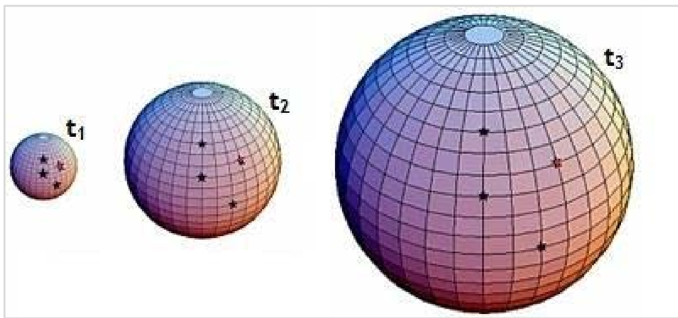
Über Die Gravitationsfeldrelativitätstheorie: Gedankenexperiment

Read pp. 10-13 in wegtransformierbar.pdf. The theory is falsifiable (p. 4 therein).

Prerequisite: Richard W. Pogge

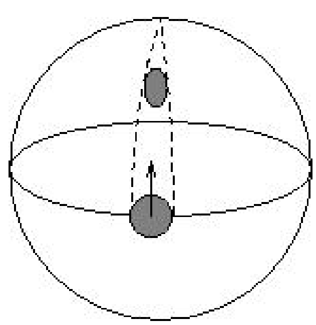
I will talk about the alteration of the *rate* of Heraclitean arrow of 4D events (p. 8), corresponding to the increasing, yet unobservable, **radius** of the 'inflating balloon': every point on balloon's surface is also point from its unobservable **radius**.



We postulate that the Heraclitean *arrow* of 4D events is *temporarily* **nullified** at null intervals viz. gravity is eliminated (not by "freely falling coordinates", Hans Ohanian): the Heraclitean *arrow* of 4D events is completely **nullified** in the ***squared*** spacetime interval (Δs^2), once at a time, as read with a clock (p. **7**). There is no reference frame in which the *physical* time t_n , **n**: $(0, \infty)$, is at rest. We choose reference frame 'at rest' only to show the *physical* (coordinate) time t_n as 'change ***in*** space' (p. 5), once at a time. Is it possible to recast General Relativity (GR) without spacetime "curvature"? This is the prime objective of Gravitational Theory of Relativity (GTR). In German, *Die Gravitationsfeldrelativitätstheorie*. Read Addendum at p. 11 below.

For example, the popular idea below is **false** (Q1). Quote from: John Baez and Emory Bunn, *The Meaning of Einstein's Equation*, January 4, 2006, Sec. Spatial Curvature.

"On a positively curved surface such as a sphere, initially parallel lines converge towards one another. The same thing happens in the three-dimensional space of the Einstein static universe. In fact, the geometry of space in this model is that of a 3-sphere. This picture illustrates what happens:



“One dimension is suppressed in this picture, so the two-dimensional spherical surface shown represents the three-dimensional universe. The small shaded circle on the surface represents our tiny sphere of test particles, which starts at the equator and moves north. The sides of the sphere approach each other along the dashed geodesics, so the sphere ***shrinks*** (emphasis mine – D.C.) in the transverse direction, although its diameter in the direction of motion does not change.”

There is another idea in GR textbooks, which is also **false** (Q2): the “pulsation” of the ‘shaded circle’ in the drawing above, due to some fictitious “gravitational waves” (GWs). Read *The Persistent Mystery of Gravitational Radiation* on p. **13** in Zenon.

I will offer a simple thought experiment to illustrate how to avoid the **false** idea of spacetime “curvature” (read also Addendum below).

Consider three temporal intervals with durations 20*****, 40*****, and 80*****, depicted below with lines built by “frames” denoted with (*****), like in a movie reel (p. 21 in BCCP). Call them ‘**a**ttractive’, ‘**n**eutral’, and ‘**r**epulsive’, and denote as $\mathbf{V_a}$, $\mathbf{V_n}$, and $\mathbf{V_r}$.

$\mathbf{V_a}$: ********************

$\mathbf{V_n}$: **

$\mathbf{V_r}$: **

Think of the three temporal intervals above as movie clips recorded with *variable* rates (frames ***** per second, FPS), and set $\mathbf{V_a}$ = 20 FPS, $\mathbf{V_n}$ = 40 FPS, and $\mathbf{V_r}$ = 80 FPS. Relative to $\mathbf{V_a}$ (20 FPS), $\mathbf{V_n}$ (40 FPS) will run twice faster; relative to $\mathbf{V_n}$ (40 FPS), $\mathbf{V_r}$ (80 FPS) will also run twice faster. In all cases, the intervals with *variable* FPS will pass **1s** Heraclitean time as ‘change **of** space’ (p. 5) along **W** (p. 8). This is how *variable rates* (FPS) can assemble *different* intervals for *the same invariant* **1s** Heraclitean time by ***inflating*** the *physical* frames (*****) on the 3D surface of the balloon above.

Notice that in all three cases their proper duration and *rate* of time stay invariant: **1s** with rate **1s/s**. This is their ‘common denominator’. There is no universal or “true” duration nor universal “true” length in GTR (*Die Gravitationsfeldrelativitätstheorie*): all ***clocks*** and ***rods*** are *flexible* and *relational*. We postulate alteration of the *rate* of Heraclitean Time (p. 8), leading to alteration of the physical (coordinate) time $\mathbf{t_n}$ built by temporal units (*****). The latter can ***inflate*** and ***deflate*** – but only relationally. Read my note on *calibration* of spacetime at p. **3** here.

The ‘neutral’ $\mathbf{V_n}$ corresponds to *weightless* objects with **zero** g-force: recall the astronauts on the International Space Station (ISS). Their clocks run *faster* ($\mathbf{V_n > V_a}$) relative to the clocks on the surface of Earth (the latter are lagging 0.007 seconds behind for every six months), and we had to adjust the clocks to have GPS navigation (R.W. Pogge).

It’s all relative, as uncle Albert used to say. Today, 14 March 2020, I commemorate his 141st birthday by introducing the equation of *Gravitationsfeldrelativitätstheorie*

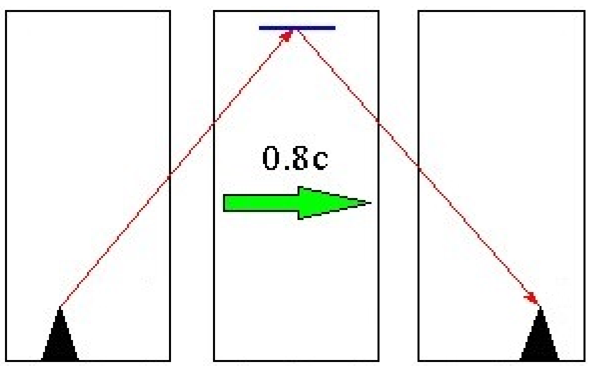
RS = **1**.

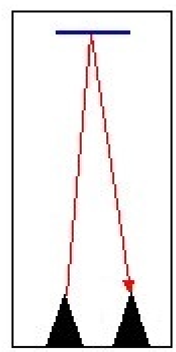
R (from **r**ate) denotes the rate of the Heraclitean 'time flow' **W** (p. 8), and **S** (from **s**ize) denotes the ***relative*** size of the squared invariant spacetime intervals (Δ **s^2**). The dimensionless **RS** factor **Ω** (p. **5**), **Ω** = **S^{-1}**, is set for the ***macroscopic*** 1m (**R** = **S**). For example, consider two cases in GTR (**Q5**); **A** pertains to the macroscopic scale.

Case **A**: **R** = 20 FPS, **S** = 20 and **RS** = **1** matches the Heraclitean '1 **RS** second', which is "deflated" *with respect to* Case **B**. Case **B**: **R** = 80 FPS, **S** = 80 and **RS** = **1** (**Ω** = **4**) also matches the Heraclitean '1 **RS** second', which is "inflated" *with respect to* Case **A**.

Case **A** is "deflated" relative to Case **B**, and Case **B** is "inflated" relative to Case **A**.

In one sentence: whether *inflated* or *deflated*, the '1 **RS** second' remains the same. To find out which one is inflated or deflated, you must be some unphysical "meta" observer in absolute spacetime, which has bird's eye view simultaneously on Case **A** and on Case **B**, like you see the inflating 'balloon' (p. 1) and the two drawings below.





The ***flexible*** (inflatable and contractible) 'tick' of Heraclitean Time (p. **7** below). In the case depicted above, the dimensionless **RS** factor **Ω** = **2.4**$\times10^8$ (p. **6** below).

The alternative to GTR (*Gravitationsfeldrelativitätstheorie*) is the established GR, which begins with a "massive body" (Wikipedia) that *somehow*, and for some unknown reason, would create particular "influence" (Sic!) in 4D spacetime. (And then "the Christoffel symbols play the role of the gravitational force field and the metric tensor plays the role of the gravitational potential", etc.)

But hold on: what kind of "influence" is that? It doesn't look like electromagnetism. All we know for sure is that gravity can alter the *rate* of time, as demonstrated, e.g., in the case of GPS navigation and time dilation. But what is '*rate* of time'? One second per second? One meter per meter? And with respect to *what*?

We need to start from first principles. Read pp. 10-13 in the main paper *Über Die Gravitationsfeldrelativitätstheorie* or in viXra:2001.0601vC, 2020-02-22.

D. Chakalov
14 March 2020, 10:30 GMT

Questions and Answers

Q1: Why are you against spacetime curvature?

A1: Look at the illustration of "spatial curvature" with the drawing by J. Baez and E. Bunn above: "the sphere ***shrinks*** (emphasis mine – D.C.) in the transverse direction". This statement may sound "intuitively clear" only to my dog.

It is impossible to "discover" some *gravitational* stress-energy-momentum tensor in GR (MTW p. 467), which could somehow "shrink" the *physical* stuff in the sphere above. No, we do not live in some abstract "vacuum" ($T^{ab} = 0$). The spatial curvature is 'pure geometry', like the shape of a mountain or rather like 'the grin on the face of Cheshire cat, but *without* the cat': read J.A. Wheeler at p. 1 in the main paper here. Which goes first, matter or geometry? As to the "curvature" of Time, recall the two drawings at p. 3 above. Yes, gravity in GTR does produce ***work*** on physical objects. We employ the phenomenon which creates and controls the genuine metric field: the *atemporal* **Platonic** world located on null intervals ($\mathbf{x}^2 = (\pm \mathbf{ct})^2$). Gravity in GTR is not some "fictitious force". We do not refer to non-tensorial Christoffel symbols either. Big difference. Read p. 13 (last) in the main paper.

Q2: Why are you denying the existence of GWs?

A2: I deny the so-called GW150914 claimed by LIGO: check out the reference at p. 2 above. Yes, the gravitational radiation is real, but only in GTR. If you decide to use the *linearized* approximation of GR, you will eliminate *from the outset* the intrinsic non-linear effect (J. Pereira) you wish to detect. Read my note from 4.10.2017 here.

Q3: Have you proved that your theory is correct?

A3: The implicit dynamics of spacetime metric (p. **3** and p. **7**) cannot be verified by experiment or observation, and yet three people were awarded Nobel Prize in 2011 "for the discovery of the accelerating expansion of the Universe through observations of distant supernovae". Read about the *calibration* of spacetime (E.F. Taylor and J.A. Wheeler, Fig. 9) at p. **3** here, and notice the two drawings at p. **7** in the main paper. There is no room in GTR for any "dark energy", "dark matter", nor some "mystery matter" (Brian Schmidt). We don't accept any "ghosts", even if backed by math.

Q4: Where is your math?

A4: Where's my Nobel Prize?☺ Read p. 21 in BCCP. How could we define the *metric* (C. Rovelli) at null surfaces (P. Chrusciel)? The task seems similar to defining the phase space of 'not yet physical' (W. Heisenberg) explications of quantum "waves" with *complex* (not real-valued) phase (C.N. Yang). Tough. The phase space of GTR is still out of sight. See a **hint** of my efforts at p. **4** in the paper here. It is not much, aber besser eine Ameise in Kraut als gar kein Fleisch.

Q5: Dimi, I don't get it. Why is **R** inverse-proportional to **S**, so that **RS = 1** ?

A5: Thanks for the feedback, Stavros. I clearly remember our chat in September 2011 (p. **31** in *Platonic Theory of Spacetime*). Surely it is my fault. I denoted with **R** the *rate* of the Heraclitean river πάντα ῥεῖ (panta rhei) "everything flows" (Wikipedia). The *rate* of the Heraclitean flow is like 'liters of water per second' (like speed). In Case **A** above we have 20 liters of water per second, meaning 20 temporal units (*****). So, if you have a bucket with volume exactly 20 liters (meaning its "**s**ize" **S** = 20), the Heraclitean flow of "water" will fill your bucket for **1s**. In Case **B** above we have **4x** greater *rate* of the Heraclitean flow, 80 liters of water per second, meaning 80 temporal units (*****). Now your bucket has **4x** larger volume (its "**s**ize" **S** = 80), and the Heraclitean flow of "water" will again fill your bucket for **1s**. *Relative to* the bucket in Case **A** above, the second bucket in Case **B** will be **4x** larger, correct? True. But only ***with respect to*** the first bucket in Case **A**. Recall the drawing of so-called **RS** spacetime at p. 20 in BCCP. It's all relative.

NB: The important point here is the phenomenon associated with the non-relational **"**speed**"** of light – it ***assembles*** 4D spacetime with variable *rate* of Heraclitean Time (p. 1) over *flexible* temporal units (*****), depicted with the drawing at p. 3 above.

Now, imagine something that is really veeeery small, for example, the **s**ize (**S**) of the proton, app. 10^{-15} m (Wikipedia). It is indeed "small", but only ***with respect to*** your table with size 1m. Your macroscopic "bucket", at the length scale of tables and chairs, is 10^{15} times larger, correct? Yes, but now your *rate* (**R**) of Heraclitean flow of "water" is 10^{15} times greater, so it will fill your "bucket" for the same *invariant* **1s**.

Ditto to an object that is really very large, for example, the **s**ize (**S**) of a galaxy like the Milky Way, app. 200,000 light-years (Wikipedia). It is indeed "large", but only ***with respect to*** your table with size 1m, because the Heraclitean flow of "water" will fill its "bucket" for the same *invariant* **1s**. This is Relative Scale (**RS**) spacetime.

For example, the so-called "inflation" of space (see **Q3** above), inferred from the distance between the dots on the 3D surface of the balloon on p. 1 above, has very simple interpretation in RS spacetime: yes, there are object that are Small and Large, but only ***with respect to*** your table with size 1m. If you are "inflated" to the size of Milky Way or "deflated" to the size of protons, your proper **RS** size will be *always* **1m**. Thus, with **RS** spacetime we have a very simple answer to the question "why is the universe larger than a football ?" (Ivo van Vulpen). Only the math is unknown (**Q4**). We still do not know exactly how spacetime applies "brakes" to accelerating bodies (John Wheeler) and induces gravitational rotation (Richard Feynman). It's a bundle.

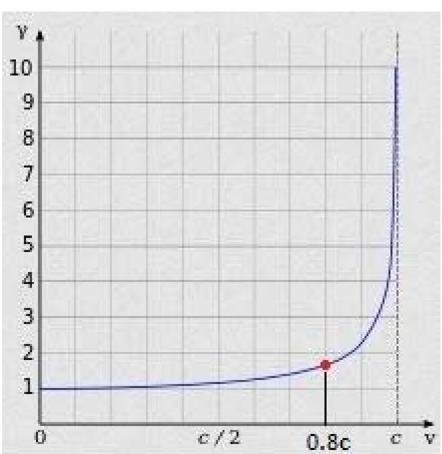
Another example is the so-called Anomalous Aerial Vehicle (p. 16 in BCCP). If our guests fly, in *their* **RS** reference frame, with *their* proper speed 5m/s, while *their* 5m matches *our* 5km on Earth (**RS** factor **Ω** = 1000), ***we*** will see *their* speed as 5000m/s, and will be terribly intrigued by their insane acceleration and mind-boggling sharp turns. But in *their* **RS** reference frame *they* fly with *their* 5m/s, which won't break their AAV. If they fly with 0.8**c** (Lorentz factor $\gamma = 1.667$) to travel "very fast", *their* clocks will 'tick' (see the drawing at p. 3 above) with *much* slower rate (**R**), relative to ours. Yet all clocks, theirs and ours, will read the "correct" *invariant* **1s**: there is no absolute time (Newton) to determine which clock was "correct". They all are.

How can you prove **RS** spacetime wrong? You only have to prove that the infinitesimal region of 4D spacetime — the elementary 'tick' of *light-travel time* (read my note at p. **3** here) — has ***fixed finite*** size, like a pixel from digital image, separated from the neighboring pixels by 'something else'. See Fig. **3** at p. **4** and p. **12** in the main paper.

Please keep in mind that the Planck length, **L** ≈ 10^{-35} m (Wikipedia), cannot serve as some fundamental "atom" of spacetime or "pixel" with ***fixed finite*** size, because **L**x10^{35} will *not* produce spacetime interval (Δ $\mathbf{s^2}$) 1m. There is no *metric* anymore at Planck scale, so when people speculate about Planck time (Wikipedia), app. 10^{-44} s, rest assured that all this Plank stuff is Russian poetry. There *must* be some ***cutoff*** on the physical spacetime, but this cutoff *must* disappear, as illustrated with my drawing below. If we denote 'the cutoff' with **O** and with (**MN**) the minimal spacetime volume, in which **N** approaches asymptotically **O**, then [**OM**) – [**ON**) = (**MN**), and **O** has gone.

As an analogy, QFT only cares about energy *differences* (J. Baez), like (**MN**) above, and if we picture **O** as the "bottom level" at the quantum vacuum (P. Milonni), one cannot attach any fixed numerical value to **O**. Likewise, there is no "upper level" to *the* largest (relative to a table with size **1**m) volume of 4D spacetime: if we imagine 'the cutoff' **O** at (future null) infinity, **N** can *only* approach it asymptotically, (**MN**) will always have ***finite*** size, no matter how large, and **O** will *physically* "disappear".

The table below shows the case of AAV flying with **RS** speed 0.8**c** (p. 5 above), with dimensionless **RS** factor **Ω** = **2.4**x10^8 (**c** ≈ 3x10^8 m/s, 0.8**c** ≈ **2.4**x10^8 m/s). Relative to *our* **RS** reference frame, their AAV will fly with **RS** speed **2.4**x10^8 m/s, but in *their* **RS** reference frame *they* will fly with **1**m/s.



Lorentz factor γ = 1.667

Speed (units of c)	Lorentz factor	Reciprocal
$\beta = v/c$	γ	$1/\gamma$
0.000	**1.000**	**1.000**
0.800	1.667	**0.600**

For **RS** speed 0.8**c** (γ = 1.667),
the **RS** factor **Ω** = **2.4**x10^8

Who has 'the right meter' and 'the right second'? In GTR — nobody. The *atom of geometry* (p. **7** in the main paper) is also **RS** flexible, as it can inflate and deflate: see the drawing of inflated 'tick' of **RS** time (borrowed from R.W. Pogge) at p. **3** above.

Anyway, sorry for my too long (and quite complicated, I'm afraid) answer to your **Q5**.

Q6: Sorry, can you make it simpler?

A6: Let me try my KISS explanation of the Gravitational Theory of Relativity (GTR).

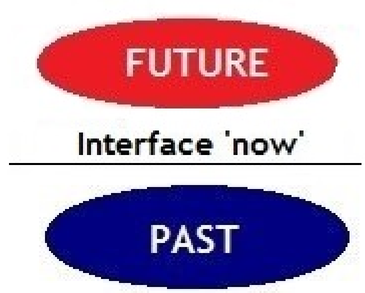
Suppose you have three intervals, **A**, **B**, and **C**, shown in the drawing below.

A: ——————————
B: ————————————————————
C: ——

The middle one (**B**) corresponds to 'one second light-travel time': read E.F. Taylor and J.A. Wheeler on p. **3** in my note here. If you **2x** *deflate* this 'one second' (**B**), you will produce interval **A**, and if you **2x** *inflate* the same 'one second' (**B**), you will produce interval **C**. Obviously, **A** < **B** < **C**. Says who? Some unphysical "meta" observer, which can see all three intervals *en bloc* (p. **3** above). You and I are *inside* interval **B**. Now, suppose interval **B** has been ***recorded*** with 20 frames "**—**" per second (20 FPS), whereas interval **A** with 10 FPS and interval **C** with 40 FPS, and then ***projected*** with their respective FPS values. What will happen? Their durations will be identical: **1s**. And the *rate* of time will be identical as well: **1s/s**. The "rate" is self-referential.

You may say, – naah, you changed the speed of light! No I did not. Again, only some unphysical "meta" observer, which can see all intervals *en bloc* (p. **3** above), could make such claim. You can't. Nobody can. If you live *inside* **B**, or *inside* **A**, or *inside* **C**, you will experience *the same* **invariant** one-second light-travel time. Why? Because the '**tick**' (Sic!) of the 'one second' in interval **B** is **2x** deflated *relative* to **C**, and **2x** inflated *relative* to **A.** The rods and clocks are *flexible* and *relational*. It's all relative.

See below the '**tick**' of 'one **RS** second': the *interface* 'now' between the **irreversible** past and the **potential** future (p. **7** in the main paper). It is **re-nullified** in Δ **s**$^{\mathbf{2}}$ (p. **1**).



Compare the *interface* 'now' to operators:

Operators: $\hat{A}\,|\psi\rangle = |\psi'\rangle$

$\langle\phi|\,\hat{A} = \langle\phi'|$

They too take some stuff at the input and convert it into another stuff at the output. They are not geometric "points" either.

Relative to the '**tick**' in **B**, the '**tick**' in **A** will be "smaller" and the '**tick**' in **C** will be "larger", meaning that interval **A** will be *rendered* as "smaller" and interval **C** will be *rendered* as "larger" (p. **5** above). Relative to *what*? ***Only*** to the interval **B.** Capiche?

NB: The *interface* 'here and now' is "inside" point **A** in the drawing at p. **1** in Zenon.

Why am I doing these efforts? Nobody cares about Einstein's unfinished project (p. **13** in the main paper). Nobody cares about the climate change either (p. **28** in BCCP).

Bottom line is that I need support to find out whether we can fly by *repulsive* gravity (nothing to do with "warp drives" or "exotic matter"), and to verify the hypothetical case of gravitational rotation, depicted in Fig. **E** at p. 18 in BCCP (details at p. **8** in the main paper). It is "crazy", as we know almost nothing about gravitational rotation (Richard Feynman). Nature can rotate a whole galaxy, so we should be able to harness it as well. Can't do it my cellar, like Jeff Bezos started *Amazon* in 1994 in the garage of a small rented house in Seattle.

I need *much* more to test the effects predicted in spacetime engineering, in tightly controlled laboratory conditions. The work needed is very small: try the experiment with your brain at p. **5** in the main paper. This is how little efforts are needed to *tweak* gravity with brain's **self-action**. If we were dealing with some physical field, like EM field in electromagnetism, we would have to produce enormous work to *counteract* gravity, as in maglev trains. Big difference. All you need is a human brain.

Back to GTR: notice **NB** at p. **5** and the three intervals, **A**, **B**, and **C**, shown in the drawing at p. **7**. The variable *rate* of Heraclitean Time over *flexible* temporal units can also be illustrated by keeping the "number" of *flexible* temporal units (shown in squared brackets below) **constant**. Start again from Case **B**, but now *inflate* (p. **3**) their duration to produce the duration in Case **C**, and *deflate* (p. **3**) their duration to produce the duration in Case **A**. The "number" of *flexible* temporal units in all cases is **5**, and the three "video clips" are obviously different in size. Yet if "projected" by *variable* Heraclitean 'tick' (p. **7**) denoted **T**, $\mathbf{T_A < T_B < T_C}$, they will be 'the same', and will carry the same ramifications (p. **5**). Read also Addendum below.

A: [–] [–] [–] [–] [–]
B: [——][——][——][——][——]
C: [————][————][————][————][————]

To wrap up, let me repeat the main ideas (**Q1**) in Gravitational Theory of Relativity: the Heraclitean arrow of 4D events (p. **8** in the main paper), corresponding to the increasing, yet unobservable, **radius** of the 'inflating balloon' (p. **1**), which is being **re-nullified** in the elementary 'tick' of Heraclitean 'one **RS** second' (p. **7**), *once at a time*, as read with a clock. The latter can show only the *physical* (coordinate) time as 'change ***in*** space' denoted $\mathbf{t_n}$, whereas the Heraclitean arrow 'change ***of*** space' (p. **5** in the main paper), along the **radius** of the 'inflating balloon' (p. **1**), is *unobservable*. Why? Because the Heraclitean *arrow* of 4D events is *exactly* **nullified** in the ***squared*** spacetime interval ($\Delta \mathbf{s^2}$) in the light cone (ibid.). It's not there. Otherwise we will face some *physical* engine of the Heraclitean Time at *absolute* rest, and the theory of relativity will be demolished. Many people stubbornly refuse to acknowledge these first principles and claim that "there is no dynamics within spacetime itself" (Robert Geroch). See Fig. 3 at p. **4** in the main paper. There is no "dark" stuff whatsoever in GTR (**Q3**), just as there is no "dark agent" in the brain (p. **5** in the main paper). There is no way to observe *with light* (Macavity) the intrinsic dynamics of spacetime (p. **7**) and the ongoing *calibration* of '1s light-travel time' (E. Taylor and J. Wheeler, Fig. 9) viz. the ongoing *calibration* of the ***flexible*** (inflatable and contractible) metric of spacetime demonstrated with rods and clocks, **1m** and **1s**: read p. **3** in my note here.

Finally, let me add a historical remark. The foundation of the theory of relativity was laid out by Hendrik Lorentz in 1904. Then Henri Poincaré derived on 5 June 1905 the famous transformation called "after the name of Lorentz" (Wikipedia). He has also suggested an expression exactly equivalent to $E = mc^2$ several months before Albert Einstein. The latter completed his paper '*Zur Elektrodynamik bewegter Körper'* on 30 June 1905. Three months later, on 27 September 1905, he suggested that "if a body gives off the energy L in the form of radiation, its mass diminishes by L/c^2. The fact that the energy withdrawn from the body becomes energy of radiation evidently makes no difference, so that we are led to the more general conclusion that the mass of a body is a measure of its energy-content." Albert Einstein did not write explicitly the equation $E = mc^2$, and of course couldn't have anticipated the development of Quantum Mechanics (QM) and Quantum Filed Theory (QFT). The point I wish to make here is that all seemingly 'academic' theories, published between 1904 and 1905, became utterly important in September 1908, thanks to Hermann Minkowski's lecture '*Raum und Zeit*', presented on 21 September 1908. Then the world changed, as we obtained the invariant spacetime interval (Δ $\mathbf{s^2}$). Now I suggest that (Δ $\mathbf{s^2}$) is *flexible* (inflatable and contractible) and offer thought experiments, to explain the crux of Gravitational Theory of Relativity (GTR) based on relativity of space (Henri Poincaré) and an alternative interpretation (p. **2**) of what was called in GR "curvature of time".

This "curvature" may sound "intuitively clear" only to my dog. GR does *not* provide what we call 'time as read with a clock', simply because it can't (C. Rovelli). GR is *not* 'parameterized field theory' (C.G. Torre) in the first place. In the context of GR, one can only *hope* that "gravity is geodesic deviation" (C.G. Torre, p. 215), as "there is no useful way to define gravitational energy-momentum densities — there is no suitable energy-momentum ***current*** (emphasis mine – D.C.) for gravity" (C.G. Torre, p. 230 and footnote 14 therein). Therefore, 'time as read with a clock' cannot ***lock*** on some "energy-momentum current for gravity", because it ain't there. Never been and never will. To find out whether time in GR can or cannot be "curved", first you have to define rigorously 'time in GR' (read C. Isham and K.V. Kuchař) pertaining to those non-tensorial energy-momentum densities. Then you may speculate about its ***rate***, and try to recover the "nondynamical time parameter" of W.G. Unruh and R.M. Wald.

"Gravity ***is*** the unequable flow of time from place to place", says W.G. Unruh. Fine, but how could you possibly associate the *flow of time* with any "curvature" (**Q1**)? That's apples and oranges, except that there are no oranges or "curvature of time".

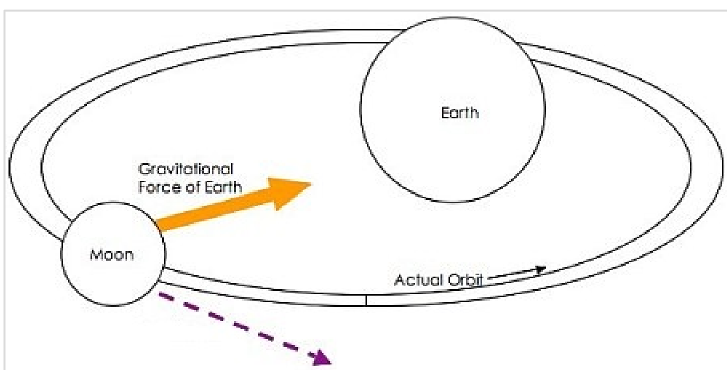
Time does not "curve". Time cannot "curve". It can only alter its ***rate***, by inflating or deflating its elementary 'tick of time' (p. **7**): see the last thought experiment at p. **8**.

Die gegenwärtige Situation in die Gravitationsfeldrelativitätstheorie resembles the theory of relativity before 1904: read the summary above. Take it with a grain of salt, but do not dismiss it only because it may sound "crazy" (**Q3**). The alternative to GTR is full of "dark energy", "dark matter", and "mystery matter" (B. Schmidt), and none of the established academic scholars, with highest academic credentials and hundreds academic articles published in prestigious peer-reviewed academic journals, can even imagine the solution to "the worst theoretical prediction in the history of physics!" (M.P. Hobson *et al*.).

Let's look at the facts (forget "black holes"): what is the range of energy release, associated with gravity and zero-point energy? The latest record-breaking explosion is roughly 5×10^{61} erg, which is "5 times more energetic than the previous record holder, MS 0735+74" (S. Giacintucci *et al*.). On the other hand, as Steven Weinberg casually mentioned at a discussion of vacuum energy in 1998, a volume the size of the earth has *less* zero-point energy than a gallon of gasoline (he is *very* good at calculations). According to John Baez (he is also very good at calculations), the energy density of the vacuum, in terms of mass density, is "less than 10^{-26} kilograms per cubic meter", although it may be also "about 10^{96} kilograms per cubic meter". You just never know. Do you believe in "life inside supermassive black holes in the galactic nuclei"? They could be inhabited by *advanced* Russian civilizations, as demonstrated recently by Slava Dokuchaev, with impeccable math (he too is very good at calculations).

Under these circumstances, we need to introduce law and order in quantum gravity. How can gravity *evoke* physical effects, despite that gravity *itself* is **not** physical field? Read p. **8** above. In GTR, the *not-yet-physicalized* gravity can interact with the **potential** future in the drawing above (see the drawings at p. **7** in the main paper). At the length scale of the Solar system, the rotation-and-attraction is properly fixed, leading to the well-known picture below. There is no "curvature" in GTR (**Q1**), only *alteration* of the **flexible** 1 **RS** meter and 1 **RS** second. The end result is gravitation (D.W. Sciama), as spacetime applies "brakes" to accelerating bodies (J.A. Wheeler) *and* induces universal (**Sic!**) gravitational rotation/spin (H. Ohanian). It's a bundle.

In GTR "*the motion of the universe*" (case ***b*** in D.W. Sciama) is **non**-relational, as the universe evolves along the *absolute* Heraclitean *arrow* of 4D events (p. **1**). The speed of gravity matches the speed of EPR correlations (H.P. Stapp). Read my endnote here.



Again, the gravitational *rotation*-and-attraction (Richard Feynman) is still poorly understood and has to be studied thoroughly. Can't do it in my cellar (p. **8** above).

Let me know (notice my email) which thought experiment you could not understand; it will be entirely my fault. Also, feel free to download the latest version of this paper (synopsis.pdf) from this http URL.

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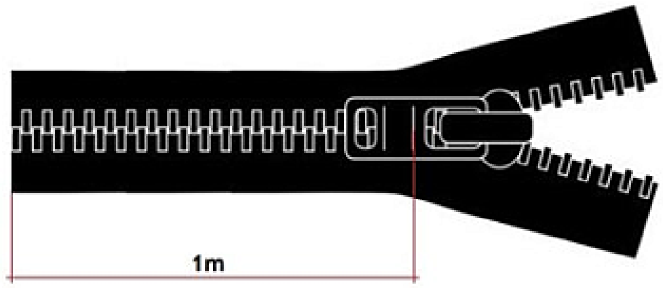
14 March 2020, 14:30 GMT

Addendum

A friend of mine (**Q5**) asked me to explain the main idea of GTR "in just two lines", without complicated examples (p. **8** above). Let me try, with 'John's jackets'.

Imagine a zip (denoted **B**), which runs with 1m/s. It will assemble (p. 5 above) the two sides of your jacket with rate 1m for 1s.



Now imagine another zip (denoted **A**, not shown), which runs with 0.5m/s, and also another zip (denoted **C**, also not shown), which runs with 2m/s. Obviously, zip **B** is twice faster than zip **A**, and also twice slower than zip **C**. For every <u>second</u> zip **B** is assembling 1m, zip **A** is assembling 0.5m, and zip **C** is assembling 2m. Also, for every <u>meter</u> zip **B** is using 1s, zip **A** is using 2s, and zip **C** is using 0.5s. Simple, isn't it?

Now comes the thought experiment, in plain Victorian English.

We will *inflate* the 1m of **B** twice, and will use it to **re-scale** 1m of **C**. We will also *inflate* the 1s of **B** twice, and will use it to **re-scale** 1s of **C**. In the *new* reference frame of **C**, the latter will assemble two sides with **C**-length 1m for **C**-time 1s. Thus, the **C**-rate of assembling, in the *new* reference frame of **C**, will be 1m/s, as in **B**.

We will *deflate* the 1m of **B** twice, and will use it to **re-scale** 1m of **A**. We will also *deflate* the 1s of **B** twice, and will use it to **re-scale** 1s of **A**. In the *new* reference frame of **A**, the latter will assemble two sides with **A**-length 1m for **A**-time 1s. Thus, the **A**-rate of assembling, in the *new* reference frame of **A**, will be 1m/s, as in **B**.

Relative to zip **B** viz. observer **B**, the time-of-assembling by zip **C** will run 2x faster, i.e., with double *rate*, but observer **B** is locked in his reference frame **B**, and hence can only see (with light) that the assembled spacetime (interval Δs^2) by zip **C** is twice larger. True, but <u>only</u> relative to observer **B**. Relative to zip **C**, her assembled Δs^2 is indistinguishable from that by zip **B**: 1m/s.

Relative to zip **B** viz. observer **B**, the time-of-assembling by zip **A** will run 2x slower, i.e., with half *rate*, but observer **B** is locked in his reference frame **B**, and hence can only see (with light) that the assembled spacetime (interval Δs^2) by zip **A** is twice smaller. True, but <u>only</u> relative to observer **B**. Relative to zip **A**, her assembled Δs^2 is indistinguishable from that by zip **B**: 1m/s.

Now let's talk about three observers, Alice (**A**), macroscopic Bob (**B**), and Carol (**C**).

Obviously, **A** < **B** < **C**. True or false? **Yes**-and-**No**. Yes, but relative to some "meta" observer in absolute spacetime, which has bird's eye view *simultaneously* on Alice (**A**), Bob (**B**), and Carol (**C**), just like you can see the inflating states of the 'balloon' at p. **1** above. No, because there is no such animal. The solution: it's all relative. Thus, in GTR 'facts' are relational *as well*.

Now replace **1m** (invariant spacetime interval $\Delta\, \mathbf{s^2}$) in the drawing above with app. 3.33564 light-nanoseconds and read about the *calibration* of spacetime by 'meters of light-travel time' (E.F. Taylor and J.A. Wheeler, Fig. 9) at p. **3** in my note here. Also, the ideas of Small (**A**) and Large (**C**) are now 'relative to **B**': read the examples at p. **5** above. In GTR, the notions 'length' and 'orders of magnitude' are relational. Namely, the macroscopic Bob (**B**) can "look" at Alice (**A**) and claim that she is ***in fact*** "small", relative to another "direction" in which Carol (**C**) will be ***in fact*** "large". True, but relative to *what*? Only to Bob (**B**). Now we can at least *think* of uniting Alice (**A**) and Carol (**C**), because the two girls will be separated *only* relative to Bob (**B**). This is the old idea of *mutual penetration* of the Large and the Small, and the conceptual basis of quantum gravity. Relative to Bob (**B**), the Planck length (**A**) is indeed $1.6\text{x}10^{-35}$m, and in the opposite "direction" the size of the universe (**C**) could be over 1000 Ym. In their reference frames, they will be 'the same' or *indistinguishable*, as they assemble the spacetime (read **NB**) with *the same* rate: 1m/s. (Here I will skip the **RS** factor **Ω**).

The limit of assembling spacetime by the zip above is ***zero*** spacetime interval $\Delta\, \mathbf{s^2}$ in the "direction" toward **A**, corresponding to single *atemporal* photon at **null interval** ($\mathbf{x^2} = (\pm \mathbf{ct})^2$), ***and*** to an *infinite* Universe in the opposite "direction" toward **C**. At this ultimate limit of the physical world, the entire Universe as **ONE** (p. **6**) is *multiplied* by every photon, and quantum gravity enters physical theology (John 1:1; Luke 17:21).

Finally, let me go back to the first puzzle of gravity, mentioned at p. **10** above: there *must* be some **force** in order for gravity to **work**, for example, to produce Earth tides (forget "gravitons"). How can gravity *evoke* physical effects, given that gravity *itself* is not physical field? The gravitational *force* of Earth (see the drawing at p. **10** above) is caused by ***deflating*** the spacetime interval $\Delta\, \mathbf{s^2}$ due to the 'massive body' of Earth. It is like going from Bob (**B**) to Alice (**A**). If Alice (**A**) is much "smaller", the *deflation* of $\Delta\, \mathbf{s^2}$ can produce *much* stronger physical effects, for example, the anomalous gravitational rotation of galaxies (forget "black holes", again). Please read **Q3** above. Notice that in the opposite "direction" toward the ***inflated*** spacetime interval $\Delta\, \mathbf{s^2}$ of Carol (**C**) we have *repulsive* gravity (not "dark energy"), and can at least *think* of gravity as tug-of-war balancing factor in the cosmos, providing *dynamic* equilibrium between the attractive and repulsive manifestations of gravity, for example, in the Laniakea Supercluster: watch a video clip by D. Pomarède here.

There is much more in Gravitational Theory of Relativity (GTR): the omnipresent and **non**-relational "*motion of the universe*" (case ***b*** in D.W. Sciama) is represented with the vector **W** of the 'space rocket' pictured at p. **8** in the main paper here, and with the increasing, yet unobservable, **radius** of the 'inflating balloon' at p. **1** above. We cannot *unzip* our 'jacket' above. It is irreversible – see the *arrow* in Fig. 3 at p. **4** in the main paper. Also, I suppose the ***universal*** 'spin' (p. **10** above) is new topological bundle of spacetime, rotation & pull up↑ (p. **7**) along **W**, but I will have to stop here.

You wanted "just two lines", so all you need to know is that an apple can fall from a tree and hit your head because the apple and the tree are in gravitational rotation.

May I add a historical remark. Forty-eight years ago, in June 1972, after studying physics for little over five months (I started in January 1972 at age 19), I suddenly got the feeling that I've finally understood the so-called fictitious force in GR. It was a beautiful feeling, which lasted until the end of 1973, and of course never came back. But in June 1972, I was very happy that I can "understand" GR, and decided to ask a friend of mine (he was teaching theoretical physics at the University of Sofia) for help: could it be that gravity acts as "mediator" (Sic!) of the human mind on its brain? After all, gravity is not physical field (p. **10**), so what if the brain is influenced by the *metric field* in GR, producing the neural correlates of mind and consciousness? My weird idea was *seriously* stupid, of course, yet many years later, in 1986, I found an unexpected similarity between the *physicalized* 'jackets' of gravity and the "action" of the mind on its brain: read p. **5** in the main paper here. Namely, the human mind endowed with volition does not act ***directly*** on its brain, just as gravity, mediated (Sic!) by geometry, does not act ***directly*** on its physical source placed in the right-hand side of Einstein's filed equations (p. **15** in Zenon). Then the ball started rolling.

What if AAVs (p. 5) fly by modulating the inertial mass? It is identical to the conserved gravitational "charge" (K. Brown). If we get a grip on the perpetual non-conservation of energy in GR (H. Ohanian), then… well, you never know. Just don't call it "magic". Any sufficiently advanced technology is indistinguishable from magic (Arthur Clarke).

GTR assumes the presence of *atemporal* **Platonic** world located on null intervals (**Q1**), which does *not* have metric and *wraps* the entire physical world *by* actual/completed infinity, up to null- and spacelike infinity: read p. **12** above. **It** is not "magic". If you are uncomfortable with the 'general rule' in GTR (p. **2** in the main paper), check out the problems with defining energy in GR in Robert Wald's *General Relativity*, Ch. 11, p. 286 ("additional structure on spacetime") and pp. 290-295 therein; read also p. 7.

In this context, I recall last year a very simple question by the same person (**Q5**): can we learn spacetime engineering (p. **6** in the main paper) without the hassle of reading my "crazy stuff" (p. **9** in The Physics of Life)? Suppose you wish to learn how to juggle three balls: watch the 'manual' at YouTube. It is a very simple skill, but suppose you cannot see the balls, and actually have three spoons instead. You only *believe* that you're dealing with balls, but they are in facts spoons. Then suppose you *believe* that you will be tossing balls (not spoons) in the air, but you have feedback from your legs only, because you are blindfolded and can't see anything. You try to move your arms and toss the balls in the air, but you are in fact moving your legs and kicking spoons on the floor. What skill could you learn without that "crazy stuff"? Try meditating on a rock instead. Good luck.

Feel free to download the latest version of this paper from this http URL.

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