

Gravitational energy: The wegtransformierbar elephant

Look at the drawing below: what do you see?



Obviously, this is an elephant walking on tight rope, only it fell off at the very **instant** you looked at it, just like Eliot's cat **Macavity**. Which is why we can only *think* about "geodesic" (H. Ohanian and L. Szabados); details in *The Atemporal Platonic World*. Some explanation is obviously needed.

The 'elephant' here stands for the energy of gravity, that is, the energy from geometry: the grin on the face of Cheshire cat, but *without* the cat, as observed by Alice.



Which goes first?

Space acting on matter (telling it how to **move**), or matter acting on space (telling it how to "curve")? Wrong question!

"Space acts on matter, telling it how to move. In turn, matter reacts back on space, telling it how to curve."
J.A. Wheeler in *Gravitation*, p. 5.

See Escher's '**drawing hands**'. Their *atemporal* negotiation is **already re-completed** at every instant from the **metric time τ** .

Thanks to the equivalence principle in GR (MTW p. 467), the influence of gravity can *always* be gauged away at any point. To quote A. Afriat and E. Caccese: "Vanishing is an important criterion: a complex whose components are **wegtransformierbar** cannot be physically real – one whose components all vanish cannot 'coincide' with one whose components don't."

But the two components don't have to "coincide". Instead, "both fluxes cancel, and thus leading to a vanishing 'flux', i.e., $t_{\mu\nu} = 0$." (M. Montesinos). How could this happen? Because, to quote again M. Montesinos, "there is a **balance** (emphasis mine - D.C.) between the 'content' of energy and momentum densities and stress associated with the matter fields (...) and the 'content' of energy and momentum densities and stress associated with the gravitational field (...)"

$$\begin{array}{c} \rightarrow \rightarrow \rightarrow \rightarrow \rightarrow \rightarrow \rightarrow \\ \leftarrow \leftarrow \leftarrow \leftarrow \leftarrow \leftarrow \leftarrow \end{array} \quad (23)$$

... in a precise form, such that both fluxes cancel, and thus leading to a vanishing 'flux', i.e., $t_{\mu\nu} = 0$. Once again, the vanishing property of $t_{\mu\nu}$ for the system of gravity coupled to matter fields is just a reflection of the fact that the background metric is dynamical. More precisely, $t_{\mu\nu} = 0$ tells us that the 'reaction' of the dynamical background metric is such that it just cancels the effect of 'flux' associated with the matter fields. It is impossible (and makes no sense) to have a locally non-vanishing 'flux' in this situation. If this were the case, there would be no explanation for the origin of that **non-vanishing** 'flux' (emphasis mine - D.C.). Moreover, that hypothetical non-vanishing 'flux' would define privileged observers associated

with it (the ether would come back!).”

But what if the ‘balance’ (cf. Eq. 23 above) at $t_{\mu\nu} = 0$ is valid only for **individual** points from the (geodesic) rope above? Can we think of **non**-vanishing ‘flux’ over the entire ‘rope’? Let me reproduce the illustration with a football at p. 5 in *The Atemporal Platonic World*.

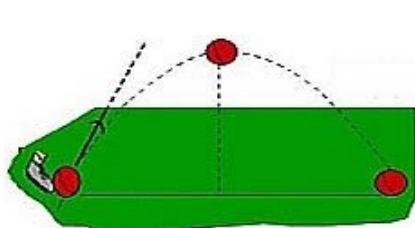


Fig. A

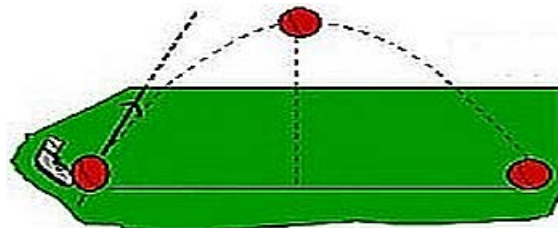


Fig. B

If the football is *gravitalized*, it can acquire “energy and momentum from the gravitational field” (H. Ohanian) and “the *intangible* energy of the gravitational field” (H. Bondi) will become *perfectly* ‘tangible’. For example, the football in Fig. A can *gain* energy-momentum, as shown in Fig. B, or lose it. Moreover, if we kick the football straight up in the air, we will expect at some point to stop raising upward and *go down*, and perhaps hit your head, like *Newton’s apple* falling from an apple tree. But if the football is *gravitalized*, it may continue to fly up in the air with *acceleration*, as if it were propelled by some mythical “*dark energy*” (p. 19 in *Zenon*, and Anomalous Aerial Vehicle at p. 16 in *BCCP*).

Briefly, the ‘balance’ (cf. Eq. 23 above) at $t_{\mu\nu} = 0$ is valid only for **individual** ‘jackets’ from the rope above, because at each and every **individual point/jacket** the *total* energy is exactly **balanced** – **nullified** and hence “conserved” – in the so-called ‘evolution equation’ (p. 4 in *Zenon* and p. 3 in *BCCP*). The quantum-gravitational ‘John’ is *wegtransformierbar Platonic* reality: at any consecutive instant from the *observable* metric time τ (C. Rovelli), the *intangible* energy of the gravitational field (H. Bondi) is *already* (*Sic!*) converted into *perfectly* tangible, localizable **positive** energy in the *right-hand* side of EFE, and the **Platonic** state of gravity, dubbed ‘John’, is *completely re-nullified* – *once-at-a-time* τ , as read with a clock. This is ‘the new normal’ *gravitalized* state at which “the gravitational field delivers no energy or momentum to the nongravitational matter” *anymore* (H. Ohanian). Will do it again, at the *next* instant τ viz. at the **next** ‘new normal’ *gravitalized* state. The general rule is very simple: the **Platonic** world is presented as ‘John’ in *Schrödinger’s cat* and with ‘zero’ in *Macavity cat*. In symbolic terms, $1 + 0 = 1$: the **probabilities** for observing **John’s jackets** sum up *exactly* to 1, whereas the chance to observe ‘John’ itself is *exactly zero*, as with the *wegtransformierbar* elephant above.

The evolution equation (Eq. 1 at p. 3) models the ability of Nature to unleash *unlimited* positive mass in the physical world by *tweaking* the cancellation mechanism producing positive mass, ranging from “positive energy density of about 6×10^{-10} joules per cubic meter” (J. Baez), or even *much* less, to 3×10^{47} joules of energy in less than a minute, in gamma-ray bursts (GRBs). The upper bound (if any) on positive energy release is unknown, as nobody knows how much energy was needed to create the universe at The Beginning (John 1:1).

Point is, forget about ‘energy conservation’, even in a mundane [geodesic](#) ([H. Ohanian](#)). You cannot even dream of “[energy conservation](#)” to ban the monopole & dipole radiation, if any. Forget about [GWs](#). Read p. 24 in [BCCP](#), p. 13 in [Zenon](#), and p. 6 (last) in [How to Bind Matter to Matter](#).

More about ‘negative mass’ from [G. Horowitz](#). Watch the explanation of the balance (*not* conservation) of energy by [P. Steinhardt](#). Notice my proposal to harness the “[anomalous](#)” gravitational rotation in Fig. E at p. 18 in [BCCP](#), and read p. 28 (last) [therein](#).

One last word about “the *intangible* energy of the gravitational field” ([H. Bondi](#)). It is not physical reality placed in the *right-hand* side of [EFE](#), but *atemporal Platonic* reality (see Escher’s [drawing hands](#)), quietly residing “just in the middle between possibility and reality” ([W. Heisenberg](#)). The *atemporal* negotiations between matter and geometry, depicted with Escher’s ‘[drawing hands](#)’ and the Cheshire cat [above](#), cannot be presented with [tensors](#). We need brand new, *not-yet-squared* quantum-gravitational waves: the *gravitalized* ‘cat’ is acting on [itself](#) *via* its own *atemporal Platonic not-yet-squared* state. Geometry alone cannot act on matter: the bare *grin* of the cat, *without the cat*, cannot have “gravitational stress-energy tensor” ([E. Curiel](#)). Matter can only act on [itself](#), like the [human brain](#).

Thus, the *intangible Platonic* world is *not-yet-squared* (recall the [squared spacetime interval](#) Δs^2) yet *physicalizable* reality. It is available to be squared and “collapsed” into positive energy density in the [physical world](#), by dropping there its 4D ‘[jackets](#)’ endowed with metric, once-at-a-time, as read with a clock: see [below](#) Fig. 3 in [How to Bind Matter to Matter](#).

The idea of “[negative mass](#)” appears in physics textbooks only because the Heraclitean *flow* of 4D events is *completely nullified* in these textbooks: there can be no *asymmetry* between the *irreversible* past and the *potential* future in the [squared invariant spacetime interval](#). Subsequently, there is no explanation of [baryon asymmetry](#) and the theory of [baryogenesis](#) sounds like a fairy tale (if not worse, like “[anthropic principle](#)”). The “[negative mass](#)” cannot be *completely* banned with *effective* “[quantum inequalities](#)” or “[weak energy condition](#)”. For if you invoke some timelike vector field or ‘[time-orientability](#)’, you’re applying “[magic](#)”.

How come nothing goes wrong? To quote [A.D. Helfer](#), “why do not perturbations (which are always present) send the field cascading through these negative-energy states, with a corresponding release of positive-energy radiation? It is a matter of common experience that such effects do not occur, or at least not often, and therefore there must be some mechanism restricting the production of negative energy densities, their magnitudes, durations, or interactions with other matter. (...) The present results suggest that any attempt to understand the consequences of negative energy densities for gravity (Hawking evaporation; effect on singularity theorems, area theorem, positivity of Bondi and ADM energies) must take into account [quantum measurement issues](#).”

You can’t argue with facts: read p. 6 in [BCCP](#). As of today, however, the experts in GR are [dead silent](#). Nobody knows how to unite the three types of mass – [positive](#), [negative](#), and [imaginary](#) – into *not-yet-squared* quantum-gravitational waves of *atemporal Platonic world*. The so-called [evolution equation](#) is still in symbolic form, pending the precise formulation of hyperimaginary numbers ($|w|^2 = 0$):

$$|w|^2 = |m|^2 + |m_i|^2 \quad (\text{Eq. 1}).$$

I still don't know how the hypothetical *not-yet*-squared quantum-gravitational waves with *hypercomplex* phase could *cancel* each other, to cast their 4D remnant with *positive energy*. If the negative component $|m_i|^2$ in Eq. 1 and its positive counterpart $|m|^2$ can "runaway" (Robert Nemiroff) to create *self-acting* quantum-gravitational systems and living organisms, perhaps we can understand and explore *the energy density of the vacuum*. Qui vivra verra.

Now, my theory of the *atemporal Platonic world* as the *origin* of gravitational energy is falsifiable, and I will offer a prediction which, if confirmed, will ruin the entire theory. I will refer to the crucial statement about the "dynamics" (if any) of gravity in GR textbooks: the mutual negotiation of 'space and mater' (MTW p. 5). It can be determined at *one* instant only (pp. 14-15 in Zenon). If the gravitational energy could be defined at *two* pointwise instants, m and n , fixing the beginning and the end of an *invariant spacetime interval* $[m, n]$, gravity will become a brand new *physical* field endowed with its own "gravitational stress-energy tensor" that will influence the *stress-energy tensor* of the football in Fig. A and Fig. B above.

Look at the *wegtransformierbar* elephant above. It is impossible *in principle* to observe the origin of gravity along a *finite* interval from the geodesic above. Denote two instants from the *metric* time τ (C. Rovelli) with τ_m and τ_n , $n > m$, for example, $\tau_n - \tau_m = 1$ sec, as read with your clock. Can you present a case in which your clock will read all (infinitely many) *pointwise* instants ("elephants") from the *metric* time τ within 1 sec? If you can show such case (read C.G. Torre), the *atemporal Platonic world* will have nothing to do with gravity, and I will eat my hat. Promise. However, gravity will become *physical* field, like the EM field, the metric will be *frozen* (not dynamical), and will define some brand new "background" spacetime of the non-linear negotiation of the Cheshire cat and its *faceless* grin above, and the non-linear bi-directional determination of Escher's *drawing hands*.

Let me reproduce and explain Fig. 3 at p. 3 in *How to Bind Matter to Matter*. The *atemporal non-squared Platonic world*, called 'It', is quietly residing "just in the middle between possibility and reality" (W. Heisenberg), depicted with the 'bridge' in Fig. 3 below. It obeys the postulate of *locality*, magnified here with *infinitesimal* $dt = 1\text{cm}$ as 'quantum of action' in the so-called 'geodesic' (K. Brown), and also shows the *quantization* of spacetime. The latter is *perfect* continuum of 4D events, because no *physical* stuff can be inserted "inside" the *infinitesimal* dt – only the non-squared *wegtransformierbar Platonic world* 'It'. Notice that the 'bridge' below is interpreted as pre-geometric and non-differentiable *Platonic* "glue" made by the *entire* Universe as ONE.

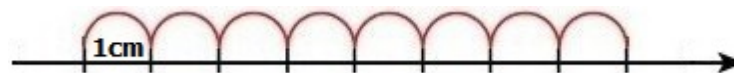


Fig. 3

NB: Forget tensors (p. 19 in Zenon). We need the *atemporal Platonic world* of non-squared quantum-gravitational waves and their fleeting "eigenstates". We need new *Mathematics*.

Recall *Albert Einstein*: "I want to know God's thoughts – the rest are mere details." Replace 'God's thoughts' with the *atemporal Platonic world* called 'It', and keep in mind that the chance to observe 'It' is *exactly zero*, as explained with the general rule at p. 2 above. This rule is crucially important, because 'the quantum state' dubbed *John* is *wegtransformierbar* as well: read Erwin Schrödinger at p. 6 in BCCP. Last but not least, the *wegtransformierbar atemporal Platonic world* 'It' is *conditio sine qua non* for all living organisms, such as the *self-acting human brain*. Without 'It', you will be left with two idiotic options: either the brain above your neck is some "super computer" or a chunk of gray matter haunted by some parapsychological "ghost" (p. 1 in *How to Bind Matter to Matter*). The choice is yours.

To avoid misunderstandings, consider an experiment with the ‘intangible’ (H. Bondi) energy of your **self-acting human brain**, demonstrating your non-verbal processing of mental images (A. Paivio). Imagine two digital clocks, A and B. Clock A shows 10:45 and Clock B shows 13:25. Convert them to analog clocks, and “look” at their mental images: which *angle* between the short and the long hands is greater? In Clock A or in Clock B? To deliver the answer, your brain must do work. Not your mind or ‘**stream of consciousness**’. Your **brain** does the job. In GR parlance, you may claim that, before the experiment, your brain was in some ‘free falling’ state along a ‘**geodesic**’, but to deliver the answer your brain had to “deviate” from its “**geodesic equation**” by producing work on **itself**, by *perfectly* ‘tangible’ (H. Bondi) energy. No, your brain does not become “**curved**”. Not a bit. It is bootstrapped and EPR-like (H. Stapp) correlated by its own *atemporal* **Platonic** state – not by some “**super computer**” or by some parapsychological “**ghost**”. And yes, your *atemporal* **Platonic** state has ‘**mental correlate**’ or **qualia**, called **mind**, **stream of consciousness**, **volition**, etc. Read *The Doctrine of Trialism*.

To cut the long story short, notice that the Heraclitean *arrow* of events (Fig. 3 [above](#)) is based on two conditions: necessary condition (‘change in space’ as local or **coordinate time**) and *sufficient* condition (‘change **of** space’ pertaining to the global **Platonic** time), explained at pp. 3-4 in *How to Bind Matter to Matter*. The two conditions are blended like a **Platonic** “hand” in 4D “glove” (pp. 5-6 in *Über die Substanz von Raum und Zeit*). The **Platonic** “hand” must be *wegtransformierbar* as well, or else there could be some *physical* origin of the Heraclitean *arrow* of events viz. some *physical* phenomenon at **absolute rest**, being the ‘engine’ of the *arrow* of events. Instead, I suggest the *atemporal* **Platonic world** called ‘**It**’, and **localizable** quantum-gravitational ‘**jackets**’, like the **Platonic** “hand” in 4D “glove”.

If you are interested in **life sciences**, look at your **prenatal brain** below and keep in mind that soon it will grow with the rate of about **15 million nerve cells per hour**, and later your brain will create roughly **1,000 trillion** synaptic connections, so that now you can read and **think**. The situation with our ‘**very early universe**’ is very similar, because its **initial conditions** and well-posed **boundary value conditions** *could not* (Sic!) exist in the ‘very early’ “glove” below, and certainly not earlier at the **Planck epoch**, just 10^{-43} sec after The Beginning at time **zero** (**John 1:1**). Simple, isn’t it?



As **Fred Hoyle** remarked (C3 at p. 8 in **Zenon**), the random emergence of even the simplest cell matches the likelihood that a tornado sweeping through a junk-yard might assemble a Boeing 747 from the materials therein.

For the record: I suggested ‘*atemporal* quantum reality’ 33 years ago, on 5 February 1987, ensuing from the interpretation of QM by **Henry Margenau** from 1954, the transactional interpretation (**TIQM**), and the first off mystery in QM from 1911, thanks to **Charles Wilson**. Read p. 4 in *Penrose-Norris Diagram*, as well as **R. Penrose** and **S. Weinberg**.

Watch 'Spacetime Engineering 101' (app. 22 min, password protected), from 15 January 2020. To obtain the password, follow the instructions at pp. 2-3 in *Spacetime Engineering*.

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