



Everything changes and nothing remains still —
you cannot step twice into the same stream.

[Heraclitus](#). *Wikipedia*, 2021

The Arrow of Spacetime

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The principle of locality (p. 27 in the manual¹) asserts that an object is directly *influenced* only by its [infinitesimal](#) surrounding. Fine. But how come this ‘influence’, called causality ([Wikipedia](#)), points to only *one* “[direction](#)”, as noticed by [Heraclitus](#)? Most importantly, why there is *any influence* in the first place⁴? Enter the *arrow of spacetime*² (p. 5).

To commemorate the seminal talk by Hermann Minkowski *Raum und Zeit* on 21 September 1908, I invited in June 2008 many [theoretical physicists](#) to my talk *The Arrow of Spacetime* on 21 September 2008: see p. 6 and ref. [16] in the manual¹. I will explain the crux of my talk, ensuing from the Heraclitean river [above](#). It is perfectly hidden by the invariant and *non-relational*⁴ “speed” of light ([Wikipedia](#)). With light, we can see only the irreversible past ([Fig. C](#)). We cannot in principle detect the *elementary cycle* of the global Heraclitean Time ([Slide 1](#)): see Fig. 4 on p. 5 in the manual¹. If we could, the *atemporal Platonic*

Ether⁴ (p. 22 in the manual¹) will be exposed to physical observations, which will demolish the theory of relativity. Let me start *ab ovo* (p. 5).

Suppose a cat is walking with speed 1m/s, relative to the man on the floor at rest (Fig. A). The man is standing still and does not "consume" space, like the car in Fig. B. Where is the *arrow of spacetime* (Fig. C)?

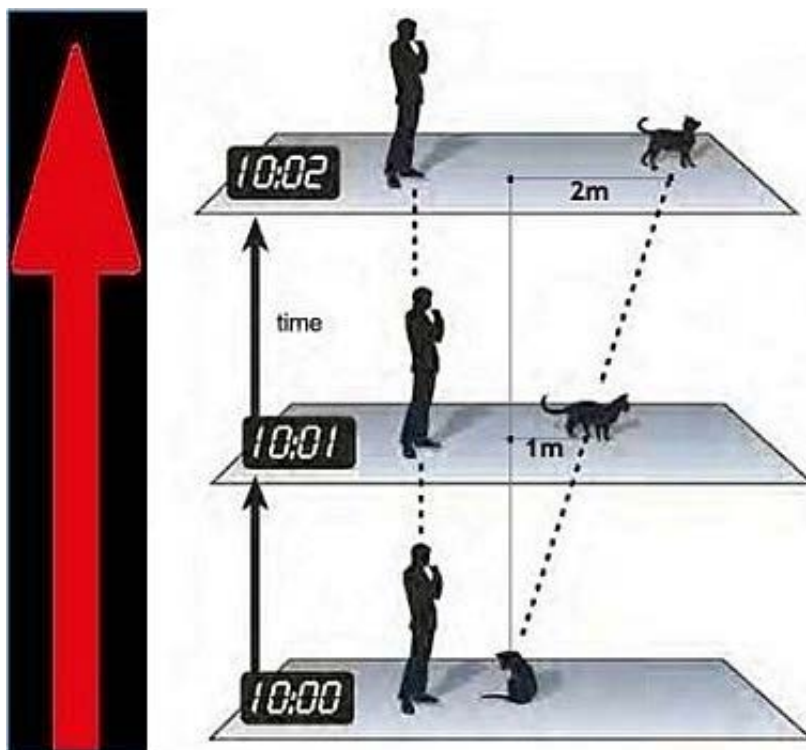


Fig. A. Read pp. 37-39 in [GR_textbook.pdf](#).

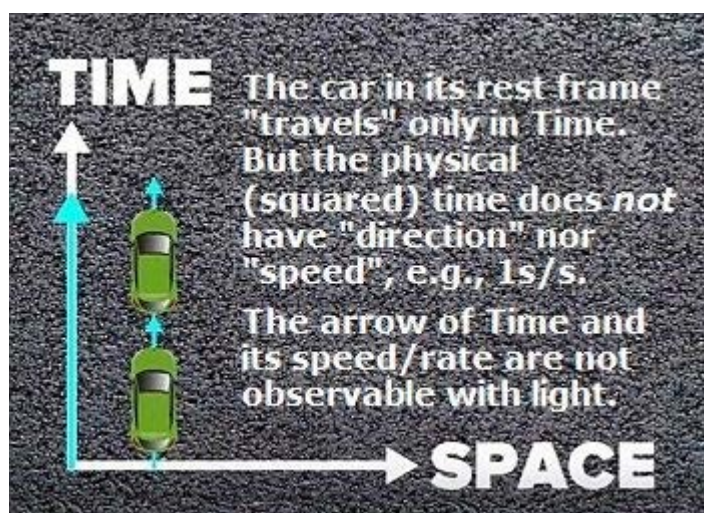


Fig. B, adapted from [Don Lincoln](#).
See Fig. 9a and Fig. 9b, and pp. 8-9 in [Intro.pdf](#).

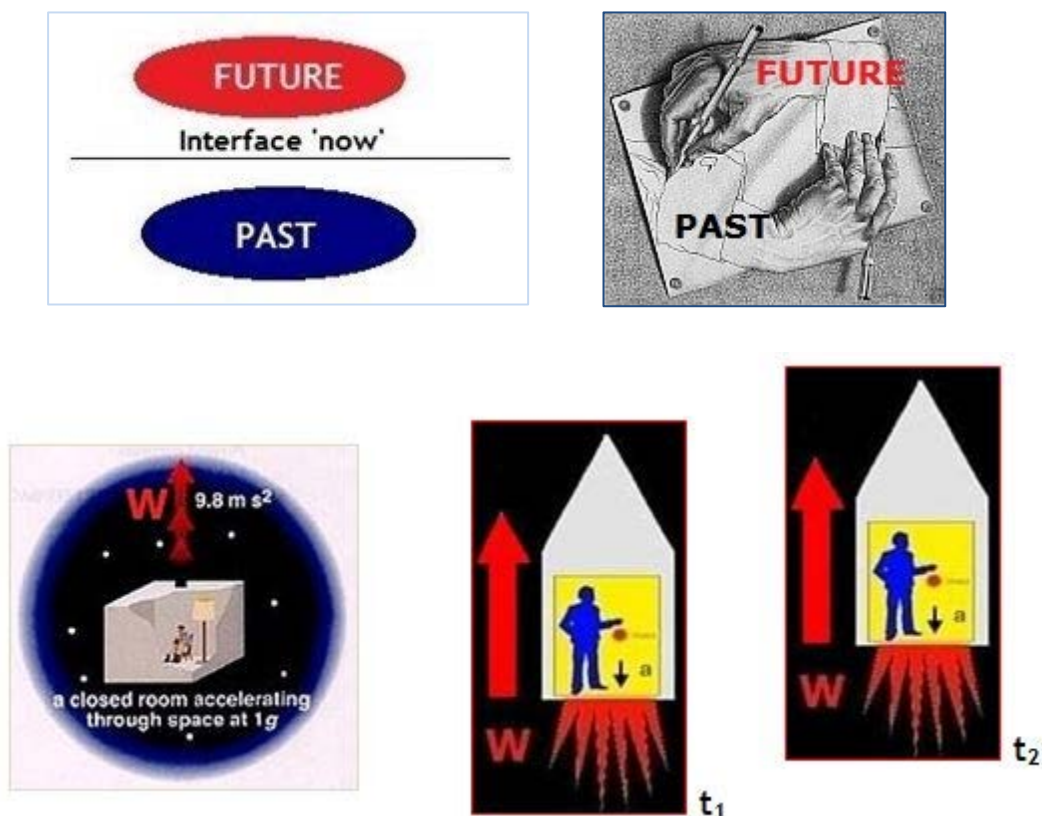


Fig. C. See Fig. F [below](#) and Fig. 7 on p. 11 in the manual¹.

The *arrow of spacetime* (Fig. C) is *non-relational*⁴, like the “speed” of light ([Wikipedia](#)). They both exist, but cannot be seen with light. We can only demonstrate evidence (not proof) of the *arrow of spacetime* – a global *atemporal* phenomenon working “outside” 4D spacetime, depicted with the black strips separating the instantaneous snapshots (the two states of the rocket in [Fig. C](#)) from a movie reel (Fig. D).



Fig. D. Read p. 24 in the manual¹.

The black strips in Fig. D belong to the global *atemporal* Ether in which the photon is ‘at rest’ and its proper time is **zero**: “A photon arriving in our eye from a distant star will not have aged, despite having (from our perspective) spent years in its passage” ([Wikipedia](#)).

As a concrete example of the global *atemporal* phenomenon² working “outside” 4D spacetime (dubbed **matrix**, p. 5 and p. 9 in the manual¹), recall the global *atemporal* phenomenon of *creating and calibrating* the *invariant* spacetime interval (Wikipedia), based on the *ideal* (Sic!) rods and clocks *pre-built* in 4D spacetime (MTW p. 397). Imagine for example that Fig. D shows a rod of 1m, which is trespassed by the cat in Fig. A for 1s. How is the invariant *ideal* rod-and-clock³ *calibrated*?

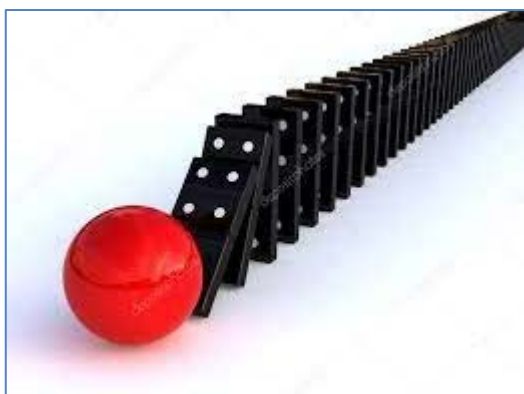
Let’s compare cat’s travel time of 1m/s (Fig. A) to light’s travel time. Suppose the separation in 4D spacetime between the two states of the rocket in Fig. C above matches 1s in Fig. A, i.e., 10:01 - 10:00 = 1s and $t_2 - t_1 = 1s^3$ in Fig. C. This 1m/s (Fig. A and Fig. D) matches 1m per 3.3 ns of light-travel time. To quote E.F. Taylor and J.A. Wheeler: “We assume that every clock in the latticework, whatever its construction, has been *calibrated* (Sic! - D.C.) in meters of light-travel time.”



Metaphorically, think of the global *atemporal* **matrix** as a Platonic ‘**hand**’ perfectly embedded in its 4D ‘glove’ (Fig. E). With light, we see only the physical **self-acting** glove, empowered by the **fifth force**². Read p. 7 and pp. 24-26 in the manual¹.

Fig. E. Read Addendum 1 at pp. 7-9 in *Spacetime Engineering 201*.

Calibrated? By *what*? By the **matrix** of spacetime above. Not by “Him” .



The Platonic ‘**hand**’ lives only in the potential **future** (Fig. C). It is the primordial Unmoved Mover² (Fig. F) inside *the* causal *influence* (p. 1) from the **Heraclitean river**. With light, we *cannot* see Eliot’s cat **Macavity**. We only see the **past** in Fig. C *post factum*, such as the **balanced** apples in Fig. G.

Fig. F

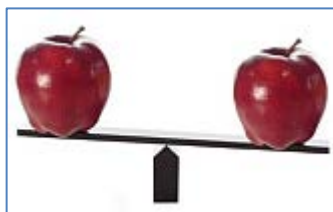


Fig. G. Re-balanced gravitational mass-energy.

To sum up, the arrow of spacetime² suggests non-trivial topology of spacetime incorporating a **Platonic** *atemporal* phenomenon “outside” 4D spacetime, dubbed **matrix** (p. 4). The local properties of matter and fields should be bundled with the nonlocal global properties of the entire spacetime *en bloc*, following the rule ‘think globally act locally’ (p. 18 in the manual¹). Hence the entire Universe can be modeled as a **brain** (p. 7 in *The Fifth Force*). The task is **strictly mathematical**.

Everybody can learn spacetime engineering. It is a very simple skill, like learning to juggle three balls in the air (p. 8 in the manual¹). All you need is available at my [website](#).

References and Notes

1. D. Chakalov (2021), *Notes on Spacetime Engineering*.

<http://www.god-does-not-play-dice.net/SE.pdf>

2. The *arrow of spacetime* (Slide 1 and Slide 2) is empowered by the **self-energy** of the Unmoved Mover (Wikipedia). This is the **fifth force**. A rough estimate of the **fifth force** in the **human brain**, facilitated by brain’s *atemporal matrix* (p. 4), is suggested on p. 25 in the manual¹.

3. To explain the *ideal* (Sic!) rods and clocks *pre-built* in 4D spacetime (p. 4), suppose they did not exist. Then the time interval 1s, measured with the clock of the man at rest in Fig. A, will have to be assembled by *exactly* 9,192,631,770 vibrations of a cesium atom, which must be also at absolute zero temperature (Wikipedia). No way. One cannot assemble *exactly* any number of vibrations: there will be always ‘gaps’ between them, as shown in Fig. D. Ergo, the *atemporal matrix* (p. 4) of *ideal* (Sic!) rods and clocks, *pre-built* in 4D spacetime, does exist. It is a **Platonic** form of reality, “just in the middle between possibility and reality” (Werner Heisenberg). It has been calibrating the 4D spacetime ever since the Beginning (Slide 12). In short, the metrology of Nature,

by which it creates and *calibrates* the universal standards for 1m and 1s, *cannot* be based exclusively on matter. The *invariant* “speed” of light and spacetime interval cannot be created and *calibrated* with matter alone. On a side note, the *atemporal matrix* (p. 4) may have a distinctive *qualia*, which is the crux of spacetime engineering. RDFM¹.

4. The *non*-relational phenomena (Fig. C) are very difficult to explain, because we have to introduce some perplexing caveats as well. For example, if we try to visualize the *non*-relational speed of light, we have to do it *relationally*, with respect to some unphysical Ether, but then we stress that the Ether is not *physically* observable (Wikipedia). We pictured it here with a **black** background around the **red** arrow in Fig. A and around the space rocket in Fig. C, and with the river banks at “absolute rest” in the drawing of the Heraclitean river (p. 1), and also with the background of the billiard balls, including the black separating strips, in Fig. D. Thus, the statement “we move through spacetime at the speed of light” (Fig. B) is correct, but the ubiquitous ‘motion’ is *non*-relational. The same applies to the origin of inertia depicted with the rocket in Fig. C – the *non*-relational ‘motion’ of the entire 4D world up↑ (Slide 2) cannot be observed with light. Otherwise the *atemporal Platonic* Ether (p. 22 in the manual¹) will be exposed to physical observations, and the theory of relativity will be demolished.

What is ‘moving’ the entire 4D world up↑ (Slide 2) and making it ‘fly’ (John Wheeler) through spacetime at the “speed” of light (Fig. B)? The Unmoved Mover². **It** (not “He”) is the primordial ‘influence’ (p. 1).

Also, the Unmoved Mover² is pictured with a **red** ball in Fig. F, which is *not* directly observable either – we can only infer the existence of a Platonic ‘**hand**’ perfectly embedded in its 4D ‘glove’ (Fig. E). This is why the *atemporal* mechanism by which the gravitational mass-energy is **re**-balanced (Fig. G), cannot be traced online in 4D spacetime, just like Eliot’s cat *Macavity*. The same applies to *gravitation-and-rotation*, created by the global properties of the entire spacetime *en bloc* (p. 5).

With light, we see only 4D “jackets” of the *atemporal Platonic* world. With light, we see only a **self-acting** 4D ‘glove’ (Fig. E) in the ‘train’.

For more, read the note on *physical theology*. It is perfectly possible that God as Love (1 John 4:8) exists, yet we cannot prove nor disprove it with a theorem. Thank God, this is impossible.

Alternatively, watch [Brian Greene](#) on [November 10, 2021](#). He will try again to speculate about time, in which the past, present, and future “exist all at once” (no joke, the guy is serious). The only reason we experience the *flow* of time was thermodynamics ([Wikipedia](#)): if you open the window of your living room during winter, you will get cold.



R.K. Sachs and H. Wu, *General Relativity for Mathematicians*, New York, 1977, p. 27: “The requirement of [time orientability](#) is suggested by our knowledge of thermodynamical processes on the earth, now. The second law of thermodynamics implies that one can distinguish past directions from future directions on earth by measuring the increase in entropy. It seems somewhat reasonable to assume that thermodynamics will smoothly determine future directions in the whole universe.”

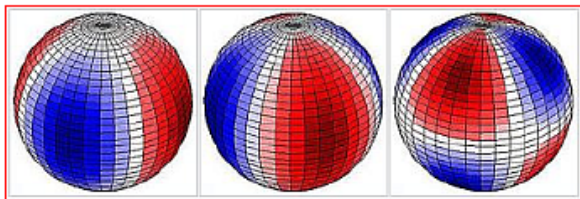
This is why we experience the *flow* of time. As Murphy once noticed, complex problems have simple, easy to understand, wrong answers.

Finally, let me address a question which probably many people have: do we need to speculate about the ongoing [calibration](#) of the invariant spacetime interval ([p. 4](#))? This is a very complex and intricate problem, since the inception of GR in November 1915, as it goes straight to the puzzle of how the spacetime could [act back on matter](#) — “there is no mutual action of gravitational fields *on* matter” ([Hans Ohanian](#)). We must solve this puzzle to eventually understand the [origin of gravity](#).

My solution is the *Gravitationsfeldrelativitätstheorie* called [Relative Scale \(RS\) spacetime](#): read p. iv and p. 14 in [Intro.pdf](#). Recall the global Heraclitean Time ([p. 1](#)): what creates Time in the rest frame of all objects ([Fig. B](#))? The [Unmoved Mover](#). All efforts to suggest *physical* origin of Time will immediately lead to ‘[turtles all the way down](#)’. The only possible cutoff, suggested in [2008](#), is the Unmoved Mover ([Fig. F](#)).

Now we can add the power of the Unmoved Mover: the [fifth force](#). It comes from the Platonic ‘[hand](#)’ — not from its 4D ‘glove’ ([Fig. E](#)). In the RS spacetime, the flow of Time, as experienced by objects at rest ([Fig. B](#)), and the so-called “[free fall](#)” are driven by the *non-relational*⁴ [fifth force](#) of ‘the moving matter continuum’ ([Zhaoyan Wu](#)). Time is universal and applies equally and instantaneously to all objects with [positive mass](#), regardless of their weight, structure, etc. [Simple, no?](#)

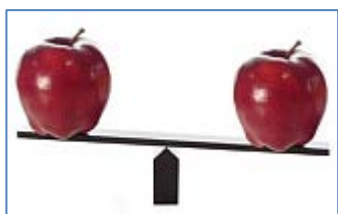
As I stressed on various occasions, an apple can fall from a tree iff the apple and the tree are experiencing **gravitational rotation**. An example of the obvious force-and-spin of gravity is delivered by the **Earth tides**. Can't explain them with some "geodesics" and "free fall" (0.08-1:08).



If GWs transport energy, they will be *physical waves*; if GWs *cannot* transport energy, they will be some parapsychological ghosts. This is the dilemma in **GW parapsychology**.

The **Christoffel symbols** cannot rotate the Earth *and* pull up↑ rocks.

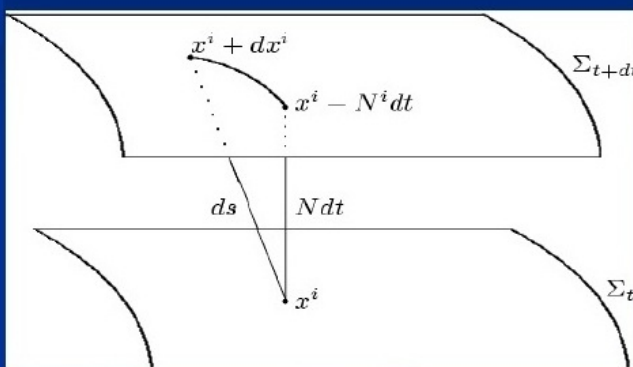
Yes, "there must exist physically correct and unique energy-mom. and spin tensors in nature" (Friedrich W. Hehl), which is why I suggested the so-called *evolution equation*: read p. 28 in *The Physics of Life* (Intro.pdf) and my essay on **physical theology**. The aim is to eliminate the "mystery matter" by a *balanced non-conservation* of the positive, imaginary and **negative** mass; details from Y.P. Terletsii.



Click the *balanced* apples to read an **illustration** of the *evolution equation*. It is still in symbolic form, pending the precise formulation of the so-called *hyperimaginary numbers* ($\mathbf{W}^2 = 0$).

To sum up, let me compare the idea of Time in Fig. C with the **ADM hypothesis** in which each of the "leaves" of the foliation of spacetime below are *welded together* only by matter and fields. **Nothing else**.

- In addition to the two variables γ_{ij} and π_{ij} there are two Lagrange multipliers called the lapse N and shift N_i .
- These describe how each of the "leaves" Σ_t of the foliation of spacetime are welded together.

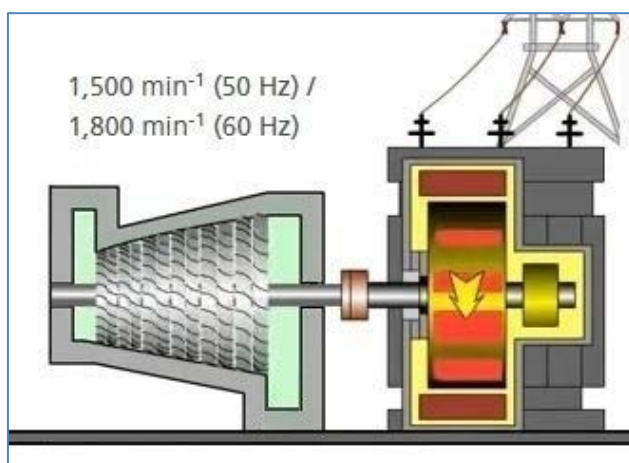


In our theory, the “leaves” shown with the black balls in Fig. D are *welded together* by both matter and fields (the 4D ‘glove’) and the Unmoved Mover pictured as Platonic ‘hand’ (Fig. F). Thus, the fifth force (p. 5) is always “dressed” by quasiparticles with positive energy density from the physical 4D ‘glove’ (Fig. E): no “intangible energy” (Hermann Bondi). With light, we cannot detect the “vertical” shift in the infinitesimal transition ($t_1 \rightarrow t_2$) in Fig. C, which is why we enjoy a perfect 4+0 D continuum cast in the irreversible past (Slide 1). In the doctrine of *trialism*, the common source of matter and psyche (dubbed ‘trunk’) is *not* comprehensible with our cognition. Also, we can never predict the future, as it includes the *unknown* unknown.

Yes, the monads are real, but have no “windows”. *Soli Deo gloria*.

Addendum

I am ready to put my theory of spacetime engineering on experimental test, and on 21 January 2022 I contacted many laboratories in the EU. The theory suggests a miniscule initial magnitude of the fifth force² in order to interact with the human brain (photo 2), perhaps in the range of the Casimir force or smaller. Point is, the physicalized fifth force, manifested only by the 4D ‘glove’ (Fig. E), is *unbounded* above, which means that the energy of the 4D ‘glove’ can in principle be unleashed to the enormous force of Earth tides (p. 8). And perhaps *much more*. Can the fifth force produce clean energy?



My proposal for producing unlimited electricity is based on gravitational rotation, as gravity can rotate a *whole galaxy en bloc*. Just spin the steam turbine rotors in the power plants with spacetime engineering. There is no need for water supply, heat, nor coal or poisonous nuclear fuel. Is this possible? *Why not?*

To watch the video *Spacetime Engineering 201*, follow the instructions (1)-(2)-(3) at p. 5 (last) in [explanation.pdf](#). The proponents of so-called ITER hope to reproduce the effects of “apples” (quantum tunneling) with some *very hot* “oranges”, and want **over €22 billion** — our money taken from our taxes — to get their Barbie. Are we stupid and gullible?

NB: The crucial effects from quantum tunneling ([Wikipedia](#)) *cannot* be substituted with a pressure cooker. The confining force of Sun's gravity is *completely different* from the [attractive force between planets](#).



Billions and BILLIONS of euros — our money earned with hard labor — will be wasted. There is nothing I can do to stop this [pathetic exercise](#). This is how [ITER](#) looks today, near Saint-Paul-lez-Durance in France:



What can we make from these buildings? Wine cellars maybe?

Send your suggestions to ENER-D4-SECRETARIAT@ec.europa.eu, cab-public@iter.org, itercommunications@iter.org, renatas.mazeika@ec.europa.eu, ian.chapman@ukaea.uk, nick.holloway@ukaea.uk, and tim.luce@iter.org.

Again, the alternative to [ITER](#) is based on the [force-and-spin](#) (p. 9) in my theory of gravity (pp. 7-8). The alteration of [the rate of time](#) is not the cause of gravity. Read [MTW p. 467](#) and pp. 5-8 in [Can Geometry Produce Work](#). My theory is inevitably speculative due to the reasons explained by Friedrich Hehl (p. 8) and [Richard Feynman](#). But at least the theory is not *manifestly false*, like the one used by [ITER above](#). And if at the end of the day I fail to produce [unlimited electricity](#), I will waste only my own cash, as I am independent researcher and do *not* accept any donations, in any shape or form. See [the difference?](#)

I need to [put the facts on the table](#). However, nobody has replied to my numerous inquiries since January this year ([labs.pdf](#)). To my utter regret, I do not have the chance to conduct the experiments at some renowned technical laboratory, and will not have their confirmation. Now I have no choice but to announce on [23 June 2022](#) the following:

Watch <https://vimeo.com/xxxxxxxxx>



No "*intangible* energy" ([Hermann Bondi](#)) or "[negative mass](#)" was used. Only [vacuum energy](#) and [quasiparticles](#), as proposed in my theory (pp. 7-8). And I didn't use [billions of euros](#) to deliver *the proof of concept*. We need unlimited clean energy and spacetime engineering may be *the only* chance to avoid the [climate catastrophe](#). **Time is running out!**

Post scriptum

Today is June 23, 2022. Nobody from the laboratories in Germany, Switzerland, Spain, Austria, France, The Netherlands, Greece, and Italy ([labs.pdf](#)) responded to my inquiries about experimental work. That is why the [BCQT experiment](#) was *not* carried out in [April](#), as I expected on 12 February 2022 – the future is unpredictable. Sorry, I can offer only my demo recorded at my home (p. 11), and can only hope that my visitors at Vimeo will not accuse me of using "animation software" or some "special gadgets". I'm not trying to "entertain" people with some [fake tricks](#). I am running for [Nobel Prize in Physics](#).

If you wish to watch my demo at [Vimeo](#) about the [fifth force](#), follow strictly the instructions (1)-(2)-(3) at p. 5 (last) in [explanation.pdf](#). First things first. Then I will upload the video at Vimeo and will send you the link. Recall that on [17 August 2017](#), 70 observatories detected EM radiation (short gamma-ray bursts), which could have originated from the *gravitational fifth force* (not the [news tensor](#)) propagating in [mixed](#) (longitudinal and transverse) modes. If true, there might be a [theoretical possibility](#) to *create* (Sic!) mass-energy and transport it with *gravitational quasiparticles*: read the idea at [p. 9](#). Yes, I believe can suggest a new path toward [quantum gravity](#), based on experiments and observations, similar to the “anomalous” fact that stones can fall from the sky (p. 4 in [video.pdf](#)). It’s [a long way to the top](#), however.

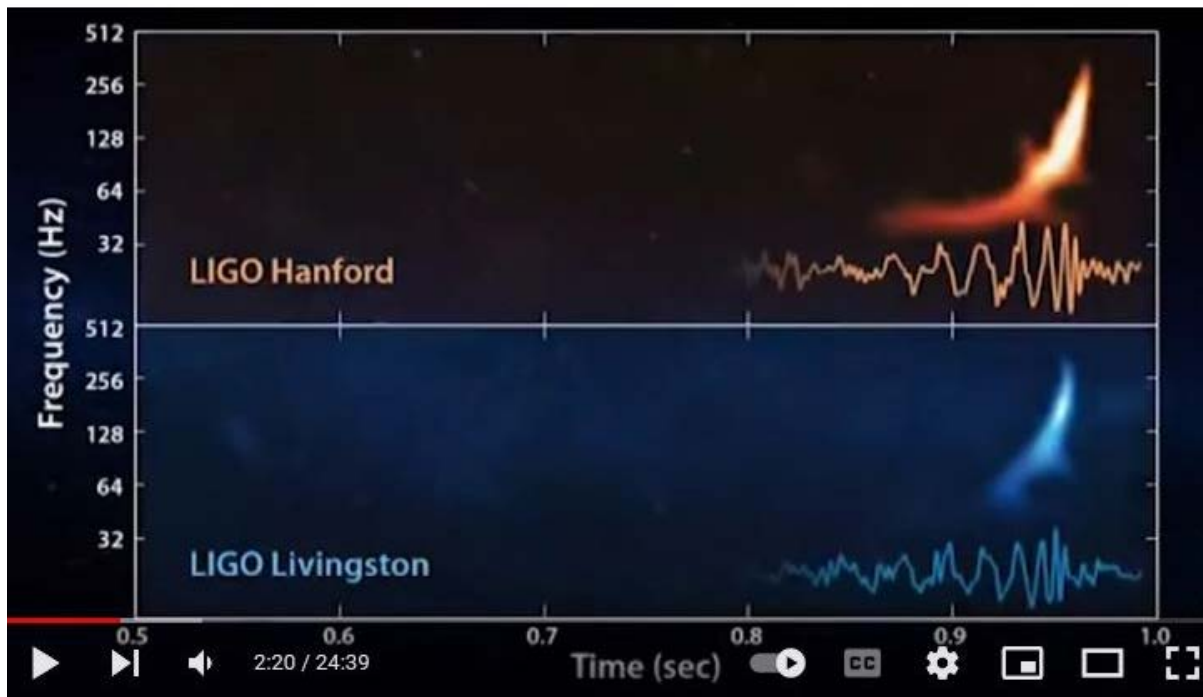
Meanwhile, the gigantic pathetic enterprise called ITER ([pp. 9-10](#)) is slowly moving toward its [dead-end](#), like a [multi-billion euro](#) Titanic. There’s none so deaf as those who will not hear. Sorry.

Finally, let me share a story from June 1972. I had a beautiful feeling that I’ve managed to “understand” the so-called [fictitious force in GR](#), after studying gravity for almost five months, since January 1972, at age 19. This precious gut feeling gradually faded away and completely disappeared. We still [do not know](#) how geometry [acts back on matter](#). Gravity is *not* a ‘[natural force](#)’. It can’t explain the [Earth tides](#) ([p. 8](#)).

How about the [fifth force](#) ([Fig. E](#))? If it was a mundane physical force like the previous [four fundamental forces](#), it will have to be “[dark](#)”. Read [p. 8](#) and Addendum 1 on pp. 7-9 in [Spacetime Engineering 201](#). Yes, I am running for [Nobel Prize in Physics](#). We need [Mathematics](#).

How much ‘[energy from geometry](#)’ is needed to pull up↑ the physical, [4D partition](#) of the universe along the *arrow of spacetime* ([p. 1](#))? In terms of energy density, it might be about 10^{-9} joules per cubic meter ([John Baez](#)). It is the [fifth force](#) of the physicalized *quasiparticle* ([p. 9](#)) which animates the entire 4D ‘glove’ ([Fig. E](#)): only matter can interact with matter. Ditto to the human brain² ([photo 2](#)), but in this case the fifth force should be stronger, perhaps in the range of [Casimir force](#). And if the *variable* fifth force ([p. 8](#)) springs from the [vacuum](#), we could unleash it to the magnitude needed to spin the steam turbine rotors in the *current* power plants ([p. 9](#)). There will be no need for new nuclear reactors to reach “[carbon neutrality in 2050](#)”. We may have it in [2030](#). Forger [ITER](#).

BTW since I mentioned gravitational radiation, see the “official” story.



Something strange happened on 14 September 2015. People called it GW150914 and claimed that it was “by far the most powerful explosion humans have ever detected except for the big bang” (Kip Thorne). But it was *totally* silent, because “a vacuum BBH merger does not produce any EM or particle emission *whatsoever*” (p. 9 in [arXiv:1602.08492v4](https://arxiv.org/abs/1602.08492v4)).

Moreover, despite the fact that we know nothing about the wave pattern of *very strong GWs* in the immediate vicinity of “the most powerful explosion humans have ever detected”, Kip Thorne and his *collaborators* believe that the same *totally unknown* GW pattern was *absolutely not* (Sic!) altered due to *non-linear interactions* of strong GWs with matter and fields in the cosmos for over one billion years (it should be *many more* years, cf. B. Schutz) before being detected on 14 September 2015, so that now you can see the beautiful drawing [above](#).

Are we so stupid and gullible? Einstein’s GR is *essentially incomplete*, firstly because it cannot explain how the spacetime could *act back* on matter by “telling it how to move” (MTW p. 5) – “there is no mutual action of gravitational fields *on* matter” (Hans Ohanian). According to GR textbooks (MTW p. 467), the *wegtransformierbar* gravity is not a ‘natural force’ (Zhaoyan Wu). It cannot explain even the *Earth tides* (p. 8). It is still a work in progress. Nobody can claim that GW150914

has “confirmed” *anything*. You just don’t know how gravity works; for example, how gravity transports mass-energy by EM radiation (p. 12). The *linearized approximation* of gravity is for the birds. What if the non-linear gravity can transport *force-and-spin* as well (p. 9)? Voila.

The only thing *GW experts* know for sure is that “*gravitons*” are very easy to produce, as explained eloquently by the *Nobel Laureate* Kip Thorne in his tantalizing essay *Gravitational Waves and Experimental Tests of General Relativity* from 7.09.2012, pp. 31-32:

Exercise 27.8 Problem: Gravitational waves from arm waving
Wave your arms rapidly and thereby try to generate *gravitational waves*.

(a) Compute in order of magnitude, using classical general relativity, the wavelength of the waves you generate and their dimensionless amplitude at a distance of one wavelength away from you.

(b) How many gravitons do you produce per second?

Fascinating experiment, straight from the horse’s mouth. I strongly recommended it to all GW experts in [arXiv:2103.08520 \[gr-qc\]](https://arxiv.org/abs/2103.08520). If they are too lazy to wave their arms “rapidly” and “generate gravitational waves”, surely they can compute, using “classical general relativity”, how many “*gravitons*” are produced by an average *Hummingbird*.

Anyway. I will leave Kip Thorne to simmer in his own sauce. I raised my voice 19 year ago, on [19 February 2003](#), and offered my critical opinion on [17 July 2005](#). It was immediately deleted. Can’t talk with *Russians*.

Read again *RS Spacetime* and its *calibration* at p. 4. Simple, isn’t it?