itself defies any probabilistic (**Sic!**) description. It does **not** decay nor evolve in the physical time<sup>3,19</sup> read by your clock.

Imagine that you enter your living room at night and switch on the light. If it is a **light bulb**, it will emit photons with rate app.  $1.8 \times 10^{20}$  photons per second. All photons are identical<sup>5</sup> and have particular wavelength corresponding to the “distance” (if any) between the two “orbits” (if any) of electrons (see **h** in Fig. 1 below).

How come nothing goes wrong with producing  $1.8 \times 10^{20}$  identical<sup>5</sup> photons per second, ever? Because of the **matrix** for a photon<sup>17</sup>. It exists with **certainty**. It is *res potentia*.

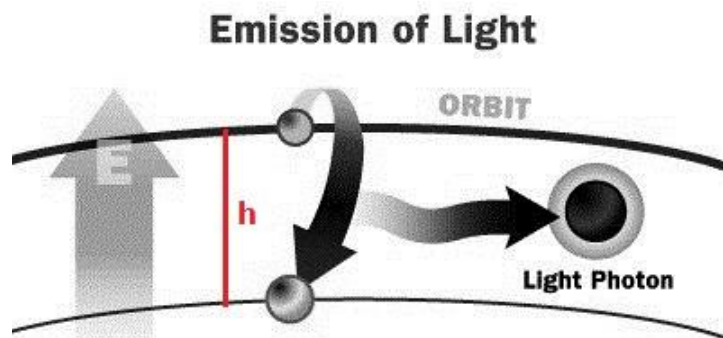


Fig. 1

As John A. Wheeler<sup>5</sup> acknowledged, the identity of particles of the same type is “a central mystery of physics.” The identity of ‘**international second**’ (Sec. 4) is not less mysterious<sup>28</sup>: no physical stuff could possibly integrate<sup>19</sup> *exactly* 9,192,631,770 – no more and no less – identical<sup>5</sup> temporal “pixels” (Fig. 6.2) to produce ‘**one second**’. The same applies to **1m**.

Recall also another mystery of physics, which is also resolved with the *atemporal matrix* for quantum particles: the most widely known, ever since 1911, public secret in physics, shown at [this http URL](#). It is about the absence of ‘**quantum time**’ in today’s textbooks<sup>32</sup>. Erwin Schrödinger has explained the puzzle in 1935.

Now let me elaborate on the matrix for a proton<sup>4</sup>. I will reexamine it later, to explain the *evolution* equation<sup>6</sup> based on hyperimaginary numbers,  $|\mathbf{w}|^2 = |\mathbf{m}|^2 + |\mathbf{m}_i|^2$  – the squared, *positivized* mass  $|\mathbf{m}|^2$  is related to the identity<sup>5</sup> of protons<sup>4</sup> and the ubiquitous mass-energy **non-conservation** acknowledged by Paul Steinhardt<sup>7</sup> and by many others<sup>16</sup>.

The squared imaginary mass<sup>2</sup>  $|\mathbf{m}_i|^2$  becomes “negative”, and will produce uncanceled forces<sup>8,9</sup> and unlimited **acceleration**, in violation of Newton’s third law and without limit:  $|\mathbf{m}_i|^2$  will be attracted by the positive mass  $|\mathbf{m}|^2$ , while the latter will be repelled by it<sup>10</sup> (self-accelerating motion, [Wikipedia](#)). The negotiation between  $|\mathbf{m}_i|^2$  and  $|\mathbf{m}|^2$  is not physical but *atemporal* phenomenon residing **along W**, “**before**” **light**. We can only observe the *physicalized* end result from the negotiation, made of positive mass-energy only (cf. ref. [35] in *The Spacetime*<sup>1</sup>), as in Einstein’s equation  $E = mc^2$ .

Let’s go back to the matrix for a proton. As Alex Dolgov<sup>4</sup> demonstrated, the error margin for producing proton’s mass is “**one part to  $10^{45}$** ”. Such astonishing precision cannot be accomplished without proton’s matrix as *res potentia*. In fact, the entire physical world is *perfectly* tuned for biological structures, which physicists call ‘**anthropic principle**’.

In general, the living and quantum-gravitational worlds offer the necessary condition for their existence, while the matrix of *res potentia* is the sufficient condition. It’s a bundle<sup>18</sup>.

Physically, the matrix – the “memory” of the physical world – will induce wave-like holomovement<sup>11,27</sup> without any **physical** source of such waves, and all biological systems (e.g., the **human brain**) and quantum-gravitational systems will exhibit **self-action**<sup>10</sup>, because the delocalized *res potentia* cannot be **physically** detected. If the matrix were *physical* object endowed with **metric**, it would have to be some sort of “**background**” of spacetime<sup>20</sup> (you cannot paint a painting **without any canvas**), which could miraculously act on the spacetime but *without* being acted upon, contrary to **Newton’s third law**. Such issue never arises here, because the **matrix** is Platonic *res potentia*. It certainly acts (**Sic!**) on the quantum-gravitational “brain” of the Universe, but since the **matrix** is not physical entity, the back action by the “brain” only enriches its “memory”.

To sum up, the *res potentia* of the physicalized universe (‘the matrix of all matter’, **Max Planck**) acts as ‘finite infinity’ (FI: check out p. 67 in [gravity.pdf](#)) and leads to dual age cosmology<sup>1</sup>. The **evolution equation** of the entire Universe is reduced at The Beginning (**John 1:1**) and at The End to meaningless identity ‘**0 = 0**’: once created, the Universe is *already* eternal (physical theology<sup>1</sup>). Namely, at every 4D instant ‘here and now’, the Universe passes through God at **absolute infinity** (**Luke 17:21**). Mathematically, *res potentia* fixes **Dirichlet boundary conditions** and **Cauchy conditions** for the **re-created** and **non-unitary** (**Sic!**) evolution of the Universe, starting from *the most simple physicalized* state, much like our **first prenatal stage** (**Zygote**): Time is God’s way to keep everything from happening all at once. Hence we have genuine free will, as the *potential* future is ‘open’ to brand new events, including the ‘unknown unknown’. We can never know the future.

## 2. About points, if any

The definition of ‘point’ (if any) resembles those of ‘**vacuum**’ or ‘**empty set**’: it only tells you what the so-called ‘point’ is not; for example, “that which has no part” (**Euclid**). It is some kind of dimensionless entity devoid of any **metric**, which is why the ‘point’ is by no means ‘the smallest region of spacetime’, as people may be inclined to think. It defies the application of bipolar notions such as ‘large vs. small’ and ‘one vs. many’. It would be like a bare label (the grin of the Cheshire cat *without* the cat<sup>23</sup>, **Fig. 8.1**), provided that we cannot ask the question ‘label of *what?*’, which makes its definition terribly intricate.

Also, the so-called ‘point’ is not related exclusively to physics (check out again the doctrine of *trialism* on p. 64 in [gravity.pdf](#)), as you demonstrated, with your good old **brain**, by referring to the *meanings* of the four sayings in Sec. 1 **above**: we all operate with some sort of ‘cognitive vacuum’, which is **UN**speakable and cannot be even comprehended. Yet the set of ‘everything that **can** be comprehended’ can be defined only relationally, only with respect to the complementary set of ‘everything that **cannot** be comprehended’.

How many elements build up such non-trivial “empty set”? Wrong question. It is the Kantian **Noumenon** or ‘**Das Ding an sich**’, an absolute “vacuum” that can be *never* looked at, as in Plato’s **allegory of the cave**. Thanks to the “speed” of light<sup>17</sup>, we cannot “turn around” and “look” at the cognitive-and-physical vacuum – the ‘light source’ in **Fig. 5** in *The Spacetime*<sup>1</sup> – explicating *res potentia* as the **matrix** of our world. It is **before light**.

To explain how we end up with such heavy metaphysics, I will use a Gedankenexperiment. Suppose you are on a ship cruising in the Pacific Ocean, and you can only see an endless **blue** ocean around you. Now you decide to look at the ocean through a funnel, which is like a pipe that is wide at the top and narrow at the bottom, say, **1 cm**. You will again see a **blue** spot from the endless ocean, and may also notice that the **blue** spot with size **1 cm**

is changing in time. But suppose the opening of the funnel has been shrunk from 1 cm to the “size” of the *infinitesimal* displacement in space,  $ds$  (Fig. 2), matching “that which has no part” (Euclid). What “part” from the endless blue ocean will you see? An *infinitesimal*, mathematicians<sup>20</sup> would probably say. Physicists will perhaps argue that you have hit the so-called Planck scale<sup>12</sup> and should not be able to see any “color” (metric).

Whatever the case is, don’t mix the funnel with the endless ocean around you: they are *ontologically* different entities, as Plato argued twenty-five centuries ago (see above).

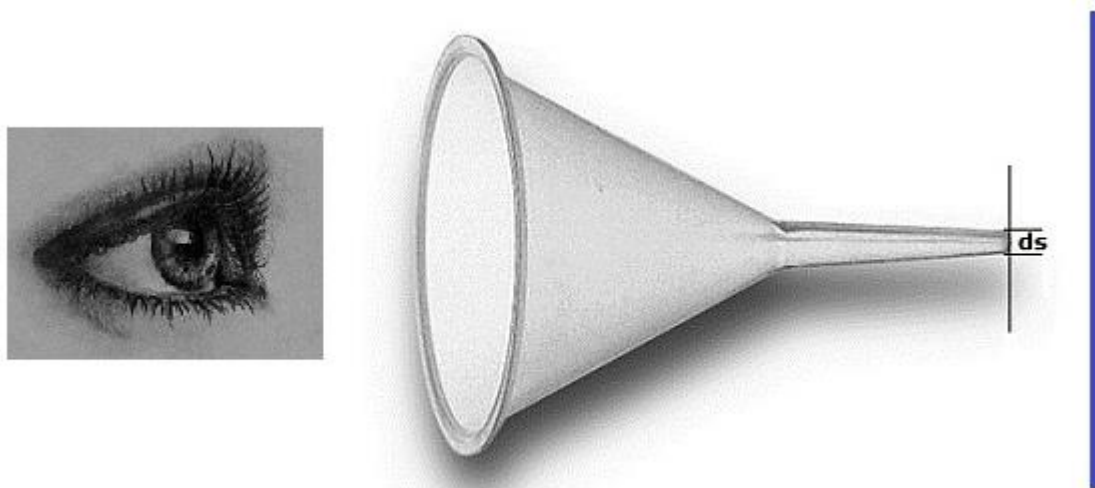


Fig. 2

The funnel stands for the *physicalized* universe – you can also look at the opposite, perpetually inflating physical world, and wonder what could possibly insert *any* limit on its size<sup>13</sup>. The limit is the same endless blue ocean, which is *res potentia* wrapping the entire *physicalized* universe (check out ‘finite infinity’ and dual age cosmology above).

The next step toward the *hyperimaginary numbers* is to place the *physicalized* universe in the irreversible *past* and *res potentia* in the potential *future*: see Fig. 7 in *The Spacetime*<sup>1</sup>. Hence they will be *both* separated by the interface ‘here and now’, in order to preserve their ontologically different nature, *and* connected by the *flow of events* (*ibid.*, Fig. 22), known as the *Heracitus river*: you could not step twice into the same river.

In the next section, I will introduce a new *hyperimaginary* axis, denoted with **W** (from the German *wunderbar*, as a tribute to Theodor Kaluza). In the *physicalized* world of the “funnel” (Fig. 2), the hyperimaginary numbers are *always* collapsed to “points” from the *number line*. Perhaps this is the reason why mathematicians have not yet noticed them. To explain the *temporal* structure and topology of what we casually call ‘spacetime point’, I will use the *limit of a sequence* and Fig. 2, and then explain the *hyperimaginary* axis **W**.

Later in Sec. 4, I will elaborate on the hypothetical mechanism of generating mass-energy, implied in the *evolution equation*, stressing that the phenomenon we call ‘gravity’ is by no means restricted to the fact that apples can fall from trees and hit someone’s head, as Newton has observed. Gravity<sup>7</sup> couples to the entire “pool” of *physicalizable* (Sic!) positive/negative energy<sup>4</sup> – not just to positive *energy difference* – and hence gravity “knows” the *indefinable vacuum energy* even “before” it becomes *physicalized* as positive mass-energy only<sup>17</sup> (Fig. 4), to *re-create* the physical world, with *astonishing precision*. This is the future of physics and life sciences, leading to spacetime engineering (Sec. 4).

### 3. Hyperimaginary numbers

If the alleged ‘point’ denoted with  $ds$  in Fig. 2 was physical stuff endowed with metric viz. Archimedean topology<sup>31</sup> (Fig. 6 and pp. 11-12 in *The Spacetime*<sup>1</sup>), we will inevitably hit the Thomson’s lamp paradox. It is agonizingly clear that we *must not* be able to hit the ‘atom of geometry’ from the physical “funnel” (Fig. 2). If we could, at least in principle, hit the spacetime ‘point’ in any *physical* way, we will need many “miracles” to recover from it.

Physically, we 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 was just about 1 cm across (Fig. 2) and a causally connected region would have been only  $10^{-24}$  cm across (the horizon problem), in such way that one could later “inflate” the spacetime by a factor of  $10^{78}$  and then *safely* keep the Lorentzian metric for at least  $13.798 \pm 0.037$  billion years rooted on the Planck scale<sup>12</sup> at which the spacetime “points” have become *totally* fuzzy and locality<sup>17</sup> has lost *any* meaning<sup>14</sup>.

Briefly, if we wish to explain the fact that time and space exist, we must introduce the matrix of spacetime, like we did for the matrix of photons (Fig. 1). Notice that every ‘matrix’ is Platonic *res potentia*, which do not have size or any physical attributes, much like the *idea* of a ‘tree’ is not smaller than the *idea* of a ‘mountain’. It is not clear whether we can make a ‘set’ of different instances of ‘matrix’, because the cardinality of such ‘set’ will have to be indefinable: the future is ‘open’ to brand new events, as stated above.

For mathematical point of view, we must make sure that the Platonic *res potentia* has unique presentation based on hyperimaginary numbers, as it always resides in the potential future and only casts a physicalized “jacket” on the number line – one-jacket-at-a-time. Since the real numbers refer to the physicalized world placed in the irreversible past (see above), they must be totally de-coupled from the hyperimaginary numbers.

The hyperimaginary numbers, needed to define the brand new “phase space” of Platonic *res potentia*, should be presented with 4D sphere  $\Leftrightarrow$  saddle transitions (Fig. 3.1) passing through God at every infinitesimal instant  $ds$  &  $dt$  (Fig. 3.2).

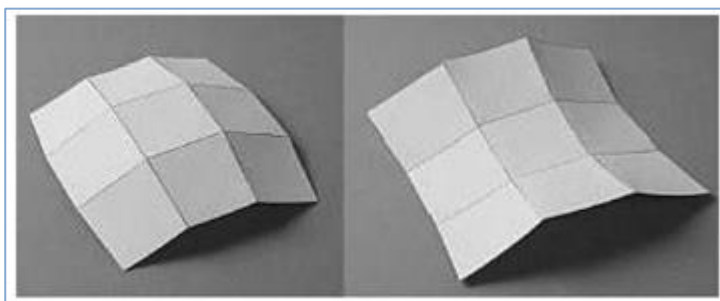


Fig. 3.1

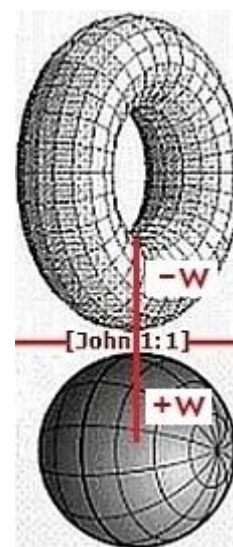


Fig. 3.2

At the end of [Sec. 4](#), I will try to explain the problems with delocalization<sup>11</sup> of [gravity](#) and [spacetime engineering](#) (often camouflaged as “[magic](#)”, just for entrainment<sup>29</sup>). The first obvious obstacle is to relate [Fig. 3.2 above](#) to the two “mirror” words, material and tachyonic<sup>2</sup>, and to the three types of masses shown in [Fig. 4](#), from Yakov Terletskii<sup>15</sup>.

According to (24.1), the proper mass is a real quantity if the vector  $P_k$  is time-like (i.e.,  $M^2 > 0$ ) and an imaginary quantity if this vector is space-like (i.e.,  $M^2 < 0$ ). The case of zero proper mass ( $M = 0$ ) can be considered as a special case of real proper mass.

Thus, if the components of the vector  $P_k$  are taken to be arbitrary real numbers, then formula (24.1) admits of three essentially different physical systems:

1. systems with positive proper mass, i.e.,  $M^2 \geq 0$ ,  $E > 0$ ;
2. systems with negative proper mass, i.e.,  $M^2 \geq 0$ ,  $E < 0$ ;
3. systems with an imaginary proper mass, i.e.,  $M^2 < 0$ .

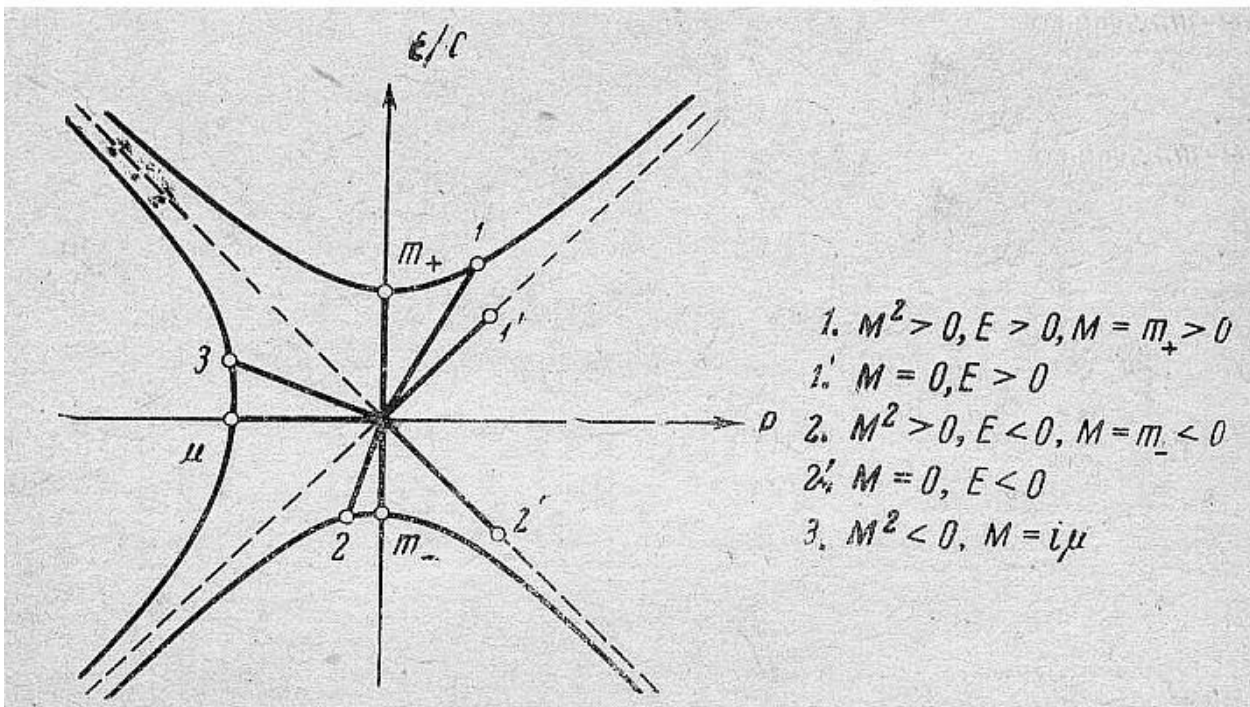


Fig. 4

Briefly on the geometric presentation of hyperimaginary numbers: the horizontal line in [Fig. 3.2 above](#) marks the sphere  $\leftrightarrow$  saddle transitions ([Fig. 3.1](#)) at the instant at which the hyperimaginary sphere and torus are inflated *exactly* to infinity. The physical spacetime, endowed with positive mass-energy only, is tending *asymptotically* toward the horizontal line in [Fig. 3.2](#), from both directions along  $W$ , from “south” (hyperimaginary sphere) and from “north” (hyperimaginary torus). Hence the physical, asymptotically flat spacetime is the arena at which the hyperimaginary sphere and torus “[clash](#)” into each other, like two

opposite waves, leading to their *complete cancellation* in the physical world ( $|\mathbf{w}|^2 = 0$ ), producing only one *physicalized* remnant from them – **one re-created remnant at a time**.

As stated [above](#), I will show the atom of geometry, called ‘point’ and denoted with  $ds$  in [Fig. 2](#). It can be explained with the [limit of \(bounded and monotonic\) sequence](#), depicted in [Fig. 5](#) (borrowed from [Wikipedia](#)).

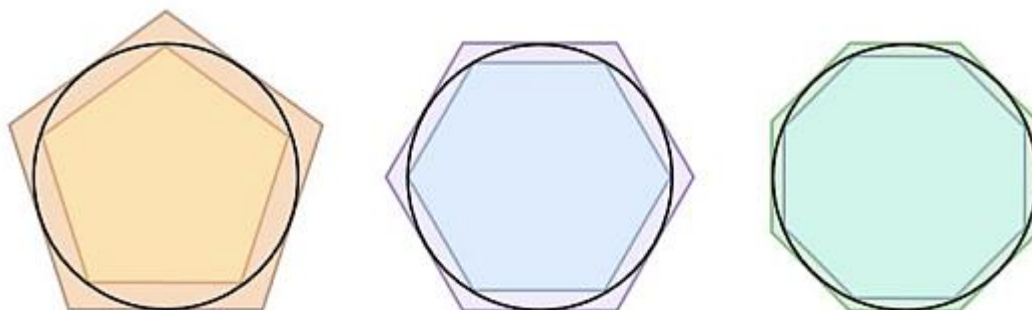


Fig. 5

This sequence has a *limit* at “infinity”, such that the side of the inscribed polygon, denoted with  $a$  in [Fig. 6.1](#), becomes *identical* to the side of the circumvented polygon  $b$  ([Fig. 6.1](#)) and to their distance  $ds$  ([Fig. 2](#)). Notice that  $ds$  does not have *metric* any more – there is no underlying spacetime to define such metric – and therefore we cannot attribute any number to it. If  $ds$  was ‘the smallest pixel of spacetime’ ([Fig. 6.2](#)), say, the [Planck length](#) ( $10^{-35}$  m), we could reproduce any *finite* region of spacetime (e.g., 1m by  $10^{-35} \times 10^{35} = 1$ ). However, at  $ds$  the Archimedean topology<sup>31</sup> is not valid any more.

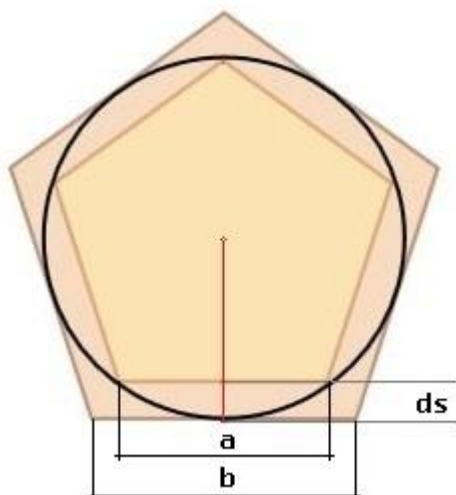


Fig. 6.1

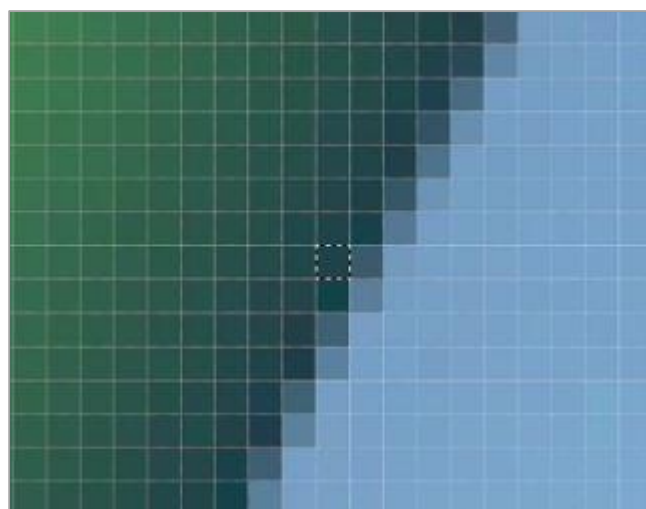


Fig. 6.2

Due to the absence of [metric](#), there is no difference between the infinitesimal  $ds$  ([Fig. 6.1](#) and [Fig. 2](#)) and the infinitesimal  $dt$ <sup>19,28</sup>. They build up the ‘atom of geometry’ and are indissolubly connected to a [completely different world](#): the Platonic *res potentia*. The atom of geometry  $ds$  &  $dt$ <sup>19</sup> only has a “footprint” on the [number line](#), and the *integration* of such footprints<sup>28</sup> is defined by *actual infinity*<sup>21</sup> (p. 67 in [gravity.pdf](#)), thanks to which we



have physicalized world cast in the irreversible past. Again, thanks to *actual* infinity<sup>21</sup> the infinitesimal  $ds$  &  $dt$ <sup>19</sup> builds up the physicalized world located in the past, while its hyperimaginary counterpart lives in the **potential future** as *res potentia*: **it's a bundle**.

Mathematically, *res potentia* would look like “zero”, denoted with  $R_\infty = \emptyset$  in the drawing from George Lakoff and Rafael Núñez<sup>22</sup> below (emphasis mine). Here the “empty set”  $\emptyset$  means that it contains are no *real* elements – only hyperimaginary *res potentia*.

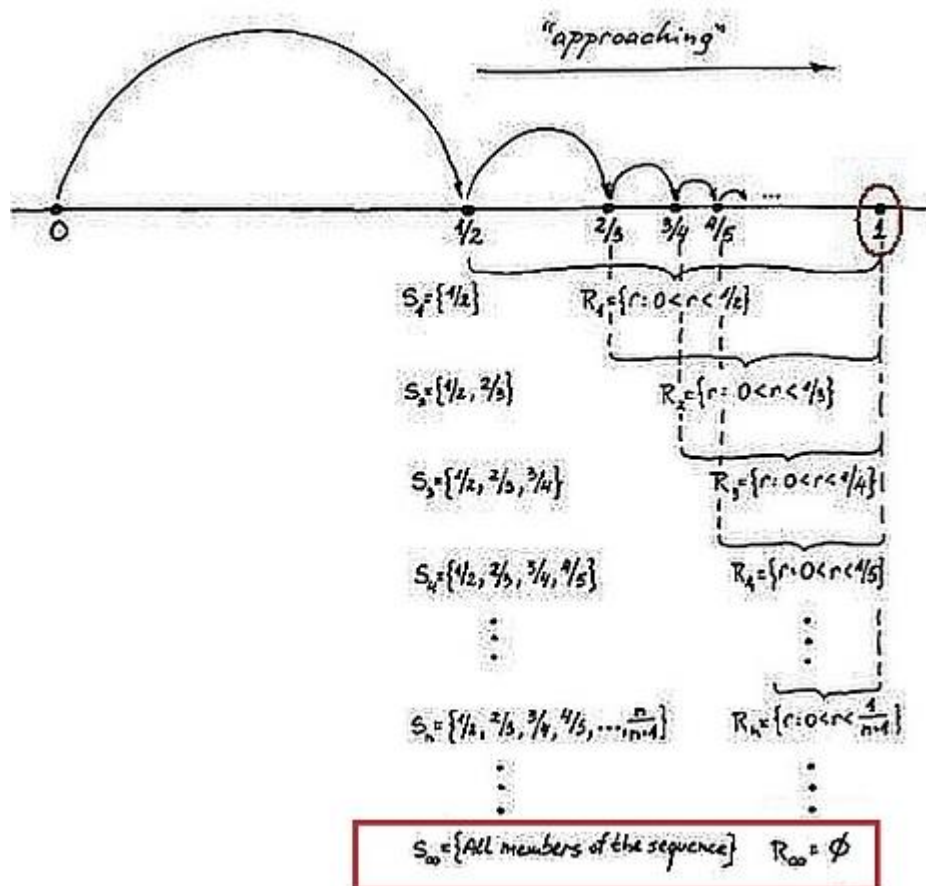


Fig. 7

The “empty set”  $\emptyset$  is depicted also in Fig. 8.1 from ‘the grin of the Cheshire cat *without* the cat’, as observed by Alice<sup>23</sup>. Again, the cat (Fig. 8.2) and its “empty” hyperimaginary grin (Fig. 8.1) are **inseparable bundle** rooted on **The Noumenon**.



Fig. 8.1



Fig. 8.2

Taking the risk to be terribly boring, I will **reiterate** that the Platonic world of *res potentia* must *never* be accessible from the physical world. Mathematically, the interval in **Fig. 7** must *never* be a closed one,  $[1,0]$ : we *must not* be able to hit the ‘atom of geometry’ from the physical world (cf. **Sec. 3**). On the other hand, the same interval in **Fig. 7** must *never* be an open one,  $(1,0)$ , because one cannot obtain ‘limit’ viz. **finite** physical world only with potential infinity: we need *actual* infinity<sup>21</sup> as well. Again, it’s a **bundle** (cf. p. 67 in [gravity.pdf](#)).

Can we have our cake and eat it? Yes we can, by placing the **finite** physical world in the **past**, and the infinite/indefinable *res potentia* in the potential **future**: see [above](#).

To sum up, the Platonic *res potentia* is unphysical and pre-geometric **matrix**, which does not emit nor reflect light<sup>24</sup>, being always “**before the light**”. It endows the entire physical world with the faculty of **self-action**<sup>10</sup>, resulting in fundamental flow of **re-created** events, called Arrow of Space: what we call ‘time’ is the joint result from ‘change in space’ and ‘change **of** space’. It’s a bundle, again. Hence the Arrow of Space (AoS) evolves along the hyperimaginary axis **W** and endows the *entire* world with self-acting **activity**. The only way to approach **it** is by following the Law of Reversed Effort and letting *res potentia* to unfold toward us. In this sense, spacetime engineering is an *effortless* activity (**Sec. 4**).

If the Arrow of Space were produced by any *physical* phenomenon, the latter will be, at least in theory, physically observable, which will pinpoint some *absolute* reference frame of the Arrow of Space at *absolute* rest, and the theory of relativity will be demolished.

Nevertheless, many people insist that *res potentia* must be some kind of physical stuff<sup>24</sup>. No, it cannot be any physical entity. It is like a transcendent (or transient) tachyon<sup>25</sup>, which is *omnipresent*, in the sense that it trespasses the entire physical world for “zero” time, as read with a physical clock: the transcendent tachyon will have “infinite” speed and will be simultaneously and instantaneously “located” *everywhere* (**Luke 17:21**) and at ‘**absolute infinity**’ shown with the horizontal line in **Fig. 3.2**.

#### 4. Spacetime engineering

Spacetime engineering is about the design and construction of case-specific **matrix**, such that it can organize any physical system in desired way. Nature has shown it with the proton<sup>4</sup> and many smart “monkeys” at **CERN** have learned to produce various “**bananas**”. Currently, spacetime engineering is guided mainly by empirical rules, and we utterly need a precise mathematical theory of spacetime, based on hyperimaginary numbers. This new approach to modeling the spacetime is highly non-trivial unresolved challenge (see [above](#)). Let me compare it to what is known as **fiber bundle** (**Fig. 9**).



**Fig. 9**

The *hyperimaginary* fibers (*bristles*) are supposed to define the brand new “*phase space*” of Platonic *res potentia*, depicted in Fig. 3.2 above. In the *physicalized* world of “mountains and waters”<sup>26</sup>, the hyperimaginary fibers are being “collapsed” to 4D events in the “*base*” *asymptotically flat* physical spacetime – once-at-a-time, as read with a physical clock – leading to holomovement of living and quantum-gravitational “fish”<sup>11,27</sup> (details in Sec. 4, p. 9 in *The Spacetime*<sup>1</sup>).

In my opinion, this is the only viable alternative to the infamous 3+1 “split” of spacetime<sup>19</sup>, and it has been communicated to many experts (cf. p. 68 in *gravity.pdf*). The point of departure is truly fundamental: we endow the ‘atom of geometry’, constituting the *number line*, with the faculties of *transience* (passing into and out of the physical world, Fig. 3.2) and *self-action*. In present-day theoretical physics<sup>28,32</sup> we have a bunch of “*yellow buttons*”, and even though we have learned how to *explore quantum mechanics* with the so-called *projection postulate*, we still have no idea what constitutes a “*measurement*”: recall the most widely known, ever since 1911, public secret in physics above.

The situation with spacetime engineering is pretty much the same. Once we unravel the so-called *hyperimaginary numbers*, we expect to learn much more about our “*yellow buttons*” and explore them for various purposes, from enhanced *natural healing* to *vacuum engineering*, to name but a few. This is the future of quantum gravity and life sciences, based on the “bridge” between the *human brain* and the Brain of the Universe: 1 John 4:8.

Now let me explain the mathematical presentation of the *matrix* in spacetime engineering. It is based on the notion of ‘set’, as described by Georg Cantor (7 November 1895)<sup>30</sup>: any gathering-together (*Zusammenfassung*) of determined and well-distinguished objects into a *whole* (*zu einem Ganzen*). If we think of a set of apples (Fig. 10), the *matrix* will be (i) the ‘bag’ itself, along with (ii) *everything* inserted between (Fig. 6.2) the denumerable apples (e.g., the air between apples is not ‘apple’), to preserve their identity (Fig. 10).



Fig. 10

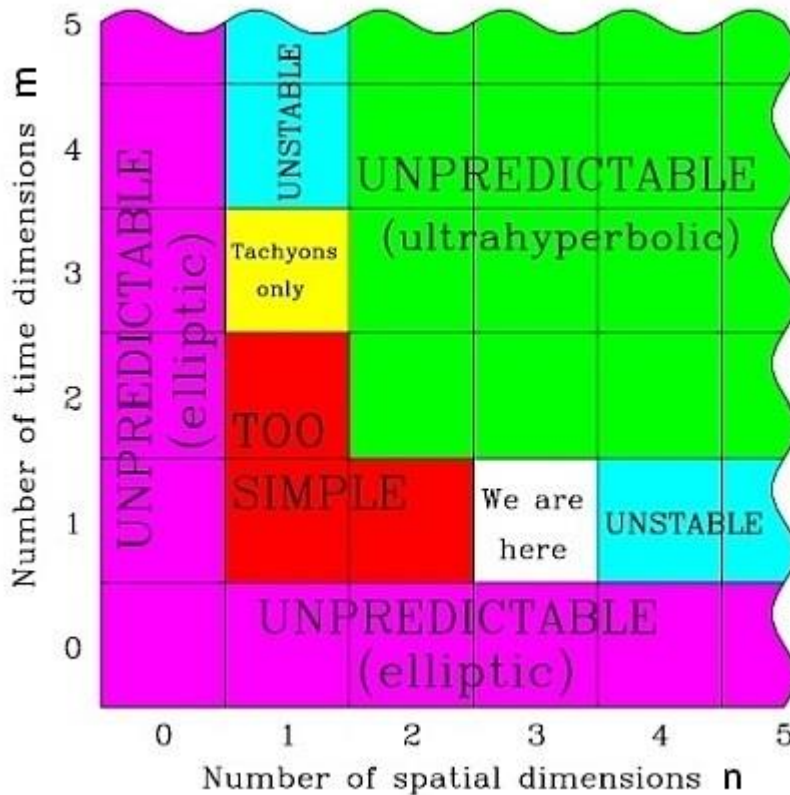
Again, the two objects, (i) and (ii), are needed for the definition of every ‘set’, and they are ontologically different from the members of *any* set. These two objects create a set of fish<sup>11,27</sup> and define *1s* and *1m*. They constitute the *matrix* in spacetime engineering, known as *res potentia* or Zen<sup>26</sup>, and the *human brain* can produce specific *quale* from *it*, as stated above. You will be able to “see” all points in space *simultaneously* by space inversion<sup>33</sup>, including the inner structure of solid objects and things obscured from three-dimensional viewpoint, e.g., all six sides of an opaque box<sup>29</sup> and *everything* that is inside the box (Wikipedia). This is not “*magic*” – any sufficiently advanced technology is indistinguishable from “*magic*” (Arthur Clarke’s *third law*).

(The full manuscript will be available only on Christmas 2016, upon request: *Matthew 7:6*.)

Christmas 2016

## References and Notes

1. D. Chakalov, The Spacetime. Online paper, Easter 2016, available at [this http URL](#).
2. Max Tegmark, On the dimensionality of spacetime, [arXiv:gr-qc/9702052v2](#), 5 April 1997.



Since a mere minus sign distinguishes space from time, the remaining case  $(n,m) = (1, 3)$  is mathematically equivalent to the case where  $(n,m) = (3, 1)$  and all particles are tachyons [14] with imaginary rest mass.

Footnote 4: The only remaining possibility is the rather contrived case where data is specified on a null hypersurface. To measure such data, an observer would need to “live on the light cone”, i.e., travel with the speed of light, which means that it would subjectively not perceive any time at all (its proper time would stand still).

3. Wolfgang Tichy, The initial value problem as it relates to numerical relativity, [arXiv:1610.03805v1 \[gr-qc\]](#), 12 October 2016.

Spacetime is foliated by spatial hypersurfaces in the **3+1 split** of General Relativity. The initial value problem then consists of specifying initial data for all fields on one such a spatial hypersurface, such that the subsequent evolution forward in time is fully determined. (...) There is a lot of freedom in choosing such initial data. This freedom corresponds to the physical state of the system at [the initial time](#).

4. Alexander Dolgov, Cosmic antigravity, [arXiv:1206.3725v1 \[astro-ph.CO\]](https://arxiv.org/abs/1206.3725v1), 17 June 2012; read an excerpt from pp. 13-14 at [this http URL](#).

5. John A. Wheeler *et al.*, *Gravitation*, W. H. Freeman, 1973, 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.

6. D. Chakalov, Potential Reality I: Relative Scale Spacetime, viXra:1410.0194, 8 November 2015, Eq. 3, pp. 24-25.

7. Paul Steinhardt explains energy conservation, 17-03-2011; watch 1:36-2:00. <https://www.youtube.com/watch?v=tjmNW3mlisE>

8. W. B. Bonnor, [Negative mass in general relativity](#), *Gen. Rel. Gravit.* 21 (1989) 1143-1157; Scott I. Chase and John Baez, Do tachyons exist? Online paper, September 2015, available at [this http URL](#).

9. Robert L. Forward, [Negative matter propulsion](#), *J. Prop. Power* 6 (1990) 28-37.

There is also no violation of the law of conservation of energy. When the two objects are at zero velocity, the total energy of the system is zero. After the two objects have reached  $v$ , their combined kinetic energy  $\Sigma P$  is still zero (I multiplied the equation by 2 to simplify its form)

$$2\Sigma E = 2E_+ + 2E_- = (+M)v^2 + (-M)v^2 = 0 \quad (2)$$

because the ball of negative matter has negative kinetic energy.

In addition, it requires no energy to make the marvelous negative matter ball to run our miraculous negative matter propulsion system. As long as we generate positive and negative matter in equal amounts during our fabrication process, the total energy needed to provide the rest mass for the combined system is zero

$$(+M)c^2 + (-M)c^2 = 0 \quad (3)$$

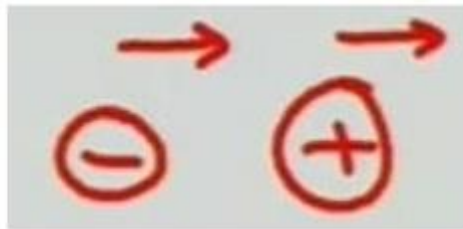
because the negative matter ball has negative rest mass energy.

10. Robert Nemiroff, Physics Lecture:- Negative Mass. November 10, 2010, [https://www.youtube.com/watch?v=qnUs4\\_26D9o](https://www.youtube.com/watch?v=qnUs4_26D9o)

## Negative Mass: Runaway Pairs

Say you have a positive and negative mass right next to each other. How do they interact gravitationally?

- The positive mass would attract the negative mass.
  - The negative mass would move toward the positive mass
- The negative mass would repel the positive mass.
  - The positive mass would move away from the negative mass
- Together the two would "run away" in the direction of the positive mass



11. Dimi Chakalov, Holomovement of Fish, December 14, 2015, <https://www.youtube.com/watch?v=0YDqx9fzT4>

Wave-like holomovement can be observed by looking how a centipede [moves its legs](#), but what makes the holomovement of fish special is that we cannot suggest some signals bootstrapping the participating fish through paths in spacetime. Every fish is *flexible* (not *stochastic*) in choosing one of its **next** states along its (perfectly *local*) trajectory, under the condition that this next **future** state will be *again* *EPR-like correlated* with the entire school of fish. Thus, every individual fish provides the *necessary* condition (see [above](#)) for negotiating its next **future** state along its trajectory, while the school of fish<sup>27</sup> provides the *sufficient* condition for correlating the trajectories of **all** fish, by keeping the matrix as *res potentia* of the holistic school of fish: the entire school of fish 'there' defines the state of every local fish 'here' and *vice versa*, just like with the appearance of '*inertia*'. Also, the [two conditions](#) produce 'waves' in the living and quantum-gravitational worlds, without any *physical* source of waves (say, an oscillating *drum* producing sound waves). As a textbook example, recall the so-called quantum waves: their *origin* is *completely unknown*. Also, while you were reading the four sayings in Sec. 1 [above](#), your *brain* produced billions of perfectly correlated *chemical synapses*, resulting in wave-like holomovement of electrical impulses along *neural pathways*.

12. Stephen J. Crothers, Jeremy Dunning-Davies, Planck Particles and Quantum Gravity, [viXra:1103.0054](#), 14 March 2011.

13. Powers of Ten™ (1977), August 26, 2010. <https://www.youtube.com/watch?v=0fKBhvDjuy0>

14. Sergio Doplicher, The Principle of Locality, [arXiv:0911.5136v1 \[math-ph\]](#), 26 November 2009, p. 21.

15. Yakov P. Terletsii, [Paradoxes in the Theory of Relativity](#), Springer, 1968, Ch. VI.

16. Sir Hermann Bondi, Conservation and non-conservation in general relativity, *Proc. R. Soc. Lond. A* 427 (1990) 249-258, cf. p. 249 at [this http URL](#); Hans C. Ohanian, The Energy-Momentum Tensor in General Relativity and in Alternative Theories of Gravitation, and the Gravitational vs. Inertial Mass, [arXiv:1010.5557v2 \[gr-qc\]](#), cf. p. 3 at [this http URL](#).



17. Kevin Brown, *Reflections on Relativity*, MathPages, Lulu, August 2016, Sec. 9.9, *Locality and Temporal Asymmetry*, pp. 671-677, available at [this http URL](#).

18. Many (otherwise smart) people are brainwashed by “materialism” and anti-theism, and deeply believe that the ‘bundle’ above is false. Don’t forget that anti-theism is a very sticky religion, from which you may never recover. A typical example is shown below.

Sean Carroll On Death And The Afterlife, 14 March 2015, watch 05:08-06:15.  
[https://www.youtube.com/watch?v=uQNnvfMJd\\_Y](https://www.youtube.com/watch?v=uQNnvfMJd_Y)

Why an afterlife isn't credible:

- The mind is the brain.
- The brain is made of atoms.
- We know how atoms work.

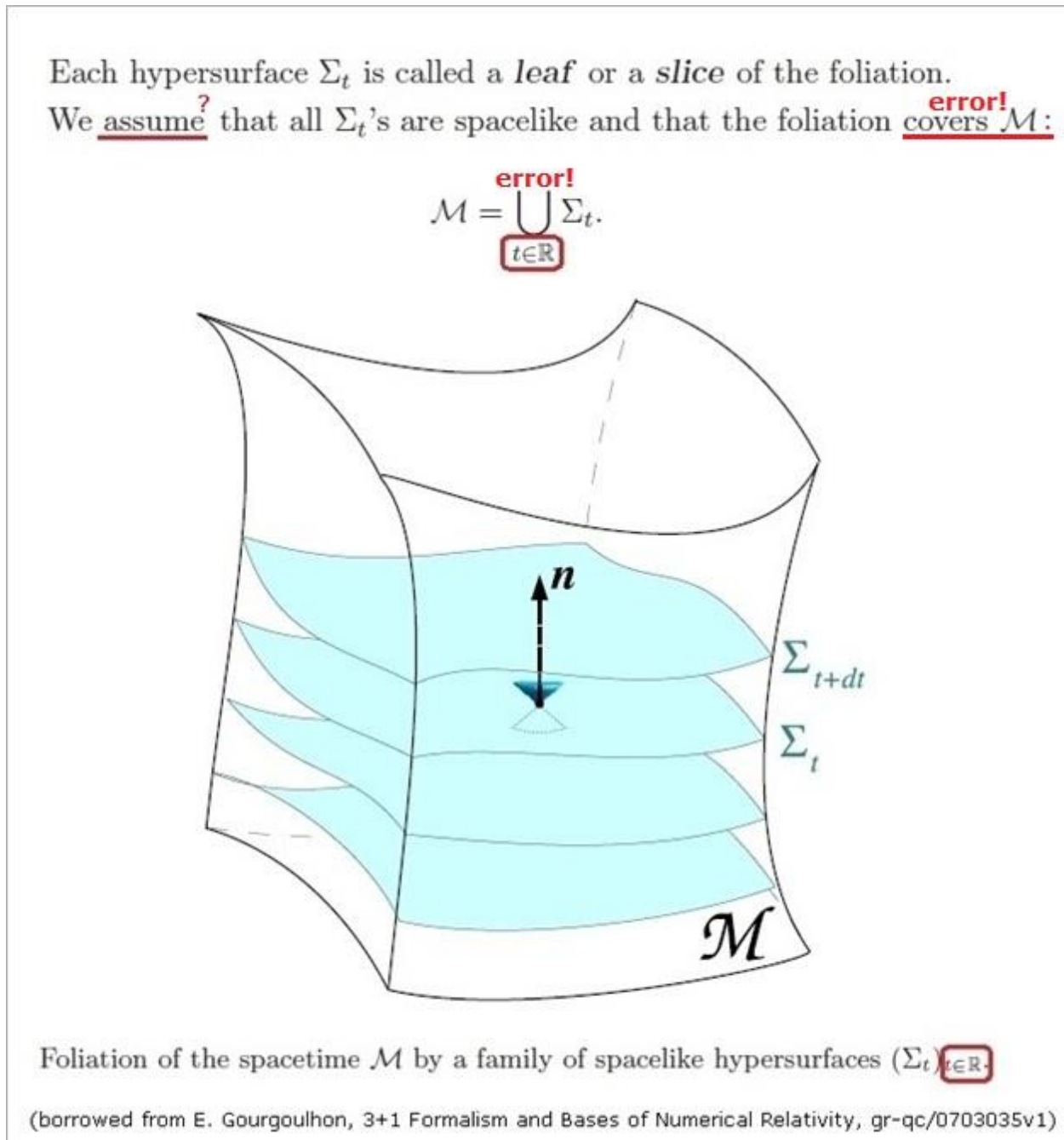



No, we don’t know how atoms work – read [Max Planck](#) and recall the most widely known, ever since 1911, public secret in physics above. As an illustration of our knowledge of how atoms work, imagine a group of monkeys in a zoo, and a large yellow button placed in their cage, such that any time a monkey presses the yellow button, a ripe banana will immediately show up on the top of the button. Surely every monkey would “know” how to “produce” bananas, even if the bananas are not attached to the yellow button in any way whatsoever. Now check out the generation of photons in Fig. 1 above and recall that every photon has not been “attached” – in any way whatsoever – to its electron before (Sic!) it was produced. We only know the “yellow button”: Einstein’s  $E = mc^2$ . As Erwin Schrödinger stressed in his *Die gegenwärtige Situation in der Quantenmechanik* from 1935,

In general, a variable has no definite value before I measure it;  
 then measuring it does *not* mean ascertaining the value that it *has*.  
 But then what does it mean?

It means that we are dealing with *res potentia* (pp. 60-64 in [gravity.pdf](#)), as acknowledged by [Werner Heisenberg](#). Physically, it was “zero” (also known as Zen<sup>26</sup>), both before and after it produced a photon or a “ripe banana”. Details in the evolution equation above.

19. Ericourgoulhon, 3+1 Formalism and Bases of Numerical Relativity, [arXiv:gr-qc/0703035v1](https://arxiv.org/abs/gr-qc/0703035v1), March 6, 2007. The drawing by Ericourgoulhon is reproduced below (emphasis mine). Notice the erroneous assumption that the “foliation” could somehow “cover” the spacetime  $\mathcal{M}$ : the “dark” colorless background, needed to define every individual “pixel”  $dt$  in Fig. 6.2, renders the *continuum* of spacetime<sup>20</sup> impossible.



Check out also Erik Curiel, *A Primer on Energy Conditions*, p. 6 and footnotes 11, 14, 17 (“What is going on here?”), 20, and 27. Online paper, October 24, 2016, at [this http URL](https://arxiv.org/abs/1610.07548).

20. Karel Hrbacek, Thomas J. Jech, *Introduction to Set Theory*, 3rd ed., Marcel Dekker, Basel, 1999; excerpt from p. 269 at [this http URL](https://arxiv.org/abs/1610.07548).

21. David Hilbert, Über das Unendliche, *Mathematische Annalen* 95 (1926), S. 161-190.



Translation by Erna Putnam and Gerald J. Massey at [this http URL](#). Notice that David Hilbert explained *actual* infinity as “a totality of things which exists *all at once*”. Here we assume that the ‘school of fish’<sup>11</sup> is bootstrapped by *Platonic res potentia* acting at/from *actual* infinity, and also that all *living* and quantum-gravitational ‘fish’ are endowed with *self-action*<sup>10</sup> originating from the Aristotelian *Prime Mover* or simply God (Luke 17:21).

22. George Lakoff and Rafael E. Núñez, *Where Mathematics Come From*, Basic Books, New York, 2001, p. 189.

23. Lewis Carroll, *Alice’s Adventures in Wonderland*, Macmillan, 1865, Ch. 6 available at [this http URL](#).

24. 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 in the tank of your car, yet you bravely run the car and push the accelerator. As your car accelerates, you obtain more and *more* petrol in the tank<sup>7,16</sup>, 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.

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

26. David Schiller, *The Little Zen Companion*, Workman Publishing Company, 1994, p. 2:

Before Zen, mountains are mountains and waters are waters;  
during Zen, mountains are no longer mountains and waters are not waters;  
after Zen, mountains are once again mountains and waters once again waters.

27. D. Chakalov, Holomovement of Fish, 14-12-2015, available at [this http URL](#).

28. T.A. Jacobson, *A Spacetime Primer*. Online paper, September 2, 2014, available at [this http URL](#). See excerpts from p. 11 and pp. 18-19 below (links added for clarity – D.C.).

In this sense, the tangent space at a point can be thought of as an infinitely magnified copy of the space of *infinitesimal displacements* from that point. It should be emphasized however that the tangent vectors do *not* lie “in” the manifold. Rather, they live in the tangent space, which may perhaps be usefully pictured as “*hovering over*” the corresponding point in the manifold.

The existence of an intrinsic time interval associated to *any timelike displacement* is another deep mystery. The fact is that, in Nature, there are systems that can serve as *clocks*. It seems to be the case that fundamental systems all march to the beat of *the same drummer*.

29. Britain’s Got Talent 2016, May 15, 2016, available at [this http URL](#). Once you design and build specific *matrix*, *it* can organize any physical system in desired way (Sec. 4). In the case of Rubik cube demonstration (watch carefully 00:40–00:45), you only have to *facilitate* the matrix with your body. No, it’s not “magic” (more *above*).



Notice that the [matrix](#) can be created without any apparent reason, in which case it is usually interpreted as [synchronicity](#) or ‘[beyond coincidence](#)’; typical example below.

Nuclear submarines collide in Atlantic. Damaged British and French vessels return to base after crash deep below ocean’s surface. By Rachel Williams and Richard Norton-Taylor, *The Guardian*, [16 February 2009](#).

A Royal Navy nuclear submarine and a French vessel have been damaged in a collision deep below the surface of the Atlantic Ocean. [HMS Vanguard and Le Triomphant](#), which were carrying nuclear missiles on routine patrols, are reported to have collided while submerged on 3 or 4 February. Between them they had about 250 sailors on board.

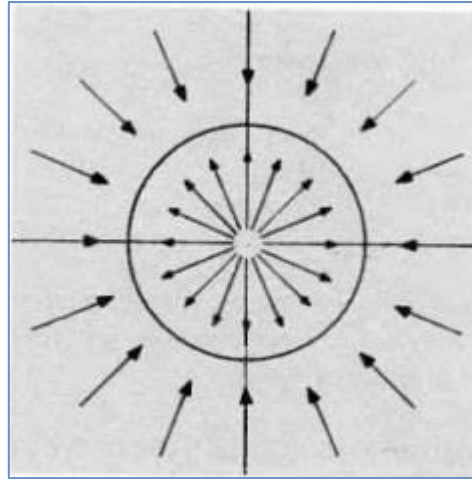
30. Georg Cantor, Beiträge zur Begründung der transfiniten Mengenlehre, *Mathematische Annalen* **46** (1895) S. 481-512.

31. Elemer Rosinger, Special Relativity in Reduced Power Algebras, [arXiv:0903.0296v2](#), 18 May 2010. Read an excerpt from pp. 5-6 at [this http URL](#).

The *physical* world of “mountains and waters”<sup>26</sup> conforms to Archimedes’ Axiom<sup>31</sup> and is governed by Archimedean topology, which can be explained as follows: if you have two timbers of different size, say,  $A = 3\text{m}$  and  $B = 10\text{m}$ , you can always find a finite 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 produce 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  $2.5\text{m}$  ( $1/4 \times 10 = 2.5$ ). But again, you can never produce some “infinitely small” timber and **stop** there. In this sense, the Archimedean topology is based on *potential* infinity with which one cannot *actually* (cf. [David Hilbert](#)) reach ‘infinity’: the physical world **cannot** include infinitely large nor infinitely small “timbers”, and therefore it does not **stop** but **trespasses** God ([Luke 17:21](#)) at *absolute* infinity depicted with the horizontal line in [Fig. 3.2 above](#).

32. Jeremy Butterfield, On Time in Quantum Physics, [arXiv:1406.4745v1](#), 18 June 2014; J. Gonzalo Muga *et al.*, The time of arrival concept in quantum mechanics, [arXiv:quant-ph/9801043v1](#), 21 January 1998.

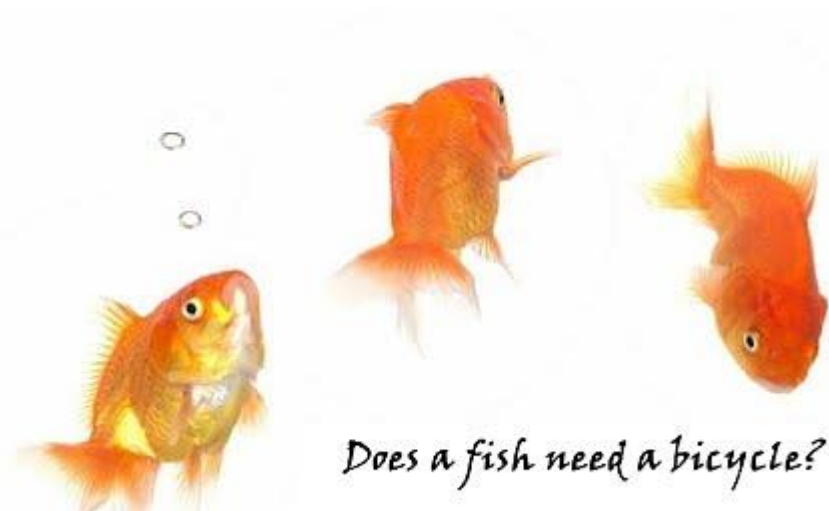
33. Space inversion (see [above](#)) resembles inverting a rubber glove inside-out ([Fig. 3.2](#)), as if you invert inside-out a right-hand glove into a left-hand one ([parity inversion](#)). The rubber glove is depicted with trapped 2D surface (sphere, [Fig. 3.1](#)) in the drawing from Mark Armstrong below. To practice spacetime engineering ([Sec. 4](#)), you should produce specific *quale* from all points on the closed 2D surface (shown with a circle below), and “see” them along all radii, simultaneously in both directions along **W** ([Fig. 3.2](#)), *en bloc*.



Adapted from Mark A. Armstrong,  
*Basic Topology*, Springer, 1997, Fig. 5.7, p. 104

If topology is not your cup of tea, recall the old joke about how to catch a lion in Sahara. If you ask a mathematician, she would probably suggest that, given the existence of at least one lion there, she would drag a cage for lions in the middle of the desert, lock herself up, and then perform space inversion with respect to the cage surface (the circle above), such that all points outside it will be converted inside the cage, and *vice versa*. At the end of the day, she will find herself outside the cage, while the poor lion will be locked inside, and they both will undergo [parity inversion](#). Needless to say, there are many unsolved issues in [Fig. 3.2](#) – the diameter of the physical “cage”<sup>31</sup> (volume of 3D space) tends asymptotically toward *both*  $ds$  ([Fig. 6.1](#)) and its reciprocal “largest” volume of space<sup>13</sup>.

Detailed information will be available only on Christmas 2016, upon request: [Matthew 7:6](#). Personally, I have very modest needs, just a few more “[bananas](#)”, and I don’t need any advanced [spacetime engineering](#), such as unlimited energy<sup>7</sup> by [vacuum engineering](#), etc. I’m fine.



## Addendum

In 1932, [Ernest Rutherford](#), the father of nuclear physics, recalled that “anyone who looked for a source of power in the transformation of the [atoms](#) was talking moonshine”.

There is no sense in offering my “[moonshine](#)” (refs. [35] and [40] in *The Spacetime*<sup>1</sup>, and pp. 59-64, p. 67, p. 77, p. 80 and pp. 89-90 in [gravity.pdf](#)) to people brainwashed by religion<sup>18</sup> – these people are lost forever, like the proverbial priests who refused to look through Galileo’s telescope in order to preserve their precious “faith”. There is no room for any faith in Mathematics (pp. 6-7 in [Penrose\\_diagram.pdf](#)), neither theism nor anti-theism<sup>18</sup>. Nobody would lose his job (p. 4 in [Penrose\\_diagram.pdf](#)) by acknowledging the facts of science (p. 6 in [holon.pdf](#)). Yet many established mathematicians and physicists pig-headedly stick to their “faith” and simply refuse to think ([gravity.txt](#)). God ([John 1:1](#)) does exist, but as *mathematical* object ([Slide 14](#) and Sec. 6, p. 12 in [spacetime.pdf](#)). It is not some “tangent space, which may perhaps be usefully pictured as “[hovering over](#)” the corresponding point in the manifold”<sup>28</sup>, but the very *interface* ‘[here and now](#)’. Simple, no?

It is like talking to a brick wall. So I have to reshape and adjust the presentation of the theory to *very* young mathematicians, even to teenagers who have firmly decided to study Mathematics: “the future lies with youth” (Max Planck, p. 36 in [spacetime.pdf](#)). I do need to unravel the so-called hyperimaginary numbers (Sec. 6 in [CEN.pdf](#)) to eventually have the chance to see the full mathematical theory of spacetime, and specifically the exact form of my evolution equation (Eq. 1 in [CEN.pdf](#)), before I go home (ref. [34] in [spacetime.pdf](#)).

By the end of 2018, I intend to record (provided I am alive and well) three video lectures on hyperimaginary numbers, bearing the provisional titles *Introduction*, *Spacetime Topology*, and *Res potentia*. The first lecture will explain the essence of the theory (Fig. 4 in [CEN.pdf](#)), the second will verify the ‘atom of geometry’ (Fig. 7 in [spacetime.pdf](#)), and the last one will explain the predictions from *Res potentia* and [quantum geometry](#). Kids will be able to watch all lectures on their smartphones and tablets (they don’t like paper, even digital), and I hope the theory will be sufficiently clear to understand the essence of hyperimaginary numbers effortlessly. Give it another ten years, and by the end of 2028 (provided I am still alive and well) I might have a team of very young mathematicians to work on the hyperimaginary numbers, which implies that after another ten years, by the end of 2038, one could hope that my theory of spacetime will see the day of light. Then we shall see whether the evolution equation works. Statistically speaking, however, it is most likely that my new, and still unknown to me, colleagues will find out whether the equation works, because by Christmas 2038 I will be dead old guy age 86, and would rather prefer to drop my deteriorating jacket and go home (case (iii), p. 7 in [CEN.pdf](#)).

## Acknowledgements

I am deeply grateful to Eugene Higgins Professor Emeritus of Physics and Natural Philosophy at Yale University [Henry Margenau](#) for his moral support and encouragement in June 1990, and to my beloved parents Gocho G. Chakalov and Dany Chakalova for their longstanding moral and financial support. They went back home and are now with Jesus.

[D. Chakalov](#)

June 25, 2017, 10:04 GMT

