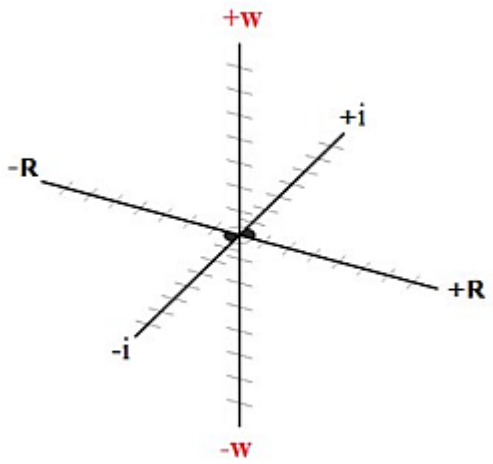

Hyperimaginary Numbers

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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 $|\mathbf{w}|^2 = \mathbf{0}$ — 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

Let me offer a simple experiment to verify the connection of your brain to the Platonic world[1] dubbed *res potentia*. If compared to the physical time read by your wristwatch, *res potentia* would be *atemporal*, in the sense that "its proper time would stand still"[2].

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 is **not** "encoded" in your brain, 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** decay and are **not** governed by the laws of thermodynamics. They do **not** evolve in the physical time[3] read by your clock either. They spring from some kind of 'cognitive vacuum', which belongs to the hyperimaginary *res potentia*. Yes, *res potentia* can act on your brain, 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* 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** below), 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[6] 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[1] 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[4]), stressing that the matrix itself defies any probabilistic (Sic!) description. It does **not** decay nor evolve in the physical time[3] read by your clock.

Imagine that you enter your living room at night, and you switch on the light. If it is a light bulb, it will emit photons with rate app. 1.8×10^{20} photons per second. That's a huge number: 180,000,000,000,000,000,000 photons per second. All photons are identical[5] 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 1.8×10^{20} photons per second, ever? Because of the "matrix" for a photon. It exists with **certainty**. It is *res potentia*.

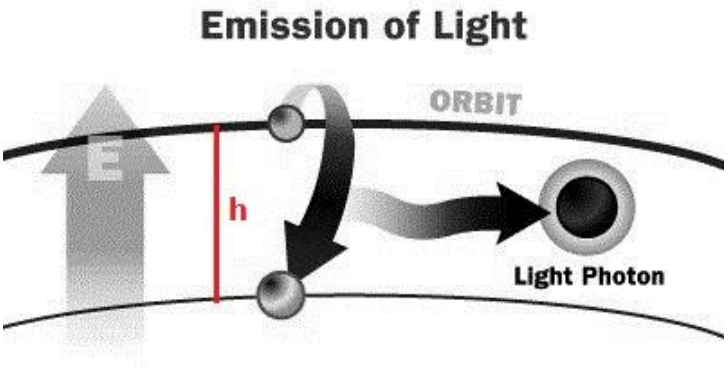


Fig. **1**

As John A. Wheeler[5] 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.

Recall also another mystery of physics, which is also resolved with the Platonic matrix for quantum particles: the most widely known, ever since 1911, public secret in physics, shown at this http URL.

Now let me elaborate on the matrix for a proton[4]. I will reexamine it in Sec. **3**, to explain the *evolution* equation[6] based on hyperimaginary numbers, $|\mathbf{w}|^2 = |\mathbf{m}|^2 + |\mathbf{m_i}|^2$ — the real mass term $|\mathbf{m}|^2$ refers to the identity[5] of protons[4] and to the explanation of mass-energy non-conservation by Paul Steinhardt[7].

The imaginary mass[2] $|\mathbf{m_i}|^2$ provides uncancelled forces[8,9] and free 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[10] (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 observe only the *physicalized* end result from the negotiation: it is **not** squared and is made of positive mass only, as in Einstein's $\mathbf{E = mc^2}$.

Let's go back to the matrix for a proton. As Alex Dolgov[4] 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 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. Physically, the matrix — the "memory" of the physical world — will induce wave-like holomovement[11] without any physical source of such waves, and all biological systems (e.g., the human brain) and quantum-gravitational objects will exhibit **self-action**[10], 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 (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 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**) and leads to dual age cosmology[1]. The evolution equation of the entire Universe is reduced at The Beginning (John 1:1) and at The End to physically meaningless identity '**0** = **0**' (Sec. **3**): once created, the Universe is *already* eternal (physical theology[1]). Namely, at every 4D instant 'here and now' the Universe passes through God at absolute infinity (Luke 17:21). Mathematically, *res potentia* offers 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, resembling our first prenatal stage (Zygote): Time is God's way to keep everything from happening all at once. Hence the future is 'open' to brand new events, up to 'the unknown unknown'. You never know with the future.

Let's see how we can unravel *res potentia* in the 'atom of geometry'.

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 is just a bare 'label', but 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 (again, check out 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 'atom of geometry'. 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[1], we cannot "turn around" and "look" at the cognitive-and-physical vacuum — the 'light source' in Fig. **5** in *The Spacetime*[1] — explicating *res potentia* as the matrix of our world.

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 would probably say. Physicists will perhaps argue that you have hit the so-called Planck scale[12] 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).

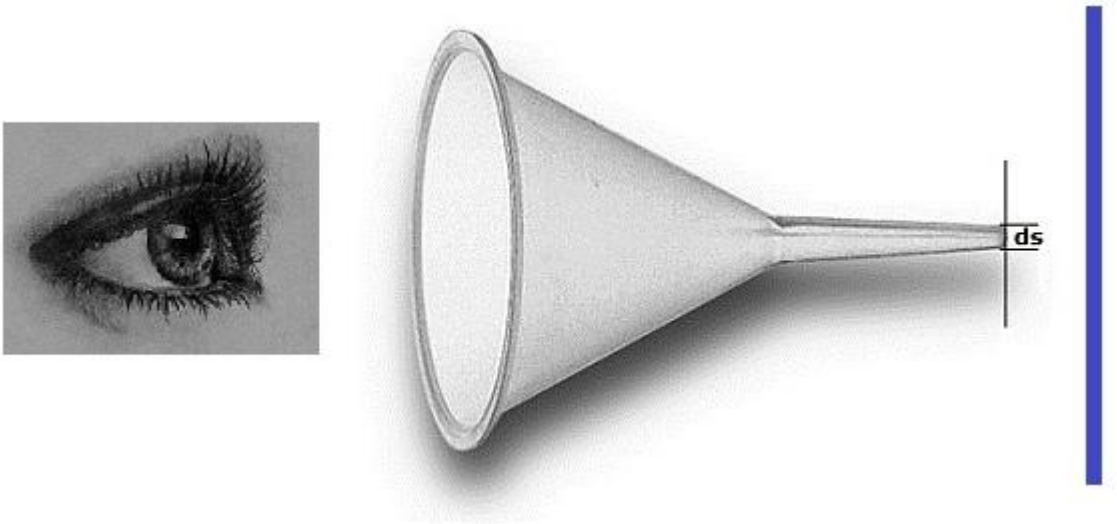


Fig. **2**

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[13]. 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*[1]. 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 Heraclitus river: you could not step twice into the same river.

In the next section, I will introduce a third *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. In the next section, I will use the (ε, δ)-definition of limit and Fig. **2** to introduce the hyperimaginary numbers, and then will explain the evolution equation mentioned above.

Later in Sec. **4** I will elaborate on the mechanism of generating mass-energy 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[7] couples to the entire energy density — not just to energy density difference — and hence gravity "knows" the *indefinable* vacuum energy "**before**" it becomes *physicalized* as positive mass-energy only, to **re**-create the world of tables and chairs around us.

3. Hyperimaginary numbers

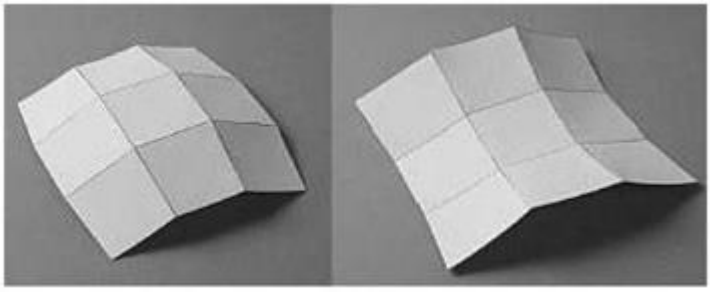
If the alleged 'point' denoted with **ds** in Fig. **2** was physical stuff endowed with metric viz. Archimedean topology (pp. 11-12 in *The Spacetime*[1]), we will inevitably hit the insoluble Thomson's lamp paradox. It is agonizingly clear that we *must* **not** be able to hit the 'atom of geometry' 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 ± 0.037 billion years rooted on the Planck scale[13] at which the spacetime "points" have become *totally* fuzzy and locality has lost *any* meaning[14].

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.

Geometrically, the hyperimaginary numbers should be obtained with 4D sphere ⇔ saddle transitions passing through God at every instant 'here and now' (Fig. **3**).



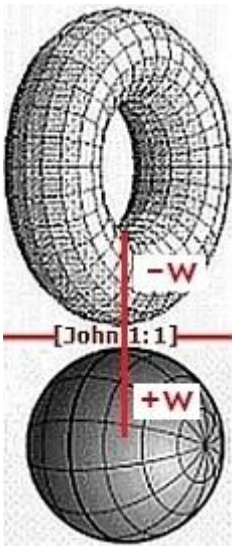


Fig. **3**

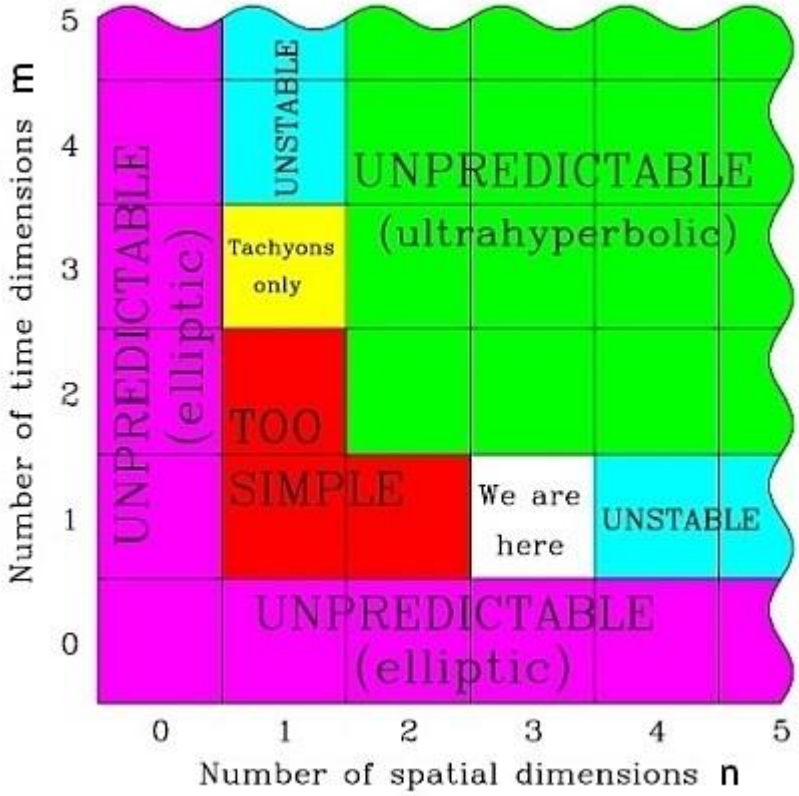
(TBC)

November 7, 2016, 03:30 GMT

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], 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.

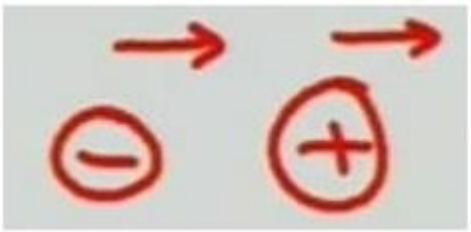
7. Paul Steinhardt explains energy conservation, 17-03-2011; watch 1:36-2:00. https://www.youtube.com/watch?v=tjmNW3mlisE

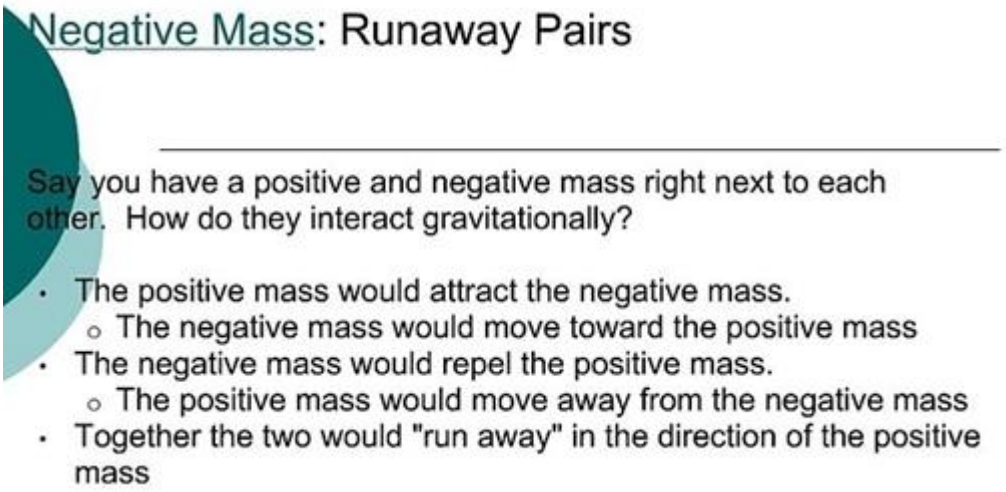
8. W. B. Bonnor, Negative mass in general relativity, *Gen. Rel. Gravit.* 21 (1989) 1143-1157; Scott I. Chase and John Baez, Do tachyons exist? Online paper, September 2015, available at this http URL.

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 ΣP is still zero (I multiplied the equation by 2 to simplify its form)
>
> $$2\Sigma E = 2E_+ + 2E_- = (+M)v^2 + (-M)v^2 = 0 \qquad (2)$$
>
> 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
>
> $$(+M)c^2 + (-M)c^2 = 0 \qquad (3)$$
>
> 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





11. Dimi Chakalov, Holomovement of Fish, December 14, 2015, https://www.youtube.com/watch?v=0YDqxC9fzT4

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 provides the *sufficient* condition for correlating the trajectories of **all** fish, by keeping the matrix as *res potentia* of the holistic school of fish. These two conditions produce 'waves' in the living and quantum-gravitational worlds, without any *physical* source of waves (say, an oscillating drum producing sound waves). A textbook example is 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. Check out also the generation of 'waves' in Fig. **1** above.

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], p. 21.