Fundamental inconsistencies in the theory of relativity.

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Abstract:

Although the *special theory of relativity (SR),* and the *general theory of relativity (GR)*, both have been found to be in accordance with the results of many physical experiments and astronomical observations, it can be shown that some of their predictions leads to clear self-contradictions/inconsistencies.

The Twin paradox:

First, an analysis of the so-called '*twin paradox*'. Many years ago I came to the conclusion that there are no *pure mathematical* inconsistencies in the "normal" scientific explanations of this thought experiment (but this does not exclude the possibility of that the mathematics is used in criticisable ways). One twin, A, stays on Earth (which in the thought experiment is regarded as an "inertial frame"), while the other twin, B, travels to another star system, and then returns to Earth. One can calculate the time dilation that B and B's clock is influenced by, relative to the time of A's clock (which will be shown at the return of B) by SR, or GR – the result will be the same!

If SR is used in the calculation, it is explained by that B, during the 'turnaround' (which is here, for simplicity, assumed to be relatively short-lived), far from Earth, is accelerated from one inertial frame, IF-1, to another, IF-2 , where time-measurements of events on Earth and in the spaceship, will lead to different results than in IF-1.[1] If two such events occur simultaneously, measured in IF-1, the event on Earth will occur first, as measured in IF-2. This "implies" that B has to conclude that time passes faster on Earth during B's acceleration, than before and after the acceleration. (Of course, this is only a coordinate/frame dependent "effect", that has no physical consequences on Earth!)

[1] A consequence of that the vacuum velocity of light is measured to be the same in all inertial frames.

A GR based explanation of the same time effect is that the Earth is higher than the spaceship in the 'artificial gravitational field'/'potential', that the acceleration of the spaceship creates, which result in that B has to conclude that the rate of time is faster on Earth than in the spaceship, during the acceleration period. (Again, a coordinate-dependent and *mathematical* "effect", that tells nothing about what makes the physical difference, that appears at the return of B!)

From A's point of view, it is a logical consequence of the theory of relativity, that it is B who is *least* aged at the return, since SR predicts that a clock in motion, relative to an 'observer', will be measured to run slower, than if it is not in 'motion'. According to the theory of relativity, a corresponding coordinate-dependent time dilation can also be measured in the reference frame of B, during the journey. Due to A's relative velocity, his clock (disregarding the inertial frame shift effect) will run slower than B's clock, judged by B. But the time effect of the inertial frame shift, during the 'turnaround' (reversal of the relative direction of travel), will be larger than the relative speed effect.

In these two relativity-based explanatory models, there are *apparently* no contradictions, and the mathematical calculations (based on SR or GR) show that A and B will completely agree in, how much B's clock-time will be behind A's, when they reunite. – But if you change the thought experiment quantitatively, to an extreme degree, as in the following, and at the same time try to understand what, *physically*, causes the time dilation, the theory of relativity based explanations become *incomprehensible and contradictory*!

First, I change the starting point of the journey, where A and B now are on a space station, far away from gravitational fields of importance. Let's make the travel distance (the whole journey) for B, *very* long: $2*10^{22}$ km and the travel speed very low: 10 km./hour. – This, according to my calculations, will cause the travel time to be approx. $2*10^{17}$ years, and the age difference between the two twins, at the return of B, approx. 10 years. And let's say that the acceleration during the turnaround of the spaceship (and the resulting speed change of 20 km./h.), takes 5 seconds, measured by B.

Here I will ask two questions:

1. What is the *physical* cause of the age difference at B's return?

2. *When* does the effect arise?

If you try to find the *cause* of the age difference at B's return, it is useless to include coordinate-dependent effects, **which absolutely cannot be used to explain *physical* effects!**

In order for B to be physically younger than A at the return, it must be B that ages physically *different* during the whole journey, or in parts of it, than before the journey begins. The physical aging of A must be constant, as he doesn't 'accelerate physically' [1] at any point of B's journey.

[1] He does not accelerate relative to the local inertial frames, and these are not free falling (not affected by gravity).

Apparently, the physical time difference, which appears upon the return of B, is "created" during the reversal of the spaceship, according to the theory of relativity: because the '*special principle of relativity*' [2] states that all inertial frames are 'physically equal'; i.e. that there is complete 'symmetry' between the *physical* rates of the two clocks throughout the parts of the voyage, where the spaceship is not physically accelerated. But how can the 10 years difference at the return be created in approx. 5 seconds (as measured in both A's and B's reference frames) when it is obvious that the reversal of the spaceship cannot cause any *physical* change in the rate of clocks on Earth? (In principle, the acceleration period can be unmeasurable short, and the acceleration unmeasurable weak, without reducing the time difference at B's return, by making the journey sufficiently long, and the journey-velocity sufficiently low.)

[2] "The **special principle of relativity** states that physical laws should be the same in every inertial frame of reference, but that they may vary across non-inertial ones." **[1]** In the words of Einstein: "If a system of coordinates K is chosen so that, in relation to it, physical laws hold good in their simplest form, the *same* laws hold good in relation to any other system of coordinates K' moving in uniform translation relatively to K." **[1]**

An observer who is close to the spaceship during its turn, but in the same inertial frame as A, will be able to detect/measure, that nothing special is happening to B's clock during the acceleration – it runs at approx. the same rate as the observer's own clock. *Thus, it cannot be during the acceleration that the physical time dilation is created!*

One can come to the same conclusion if B (or A, or both) stops the running of his clock during the acceleration, and then starts it again. Of course, this will not prevent B's clock-time from being approx. 10 years after A's clock-time, at the arrival!

It is thus seen that twin B's clock necessarily have to run **physically** slower than A's, *during the whole journey*, according to the theory of relativity (and contrary to the same theory) – and that the physical difference of their clock-rates, must be *constant* throughout the unaccelerated parts of B's journey.

And it is evident, that it is irrelevant for the physical rate of an *atomic* clock, whether it accelerates [1], or not. Apparently only the *speed* has significance – even though this would make no sense, if speed was only relative.

[1] It is well known by experts that even very powerful acceleration has no measurable influence on the rates of atomic clocks. **[2]**

But, "according to" the theory of relativity, it *does* matter if, and how much, it has accelerated *in the past*. If two atomic clocks are first at rest, in relation to (and close to) each other, in an inertial frame where they are found to run equally fast, and one of them then is accelerated to another inertial frame, then, based on the above arguments, one has to conclude that the theory of relativity predicts that the accelerated clock will run physically slower than the unaccelerated, also after the acceleration has stopped! (This conclusion will be confirmed later in this paper.)

Here I would like to draw attention to an argument of the former British professor of History and Philosophy of Science, *Herbert Dingle*, against the relativity-based interpretation of the twin paradox:

"To sum up, if accelerations are ignored, symmetry shows that the clocks cannot differ on reunion. If, however, accelerations determine the issue, then either the 2½ years [saved by the traveler] (if gained at all) is gained during them or they affect the later rate of the uniformly moving clock. The former's impossible; the accelerations may be far too brief. Hence the rate of a uniformly moving clock, for no known reason, depends on past accelerations, ..." [3]

I think this argumentation clear and precisely shows what the problem is – and nor for me it makes sense, that the physical rate of a uniformly moving clock should depend on (or be influenced by) past accelerations, if all inertial frames are equal.

If the calculation of the physical time dilation in the twin paradox was done by help of *Lorentz ether theory* (LET) the result would be exactly the same as predicted by the theory of relativity – but without inconsistencies, since the cause of the predicted physical time-effect, then is that the average dilation of B's time will be greater than the average dilation of A's time [2] – which is inevitable, when it is the 'inertial frame shift' of B (his acceleration in relation to the ether rest-frame), far from A, that causes the two twins to meet again.

[2] If B accidentally is at rest relative to the ether during the unaccelerated part of the outward journey, and the speed of A constantly is 240000 km/s., relative to the ether rest frame (so it is A who ages *least* during this part of B's journey), and we assume that B has the same speed, relative to A, during the out and return journey, then the speed of B, during the return journey, as measured in the ether rest frame, will be equal to the SR calculation of 240000 + 240000 ≈ 292524 km/s, and this will cause a greater overall dilation of B's time, than of A's time. (According to LET, nothing can move faster through the ether than electromagnetic waves, and it will require infinitely much energy to accelerate a body or particle up to the same speed as light in vacuum.)

These arguments should be sufficient to realize that there is something wrong with some of the *interpretations* of the theory of relativity, but I will nevertheless show some other consequences of the conclusion that only *speed* can have influence on the physical rate of an atomic clock, according to "SR". You can imagine an observer, C, with an atomic clock and other scientific equipment is placed somewhere, close to the (for B) unaccelerated part of B's travel-route, *at rest relative to A*. This observer sends a very short pulse of light, with a predetermined emission frequency toward a receiver on B's spaceship, at the moment when the sender and the receiver are closest to each other, and B sends a corresponding pulse of light, with exactly the same emission frequency toward C's receiver, at the moment when it is closest. Since the events, according to SR, are completely symmetrical, the *special principle of relativity* predicts that B and C will receive exactly the same frequency, (although the frequency of both light pulses have become altered by *relativistic Doppler shift*). And if that is the result,[1] then (***based on SR***), it must be concluded, that B's and C's clocks run at the same rate, physically.

[1] What both relativity-experts and I would expect.

Since C's clock and A's clock are in the same inertial frame, and therefore run at exactly the same rate, *physically*, B's clock should also run at the same rate as A's clock, physically. But if that was the case, *there would be no physical time dilation of B's time at all*, and the two clocks ought to show the same, at the return of B! Therefore the theory of relativity *"have to"* predict an asymmetry in the receiver frequencies,[2] contrary to the special principle of relativity, but in accordance with my conclusion that the traveling twin will age physically slower than his brother throughout the journey, according to the same theory.

[2] Lorentz's ether theory **[4]** predicts *symmetry* in the receiver frequencies, in such an experiment. And when this apparently is contradictory to the physical time difference that emerges at the return of B, the explanation is, according to this theory, that the measuring instruments used by B and C for the frequency tests, have not been at rest in relation to the ether, and therefore will not measure completely correctly. Such an explanation cannot be used to defend SR, since this theory presupposes that one can rely on the measurement results (that they 'reflect' the physical reality) when the measuring instruments are OK, and measure with sufficient precision.

A circling observer:

There is another way to show that there is something completely wrong with Einstein's interpretation of time dilation. Here my starting point is a 'scientific paper abstract', which I found on the internet. It was published in 1999 and written by *Dennis J. McCarthy*. I reproduce the entire abstract here:

"**Experiments confirm that a circling observer will see a stationary inertial clock in the center of the circle run fast. For large circles, one can always hypothesize the existence of a co-moving inertial "lab partner" who is co-located and essentially stationary with respect to the circling observer for some finite period of time. The circling observer must interpret that his observation of the rate of the center clock, as determined by the relativistic Doppler equation, show the center clock is running fast with respect to his stationary clocks. According to the special theory of relativity, the co-moving inertial "lab partner" of this circling observer must interpret that this same observation shows the center clock is running slow with respect to those same stationary clocks. The Lorentzian Relativity analysis of this orbiting clock situation should be preferred to the Einsteinian explanation because it does not demand that co-located "lab partners" interpret the exact same observation in two different ways.**" **[5]**

However, after having calculated such effects in different hypothetical cases, I have come to the conclusion that, according to the theory of relativity, the two co-located 'lab partners' *will* observe the same (a blue-shift of the light from the center clock), in that situation, but subtracting the *classical Doppler effect* from the (inertial) lap partner's frequency measurement (so only the effect of speed-based time dilation remains), will result in a *red* shift, since he, according to the special principle of relativity, necessarily have to measure that the center clock runs slower than his own. For the circling observer, there is no 'classical Doppler effect', as he constantly has the same distance to the center clock.

Despite this conclusion I will show that a slightly altered version of McCarthy's thought experiment constitute a clear and crucial problem for the theory of relativity: We have two clocks; one, **C1**, is at rest in an inertial frame, while the other, **C2**, is in a circular orbit around **C1**, in the center. The theory of relativity then predicts that **C2** runs *physically* [1] slower than **C1**, and this is (indirectly) confirmed by experiments **[6]**. It is also in agreement with the GR-prediction that the circling observer will receive light from the center of the orbit, as blue-shifted **[7]**.

[1] That it is a *physical* effect can be made clear if you let **C2** make many orbits around **C1**, and then return to **C1**. If **C2** then is so much after **C1**, that this fits well with the prediction of SR / GR, based on the speed **C2** had, measured in the inertial frame of **C1**, it is clear that this cannot be just a coordinate-dependent effect. The experiment would be a "kind of" twin paradox experiment, and the expected time difference, just as physical.

Now let's imagine that the orbit radius of **C2** is so extreme large, that it will be *almost* at rest compared to an *inertial* clock, **C3**, for a relatively long time, even though the orbital speed is so large that **γ** (gamma) is equal to **2** (i.e. about 260000 km/s). Then it is clear that in the orbiting laboratory it must be found, that the two clocks run "*equally fast*" (within the measuring accuracy), by comparison during the period in question. The problem with this is that GR predicts that **C2** will run only half as fast as **C1**, ***physically***, while the *special principle of relativity* predicts that **C3** will run at exactly the same ***physical*** rate as **C1** [2], because of the symmetrical situation.

[2] Of course, this is not a normal interpretation of SR, where only coordinate-dependent space-time effects is taken into account, but I see no reason not also to focus on what can be deduced about physical effects, according to the theory.

A conclusion must be that **C2** and **C3** run *equally fast*, ***physically, even though the theory of relativity predicts that they will receive the same light signal from C1 with different frequencies*** (when the classical Doppler effect is not included)!

Formulated in another way, where it is not necessary to distinguish between coordinate dependent and physical effects: As judged from the frequency of the light that an observer in the orbiting lab, who constantly is at rest in relation to **C2**, receives from *the center clock*, he (according to the theory of relativity) has to conclude, that *the center clock* runs ***much faster*** than **C2**. As judged from the frequency of the light that an observer who constantly is at rest in relation to the inertial clock **C3** (and close to it) receives from *the center clock*, he (according to the theory of relativity) has to conclude that it runs ***much slower*** than **C3**. But at the same time the two observers can state that **C2** and **C3** are running equally fast!??

It is clear that the theory of relativity necessarily have to predict that **C2** and **C3** run at approx. the same rate, physically, when they are almost at rest in relation to each other, even though it is only **C2** that accelerates [3] – and that both of these clocks run physically slower than **C1**. This is entirely in line with my previous conclusion that SR/GR *have to* predict, that the traveling twin will age physically slower than his brother, *throughout* the journey. Again, it is seen that the *speed* is decisive, and that accelerationhas no physical influence on the time effect – but the question is: the speed in relation to *what*?

[3] **C2** accelerates in relation to **C1** and "the universe".

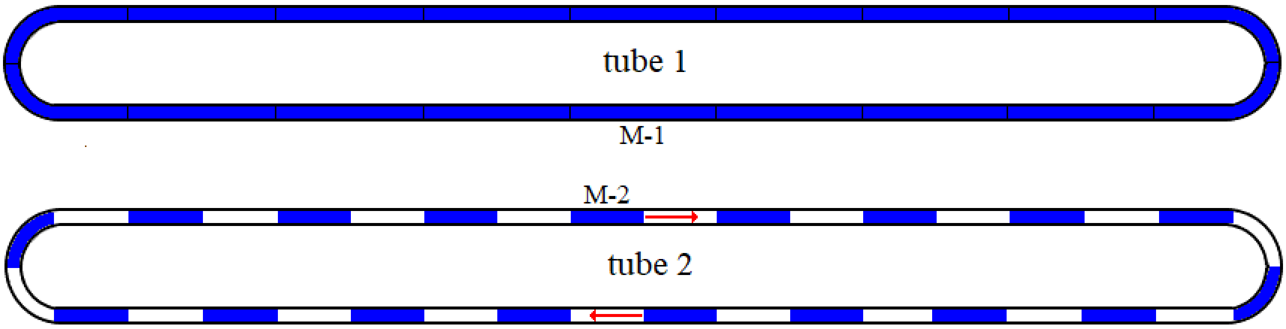
Physically contracted measuring rods:

Here I repeat some of what I wrote on page 3:

"If two atomic clocks are first at rest, in relation to (and close to) each other, in an inertial frame where they are found to run equally fast, and one of them then is accelerated to another inertial frame, then, based on the above arguments, one has to conclude that the theory of relativity predicts that the physically accelerated clock will run physically slower than the unaccelerated!"

This is "consistent with" something I discovered in 2002, by analyzing one of Einstein's thought experiments. Then I concluded that the theory of relativity predicts some very strange and, in my belief, *paradoxical* physical phenomena. If this theory was in complete accordance with reality, physical bodies would *inevitably* be ***physically*** contracted in the direction of relative movement, if they were accelerated from one inertial frame to another, and the rest length was preserved. I have argued thoroughly for this in the paper: "Questions regarding the foundation of the theory of relativity" **[8]**, but I will also put forward some arguments for this claim here.

Let's imagine that we do the following experiment: In an inertial frame, IF-1, we have two transparent tubes, as shown in the illustration below. At the start of the experiment, the two tubes are completely filled with identical measuring rods, which are at rest relative to the tubes. Subsequently the rods in tube 2 are accelerated up to a relative speed of about 260000 km/s, so *gamma* is equal to 2.



We presuppose that the *rest lengths* of the 'moving' rods are preserved. Then we know that these rods have become shorter, as measured in IF-1, according to the theory of relativity. Since the length of tube 2 has not changed, as measured in this frame, it is inevitable that gaps between the rods in this tube will emerge! And by the relative speed concerned, the gaps will be just as large as the rods. It is then clear that they have become *physically* contracted, and it can thus be deduced, that SR have to predict, that all bodies and particles will be physically contracted, if they are transferred from one inertial frame to another (when the *rest lengths* are preserved).

As the illustration shows, one of the rods in tube 1 is named M-1, and one of the rods in tube 2 is named M-2. The inertial frame that M-2 is at rest relative to, in the illustrated situation, we call IF-2.

If we only take the length of M-2 as measured in IF-1, and the length of M-1 measured in IF-2 (in the illustrated situation) into consideration, this is according to the *special principle of relativity*, a 'symmetrical situation'. An observer in IF-1 will measure that the rod M-2 is shorter than M-1. An observer in IF-2 will measure that M-1 is shorter than M-2. (We presuppose that the two observers make their measurements while M-2 is in one of the straight parts of tube 2.)

My question is now: how can this be a symmetrical situation, when M-2 obviously has become physically contracted. (If there is space for x rods of the same *physical* length as M-1, in succession between the Earth and the Moon orbit, then obviously there must be space for 2x rods of the same *physical* length as the "moving" M-2, according to SR.) M-2 is contracted *in relation to* 'space', while M-1 is (coordinate dependent) contracted *together with* 'space'.

The contraction of M-2 is, according to "SR", of the same physical kind, as the by GR predicted shortening of measuring rods along the edge of a circular rotating disc – an effect that Einstein used as an argument for non-Euclidean geometry in gravitational fields, in general. **[9]** According to GR, however, the effect is not due to gravitational *forces*, but to differences in 'gravitational potential', and therefore have to exist also for a rod inside a homogeneous spherical shell of matter (where it will experiences no net gravitational force from the shell **[10]**).

But since the effect in the 'gravitational field', created by the rotating disk, is not due to acceleration or differences in gravitational potential, but solely ***velocity*** [1], this seems to be a serious problem for Einstein's argument. Furthermore, I see the following problem for it: If you use physically contracted rods to measure space distances, without taking into account that they are contracted, then it is obvious that you will reach misleading conclusions! **This invalidates Einstein's argument for non-Euclidean space-geometry.**

[1] In a way, it seems reasonable to conclude that the effect is due to differences in 'gravitational potential', but since I have shown that measuring rods inevitably will be physically shortened if accelerated from one inertial frame to another, according to the theory of relativity, and this can "explain" the whole effect, it cannot be true that there also is another cause that explains the whole effect.

Thus, it is seen that the theory of relativity "predicts" that the *sizes* of physical objects, (and *rates* of clock-times), are changed in physical ways, when they are accelerated from one inertial frame to another.

Another problem for the theory of relativity is that it is ***impossible*** for the (measured) rest length of an object to be unchanged, if its physical length has changed **–** *unless* the used measuring instruments have measured "incorrectly" (given results that do not 'reflect' the physical length change of the object). And this is precisely what, according to *Lorentz ether theory*, is the cause!

Inertial frames in GR

GR gives a very different 'picture' of inertial frames than SR. According to *Wikipedia*, an *inertial frame of reference* can, based on **SR,** be defined as such: "...a frame of reference that describes time and space homogeneously, isotropically, and in a time-independent manner." And: "All inertial frames are in a state of constant, rectilinear motion with respect to one another;" **[11]**

According to **GR**, inertial frames exist only 'locally', but inside a *sufficiently small* closed box / laboratory (let's call it an 'Einstein lab') that is in free fall, it should not be possible to demonstrate any gravitational effect, or differences in measured physical conditions in such a situation, compared to if the 'lab' was far from gravitational sources of significance and not affected by external forces. This is, according *to GR,* due to *local inertial frames* falling like particles / small objects, in (atmosphere-free) gravitational fields. But is this conclusion consistent with all other parts of GR?

An alternative 'twin paradox'

Let's look again at the GR interpretation of the 'twin paradox'. As is well known, this requires that the traveling twin is affected by a coordinate-dependent and homogeneous gravitational field, during the turn of the spacecraft far from Earth. But it is clear that the turn could be caused by a *'natural gravitational field'*. This could, in principle, happen if two bodies with sufficiently large masses (e.g. comets) simultaneously, from opposite directions, and perpendicular to an imaginary line between Earth and the spaceship, passed close together between Earth and the spaceship, close to this. It could also happen if the spaceship makes a half orbit, in free fall, about a globe (if the spaceship has the right direction and speed). But here a problem arises for GR.

In order not to create a *real paradox*, it is necessary that there is still, *in addition to* the natural gravitational field, a gravitational potential difference from a coordinate-dependent and *homogeneous* gravitational field (although the twin in the spaceship does not feel any acceleration force). And the temporal consequences of this gravitational field must be equal to the consequences of the 'field' that would have arisen if the acceleration were solely due to the engines of the spaceship! The reason is that in a natural gravitational field, the two twins will *agree* on which of their clocks has the fastest rate (as opposed to an 'artificial gravitational field', where the twin that does not accelerate relative to the 'universe' shall not take into account the field that his brother notices). In order for the two twins to be able to agree on their predictions of who has aged the least at the reunion, it is necessary that, in addition to the speed effect, there is another time effect on which they *disagree*, and to a sufficient degree. And here the homogeneous gravitational field predicted by GR, caused by B's acceleration relative to 'the universe', seems perfectly usable.[1] This shows that GR *has to* predict that the by SR predicted perfect system of inertial frames is either completely or almost *unaffected* by gravitational fields! (It seems to be conceivable that 'inertial frames' (the ether?) will be *deformed* by gravitational fields, even if they are not accelerated by them.)

[1] If e.g. *the relative speed* causes B's clock to lose 10 years during the whole journey, according to A, then the relative speed causes A's clock to lose 10 years, according to B. And if it is rocket motors that cause B's spaceship to change direction, then this will result in A's clock *winning* 20 years, according to B, and this means that the two brothers agree on their predictions of the final result. However, if the acceleration of the spacecraft (relative to A and the 'universe') during the voyage is due to a natural gravitational field which (without velocity effect) entails that B's clock loses e.g. 20 years compared to A's clock - *physically* - then of course it will not - without a homogeneous artificial gravitational field - be avoided that their predictions of the final result will be different, and thus paradoxical!

This can also be shown in a slightly different way: we can imagine that an atmosphere-free globe is far from other gravitational fields. Through the globe a completely straight tunnel, which goes straight through the globes center of gravity, has been drilled. Two twins, A and B, are standing next to the drilled hole and have agreed that B should let himself fall into the hole. Before that happens, they discuss what GR predicts about what their clocks will read when B returns to A, after first reaching the opposite side of the globe, and then falling back to A. The question is now: what are their predictions of the temporal results, if B makes his calculations as if he was in the free-falling frame.

The difference in gravitational potential between them during B's free fall must, in isolation, mean that B will age the least, as during the whole fall he is lower than his brother in the gravitational potential of the globe.[2] This prediction the two brothers *agree* on, but on the other hand, they *disagree* on what the relative speed difference will mean for their relative *physical* aging. In order for them to agree on their predictions about the total physical effect on A's and B's aging, during B's journey, it is required that B must take into account that he is accelerating relative to the "universe" during the free fall, and that A's time for this reason will pass faster (**at *average***, not during the first and last part of the free fall) than without this effect.[1] And the artificial (and changing) 'gravitational field' created by the acceleration must also in this case be *homogeneous*, if A and B are to agree on their predictions about how they are aged in relation to each other, when they meet again.

[2] Although B is in free fall, and therefore does not feel any gravitational force, he and his clock must still be affected by the GR time effect, which is evidenced by the fact that atomic clocks of satellites (although these are in free fall) are more affected by this effect, the closer their orbits are to the Earth's center of gravity. And (as relativity experts know) GR predicts that a clock inside a hollow, spherical and homogeneous mass shell will go physically slower than a clock far from matter of importance, even though none of the clocks are affected by inertial forces.

[1] This necessary prediction of GR is not the normal GR interpretation of acceleration, where there is no 'proper acceleration' if you are in free fall, and therefore can not feel that you are accelerating in relation to 'the universe'. According to this GR interpretation, it is A and not B that 'accelerates', during B's free fall!?

The crucial thing is that natural gravitational fields cannot "neutralize" the *symmetrical* velocity-based time dilation, and that GR therefore has to predict that there is also another field, that has the necessary effect!

In the original 'twin paradox' thought experiment, it is the twin who has ***felt*** the forces of inertia / gravity that is least aged at reunion. But that this can not be used as a rule that applies in all cases is demonstrated in the article: "*Adding to the paradox: the accelerated twin is older*" In this article **[12]** a thought experiment is described where a twin, B, orbits a globe (in free fall) at a certain height, while twin A is at rest relative to the globe, at the same height as B's orbit. The two authors write that twin A is thus accelerated (according to GR), while B is not, but still concludes that A will be older than B at the reunion, according to GR. This conclusion is confirmed by GR expert *Øyvind Grøn* in the article: "*The twin paradox and the principle of relativity*" **[13]**, where he writes:

"M. A. Abramowitz and S. Bajtlik have, however, shown that there exist situations where the proper time is *not* maximal along a geodesic curve."

If we use known knowledge together with these expert conclusions, we apparently still can make a more general rule: **the twin that accelerates in relation to the inertial frames of SR / "the universe", ages the *least !*** [2]

[2] A similar rule based on Lorentz's ether theory could be that *the twin that accelerates in relation to the 'universe' also accelerates in relation to the ether, and thus will age the least*, as it will cause a greater speed-based time dilation. (Here, the 'Big Bang' theory is not taken into account.)

Let us now imagine that a laboratory falls freely in a natural gravitational field (which, inside the lab, is only unmeasurable inhomogeneous), directly toward the center of gravity of the gravitational source (the floor is closest to the center of gravity). According to GR, there is no measurable gravitational field / gravitational potential difference inside the lab, but my conclusion is that the theory of relativity *must* predict that spacetime in the lab still is affected by a coordinate-dependent artificial gravitational / inertial field, due to the acceleration relative to the inertial frames of SR.[3] And this field should, in isolation, make a clock at the lab floor go faster than a clock at the ceiling. But since, according to GR, it should not be possible to demonstrate any gravitational effect in the lab, it could be explained by the fact that the running of the clocks (despite the free fall) is also affected by the natural gravitational field, which then, in isolation, would affect the clock at the floor to go at a slower rate than the clock at the ceiling. Since the two fields are (almost) equal,[4] but opposite, they will (almost) neutralize each other's effects.

[3] But, as relativity experts know, it cannot be acceleration relative to the 'universe' that is the cause of humans and other matter '*instantly*' being affected by forces of inertia, by non-gravitational acceleration. If it has anything to do with distant matter/energy, then it must (in order not to exceed the speed of light) be gravity effects that were emitted a long time ago, but which now - either affect the local space-time / 'ether' - or affects bodies and particles, in the area in question - directly (but delayed) - with gravitational forces.

[4] Only the non-homogeneity of the natural field in the spaceship means that the two fields do not cancel each other out 100%.

On the internet I have found a statement from *Einstein* which seems to confirm that this was also his conclusion: **"I decided to extend the theory of relativity to the reference frame with acceleration. I felt that in doing so I could solve the problem of gravity at the same time. A falling man does not feel his weight because in his reference frame there is a new gravitational field which cancels the gravitational field due to the Earth. In the accelerated frame of reference, we need a new gravitational field." [14]**

It is incomprehensible to me that Einstein (apparently) did not realize that such an explanation is incompatible with the GR hypothesis that inertial frames fall freely in gravitational fields. If they do, there is no field to counteract the 'natural gravitational field' in a free-falling 'Einstein lab'! And then there is neither a homogeneous field to prevent a true paradox, in certain versions of the 'twin paradox'!

My conclusion is that GR is forced to predict that local inertial frames (**LIF**'s) do not fall freely, or accelerate relative to the 'universe', in gravitational fields (so that no paradoxes occur), but that this is contradictory to an important part of GR itself. Another thing you can deduce from the argument is that the gravitational forces you feel when you stand on Earth (according to this interpretation of "GR") are not ***inertial*** forces, but therefore must be ***gravitational*** forces that are counteracted by electromagnetic forces. And that the reason why objects and particles in free fall in the gravitational field of a planet, are accelerated relative to both the planet and "the rest of the universe", must be that they are affected by ***gravitational*** *forces*.[1]

[1] The argument does not exclude that gravitational theories other than GR (including ether theories) may be consistent with reality, even though they 'predict' that **LIF**'s (or ether 'particles') are accelerated, relative to 'the universe', by gravitational fields.

The reason why all (not too large or heavy) bodies fall with the same acceleration in the gravitational field of a globe, can be explained by the fact that a body that is twice as heavy as another also contains twice as much 'matter'/energy that the gravitational field can interact with, what outweighs the larger inertial mass. (I suppose that this was how the phenomenon was explained before GR.) And the reason why you do not feel any *force* when you fall (in a homogeneous field area) in an airless space, may be that all the molecules of the body are accelerated to (almost) the same degree, and at the same moment (disregarding the final velocity of gravity, which does not change the conclusion).

Inertial frames are not just coordinate frames. Something *physical* (e.g. the *source* [2] of 'zero point energy'?) must be behind them, since it requires *forces* to accelerate in relation to them – *extremely* strong forces in some cases. My assertion is that it will not be possible to accelerate inertial frames in relation to 'the universe', without affecting "them" (the physical phenomenon that lies behind them) with *forces*! And **therefore free-falling objects in natural gravitational fields will in any case be affected by forces**, even if it may only be *"indirect"*: one could imagine that gravitational forces accelerate 'inertial frames'/the local ether, which then accelerates particles and objects, without affecting them with *measurable* forces.

[2] As I see it, zero point energy is just inevitable (quantum-based) imbalances in an 'ether' with extremely large energies.

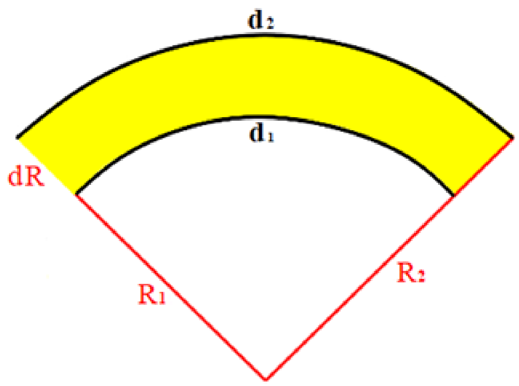
What is the cause/causes of gravity?

Some relativity "experts" claim that 'curved time' (gravitational time dilation) in gravitational fields is the cause of *Newtonian gravity*. To me, this is a completely incomprehensible assertion. How can such a small effect by (e.g.) the surface of the Earth, be the cause of the gravitational acceleration of approx. 10 m/s^2 ?

In 1 sec. a clock on the Earth's surface loses approx. 0.0000000007 (7E-10) sec., measured far away from Earth and other sources of gravity. At the same height, *radially* placed standard measuring rods (with unchanged locally measured lengths) are coordinate contracted by approx. 0.0000000007 (7E-10), according to GR. In other words, *time*, and *'space' in the radial direction*, are affected to the *same* degree. Then, *why* is it claimed that Newtonian gravity is due to gravitational time dilation, but not to the curvature of space (since this only affects, for example the orbits of the planets (in our solar system) extremely little, in relation to the effect of Newtonian gravity, according to GR)?

And when e.g. an apple falls vertically towards the Earth's center of gravity (in a direction where GR's time and space effects are equal), how can gravitational time dilation be the main cause of this? I have, on the contrary, concluded that this effect, according to GR, *counteracts* the gravitational acceleration of objects and particles with low horizontal velocities in relation to the speed of light (at least the *coordinate* gravitational acceleration), as any 'coordinate acceleration' in gravitational fields must be affected by that coordinate time is passing differently there, than far from gravity sources of importance.

But the GR time effect has – *maybe* – also a *reinforcing* effect on the acceleration of gravity, when an object does not move exactly in the direction of the gravitational field. Below is a very simplified illustration of the deflection of a light beam (shown extremely exaggerated) in a gravitational field, according to GR (here only gravitational time dilation is taken into account, and thus not the 'curvature of space'):



R_1 represents the radius of curvature at the inner part of the beam and R_2 represents the radius of curvature of the deflection at the outer part. The *distances* that the two parts of the beam travel in the illustration are denoted by $\mathbf{d_1}$ and $\mathbf{d_2}$.

In the case of electromagnetic waves, the curvature of the path (disregarding the 'curvature of space') depends, according to GR, on the difference in gravitational time dilation – and thus the difference in coordinate speed – at the upper and lower parts of the beam. *If* matter is affected by gravitational time dilation in a similar way, due to different time dilation at different parts of a body or a planet, then one can easily calculate how much acceleration bodies at different speeds will be exposed to by this cause. The curvature of the path must in that case be *exactly the same as for light* (since the "speed of time" is independent of the speed of the particles/waves), and then it is obvious that objects or waves that take much longer than light to travel a certain distance, therefore will also be accelerated much less by gravitational time dilation (much less than the acceleration of gravity, g).

My conclusion is that it cannot be the GR time effect that is the main cause of gravitational acceleration, and since this (by all accounts) is nor due the local inertial frames falling freely, it must be gravitational ***forces*** that are the main cause! If *gravitational time dilation* was the main cause of the gravitational acceleration of e.g. a falling apple, then *free-falling inertial frames* could not also be the main cause, and vice versa!

Gravitational time dilation is not dependent on inertial frames falling 'freely', because it is *the height* in the gravitational field (together with the mass/energy of the gravitational source) that determines how big this effect is, physically speaking, and it is independent of whether a clock is in free fall or not!

Light deflection in gravitational fields

– what are the causes of that, according to GR, and are these the real causes?

First, I will focus on the lengths of measuring rods in gravitational fields. If a rod, which has a – locally measured – rest length of exactly 1 meter, has its longitudinal axis in horizontal position, then GR predicts that its so-called coordinate length also will be exactly 1 meter.[1]

[1] Here we disregard a possible speed-based contraction, and the inhomogeneity of the *local* field, which in principle can be arbitrarily small.

However, if the longitudinal axis of the rod is in radial position, with a locally measured rest length of exactly 1 meter, GR predicts that its coordinate length (measured higher up in the gravitational potential, at rest relative to the rod) is less than 1 meter. If this is true, it means that there is room/space for more standard measuring rods (with preserved proper lengths), in extension of each other, between two test bodies (that are at rest in relation to each other) in outer space, if one or more, sufficiently heavy sources of gravity are located "between" them (or close enough), according to GR.

If this GR prediction is correct, it means, as I see it, that measuring rods and other objects in gravitational fields are ***physically*** contracted [2] and diminished – in relation to the outer 'space'/universe – even if these effects cannot be measured locally! (An accelerating observer will never be able to cause such physical effects, of course!)

[2] There will be space for more standard measuring rods in the universe, and therefore they are *physical* effects.

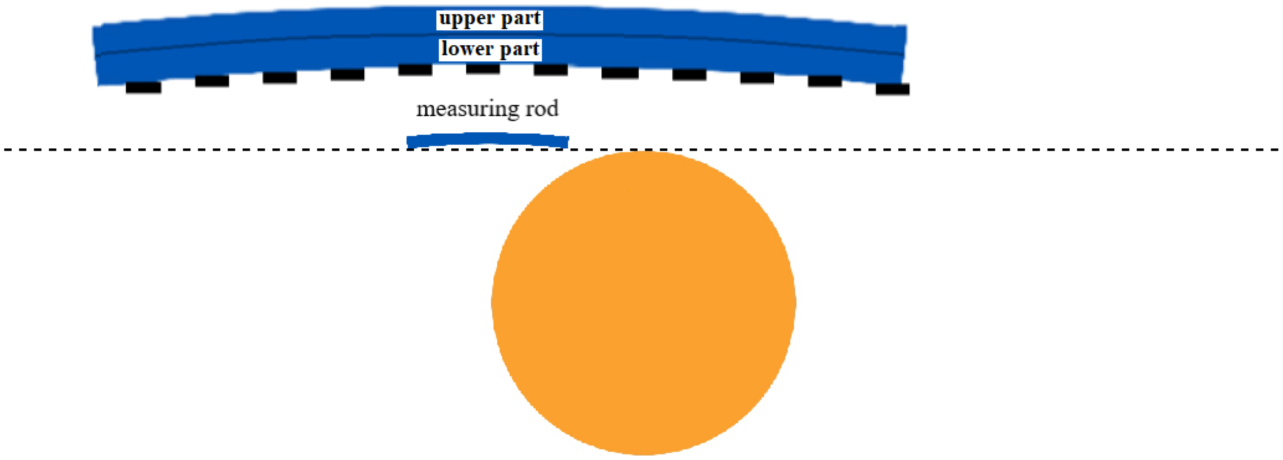
There is another argument that supports this conclusion: In a so-called 'artificial gravitational field', such as the example with measuring rods along the edge of a rotating plate, I have shown that the rods must necessarily be *physically* contracted, ***according to SR/GR***. Due to the principle of equivalence, I conclude that measuring rods in a natural gravitational field must therefore also be physically contracted, according to GR (otherwise there will be a *qualitative and decisive* difference between an 'artificial' and a natural gravitational field).

Another interpretation could be that it is space that is *physically expanded* in gravitational fields (possibly into a 4th *space* dimension – but this was not Einstein's view), while measuring rods, and other objects, retain their physical sizes – this is what, according to GR, in principle, is measured locally. But, as I see it, GR *have to* predicts that it is the measuring rods that change physical sizes, which the following thought experiment makes probable:

Let's say that we have an area where more and more mass accumulates around the common center of gravity, and that, at some point, a black hole forms (e.g. by a merger of two neutron stars). If this meant that more space had been *physically* created in the universe, then according to GR an *infinite* amount of space would have been created during *finite* time, as rods, according to the same theory, become infinitely "short" (in the radial direction) in relation to the local space, at the event horizon.[1] Such a problem will not exist if the conclusion is that it is rods and other objects that become physically smaller, while space retains its physical size.

[1] According to normal GR interpretation, the rods retain their physical sizes if the 'coordinate changes' cannot be measured locally, in which case the conclusion must be that it is space that has been *physically* expanded.

Let us see what such a conclusion can tell about light deflection in gravitational fields. The following illustration depicts a situation where a ray of light (dotted line) moves close past the Sun. And in addition, a measuring rod in two versions that are both very enlarged in relation to the image of the Sun, is seen. Let's say that its proper length is 1 meter.



The measuring rod, which is as *straight* as theoretically possible, is in free fall, and therefore the light beam, according to GR, will follow the lower edge of it [2] (as shown by the top rod). – The reason why the rod is curved is that the "lower" part, *as a whole*, is closer to the center of gravity of the Sun, than the "upper" part, and therefore shorter. In order for the rod to bend for this cause, the lower part must be *physically* shorter than the upper! It is obvious that a measuring rod will not curve simply because an observer accelerates (to me this confirm that GR predicts *physical* contractions and bending of objects, in gravitational fields)!

[2] When the path of the light ray is parallel to the longitudinal axis of the rod from the beginning, and the rod does not rotate.

If the light beam did not follow the lower edge of the rod exactly in a freely falling 'Einstein lab', one could – *in principle* – show that the lab was in a gravitational field, contrary to the equivalence principle.

Measured (in principle) by an observer who does not accelerate significantly relative to the Sun, however, the light ray curves more than the measuring rod, according to GR, as the ray is also in free fall. (But the entire curvature of the ray can also be interpreted as being caused by different speeds of light, at different heights!)

According to a normal interpretation of GR, the curvature of space at the place in question, will be the same as the curvature of the measuring rod, but I *completely disagree*, as according to GR the rod is not contracted *together* with space, but *in relation to* space (there will be room for more rods). And therefore it must also be *curved* in relation to space!

And since a ray of light in a natural gravitational field therefore must follow the curvature of a freely falling perfect measuring rod (when certain start conditions are met), it is evident that the ray of light does not follow 'space' either [1] (at least not, according to the 'equivalence principle')!

[1] There are therefore many indications that GR cannot predict that space in gravitational fields is curved in relation to space in gravitationally weak areas, but that it instead predicts that it is measuring rods and light rays that are curved, in relation to both the local and the 'outer' space - that is, that *space is not physically affected at all by gravitational fields*, which is in accordance with my previous conclusion (page 8) that GR *has to* predict that inertial frames is either completely or almost unaffected by gravitational fields!

But what is it then that causes a ray of light in a natural gravitational field to curve twice as much as the equivalence principle (alone) predicts?

When I began my (private) research into GR's prediction of gravitational light deflection, I got the impression that the deflection, according to GR, had the following two causes: *the inertial frames are free-falling*, and *space curves*.
Later, I concluded that there was a third possible cause: *gravitational time dilation*.

According to some 'experts', there are two "causes": the principle of equivalence and the curvature of space. Others claim that the deflection is due to the curvature of space-time.

Some 'relativity experts' say that gravitational time dilation follows from the principle of equivalence. But gravitational time dilation and free-falling inertial frames are clearly not the same phenomenon [2], and both should apparently have a significant impact on light deflection, according to GR. But if that was the case, it could not be true that the 'curvature of space' also has a significant influence!

[2] ***Gravitational time dilation***, ***space curvature*** and ***free falling inertial frames*** will, each, contribute with approx. **50** % of the total (measured) light deflection in the Sun's gravitational field, *if* they have a (significant) influence.

However, there is an opportunity to clarify the question, at least if one relies on the test results of the so-called *Shapiro delay*, that the speed of electromagnetic waves is reduced in gravitational fields. This effect has been measured many times, and has shown that the causes of *Shapiro delay*, by all accounts are the same as the causes of gravitational light deflection. I have concluded that neither possible *freely falling inertial frames*, nor *gravitational forces*, can have effect of importance on the *Shapiro delay*, in a relatively weak gravitational field like the Sun's, although the resulting deflection of electromagnetic waves would make the distance a little longer. This is well known among experts.

Therefore, GR have to predict that Shapiro delay is due to a combination of *'space curvature's* (expanded space) *and 'gravitational time dilation's influence on the coordinate speed of light*. But these two alleged causes must necessarily also deflect light in the Sun's gravitational field, which "completely" [3] explains the measured effect, and therefore there is no 'room' for that possible freely falling inertial frames, or gravitational forces, can be main causes of the deflection!!

[3] The measurement uncertainty will of course mean that it cannot be ruled out that other physical phenomena may have some – relatively little – impact.

So, not only are *freely falling inertial frames* in conflict with other parts of GR, but apparently also in conflict with scientific tests!?

One could argue, however, that this would not be the case if free-falling inertial frames only affect matter but not electromagnetic waves, but can such an explanation be reconciled with the principle of equivalence and gravitational redshift?

Two different kinds of 'curved space'.

If you ignore my conclusion that GR cannot predict *curved space* without contradicting other parts of the theory, it apparently predicts two very different kinds of *'curved space'*. According to a 'normal interpretation', the well-known and *measured* light deflection in gravitational fields is due to (in addition to the gravitational time effect) space curving *in the 3-dimensional space* (?) [1], here called ***curvature 1*** – but according to experts there is another "curvature" of space, which the vast majority of experts probably will interpret as a pure mathematical "effect", here called ***"curvature" 2***, but which, *in principle*, can be interpreted as a curvature into a *real* 4th space dimension (this was, however, not Einstein's interpretation).

[1] GR experts presumably interpret it as a *deformation* of the 3-dimensional space.

Both effects should 'coexist' in almost all situations, but if electromagnetic waves are sent *precisely* vertically down into a gravitational field, there can be no measurable deflection of the waves, of course, and therefore no ***curvature 1*** effect, while there will still be a ***"curvature" 2*** effect, according to GR.

By the so-called *Shapiro time delay*, ***curvature 1*** extends the distance that the electromagnetic waves travel; but in relatively weak gravitational fields like the Sun's, the effect is so small, that it has no influence on the measured effect. In contrast, ***"curvature" 2*** causes a measurable Shapiro time delay (according to GR), which can be interpreted as either due to the reduced speed of the waves (coordinate dependent), or that the distance they move is longer (locally measured) than if there had been no gravitational field.

I do not consider the next section to be an important part of my arguments against the theories of relativity, so it can be ***ignored***. It's primarily included because I'm interested in knowing how relativity experts will judge my arguments and calculation methods in the section. But also because I have not ruled out the possibility that my Shapiro delay calculations may contain something useful, scientifically.

Calculations of light deflection and Shapiro time delay.

Approx. 20 years ago, I calculated gravitational light deflection around the Sun using my computer's spreadsheet. The reason I started on that was that I could not understand how two very different methods that relativity experts use to calculate the effect could give the same result, as the experts claimed. One method (using *'Schwarzschild coordinates'*) takes into account that the coordinate speed of light in a gravitational field is different in different directions, according to GR. But there is a considerably simpler method where one "pretends" that the coordinate speed of light is the same in all directions (isotropic coordinates).

Since I have never learned (and probably would not be able to learn) the advanced mathematics used by experts, I had to use (for me) much more comprehensible calculation methods, which however required ***many*** individual calculations – calculation of the deflection in relatively short distance intervals. The result I got was independent of which of the two calculation methods I used – and very close to Einstein's. So I concluded that he and the other experts were right on this issue.

Then I used spreadsheets to calculate Shapiro time delay [1] in several experiments, and as expected, the results showed that the two calculation methods give *different* results when it comes to the influence of gravitational time dilation on the total 'travel time' of electromagnetic waves.

[1] An extra delay of electromagnetic waves in gravitational fields, predicted by GR, which can be measured by emitting radio waves towards other planets (or space probes) in the solar system, where they are reflected back to Earth. Such experiments were proposed by Irwin Shapiro in 1964.

I calculated the difference to be approx. 20 μsec. (Mars and Mercury experiments). But in 2020 I repeated the calculations in a "slightly" different way and got the result: approx. 13.65 μsec., and I remembered that Irwin Shapiro in an article: "Ross-Schiff Analysis of a Proposed Test of General Relativity: A Critique" **[15]**, had stated the calculated result for 'β' [2] to be 13 μsec. – This "agreement" was probably not random, I assessed, and concluded that I had found a way to calculate β.

[2] β was stated by Shapiro to be a 'nonlinear term' in GR.

But Shapiro also claimed (in 1965) that β could not be measured in his proposed time delay experiments:

" More precisely, whereas the maximum magnitude of the effect on time delay of the nonlinear term is 13 μsec in Einstein's theory, the deviation between the contribution to the time delay of this term and of a suitable linear combination of a change in solar mass and a change in, say Mercury's radius will nowhere exceed about 0.4 μsec, as shown below." **[16]**

and:

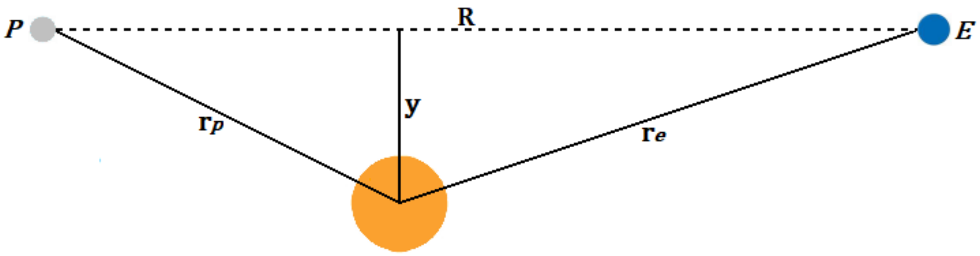
"For the model of circular orbits, we may conclude that measurements of interplanetary radar-pulse time delays are sensitive to the γ term in the generalized metric, but are insensitive to the β term. Even were we to consider an experiment based on "exact" optical determinations of individual planetary orbital periods in addition to the radar measurements of time delay, distinguishing reliably a β-dependent term for circular orbits would not be feasible. For actual noncircular orbits, the β term in the metric will in fact be detectable from several years of radar data since it affects the advance of planetary perihelia." **[17]**

and:

"The mass of the target planet affects its orbit and must also be estimated from the observations. The estimate of this parameter, too, is very highly correlated with the estimate of β." **[17]**

I do not fully understand these explanations, but I do understand that the calculations of Shapiro time delay have been extremely complicated (*however, I am absolutely open-minded to the possibility that the explanations are correct*). What I especially do not understand is how they could measure γ with an accuracy of less than 1 μsec, in some time delay experiments (e.g. in the Viking spaceship experiments in 1976-77), while they could not measure a 13 μsec. β-effect!? Something else that I do not understand is how the β-effect on the speed of the radio waves in the Solar System can be 'correlated' with the estimates of the target planet's orbits, when their orbits around the Sun take place at (generally) very different distances to the Sun than the paths of the radio waves in question? But of course, uncertainties in the orbits of the target planets will affect the accuracy of the measurements.

The illustration below shows schematically a Shapiro time delay experiment in which radio waves are sent towards a planet (or probe) and are reflected back to Earth.

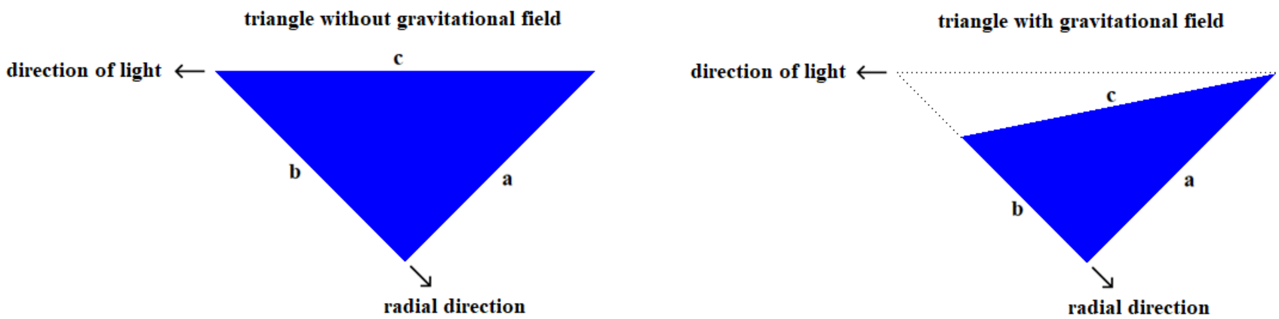


The following table/scheme shows some of the results of my calculations (from 2020) of Shapiro time delay. The calculations of the extra delay of the electromagnetic waves, according to GR, based on *isotropic* coordinates I call: '2γ' [1], and the calculations based on *anisotropic* coordinates I call: '2γ-β'. (The distances are in *km*.. The results are in μsec.! GM for the Sun I set to 1.327E+20.)

		R	y	2γ	2γ-β	β
Mariner 6	29/4 1970	402250000	2436000	199,9	186,2	13,654
Mariner 7	10/5 1970	385560000	4106400	178,0	164,3	13,653
Mercur		208000000	696000	220,3	206,6	13,655
Venus	1970	257760000	2540000	181,5	167,9	13,653
Venus		257810000	696000	232,5	218,9	13,655
Mars	1976	377500000	696000	247,3	233,6	13,655

[1] γ I perceive here as the 'curvature of space's influence on the Shapiro delay of light in all directions, using isotropic coordinates, according to GR. Since the effect of gravitational time dilation on Shapiro time delay is just as great, according to GR, I multiply γ by 2.

The biggest problem I had with the calculations of the light deflection and Shapiro delay was the calculations of the speed of electromagnetic waves in directions other than the radial and the horizontal. First, I calculated the contraction of a radially placed measuring rod, at the place in question, in order to be able to calculate the speed of light in the radial direction. Next, I tried to calculate the contraction of the rod in the desired direction, and the method I used for it in 2001 can be seen in the following illustration:



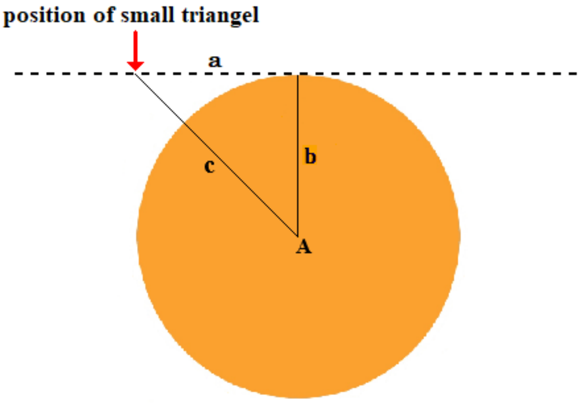
We see a triangular measuring tool in two situations, one completely without field, and one in an extremely strong but almost homogeneous field area.

I was interested in finding the relative length change of the side '**c**', and used the well-known knowledge that there is no contraction of measuring rods/objects, perpendicular to the field direction, according to GR.

As can be seen: after the contraction, the direction of **c** is no longer parallel to the direction of the light, and one does not find the length of **c** in the direction that was desired, but it is my conclusion that in a relatively weak field like the Sun's, the change of the direction is so little (also as a whole) that it will have no measurable significance. Using this method in my calculation of the deflection of light in the Sun's gravitational field, I got the same result as Einstein's.

But for the results of my Shapiro delay calculations, there was a difference. My result in 2001 gave a β-value of approx. 19.7 μsec.

The method I used in 2020 was the following:



I imagined that the large triangle seen in the illustration, with the sides **a**, **b** and **c**, where **b** is the radius of the Sun, is made very small and placed at the place where I wanted to calculate the Shapiro delay (or light deflection). My idea was that the length of **a**, relative to the length of **c** (whose direction is always radial) could possibly be equal to the ratio between the contraction of **a**, and the contraction of **c**.

I concluded that the results would then at least be correct (or almost correct) in the two 'boundary areas' where the angle **A** is either very close to 0 (and **a** is almost perpendicular to the field, and is very small relative to **c**, in accordance with the prediction that there is no contraction exactly perpendicular to the field), or **A** is very close to 90 degrees (where **a** and **c** are almost equal in length and almost parallel, and the direction of **a** therefore is very close to being radial).

As an example of these calculations we can take the situation on the illustration where **A** is 45^{o}. Since the radial contraction is inversely proportional to the distance to the center of the Sun, the radial contraction at the small triangle must be equal to cos(**A**) multiplied by the radial contraction, at the surface of the Sun (approx. 0.00000212). This gives approx.: 0.00000150. – This sub-result must then be multiplied by the ratio between **a** and **c** (= sin(**A**)), to find the real contraction of **a**. The result is then approx.: 0.00000106.

That the Shapiro delay result for β I got by this calculation method (13.6 μsec.) is almost the same as Iwin Shapiro himself states (13 μsec.) I doubt can be accidental [1], but of course I cannot exclude it. However, I still do not understand why my 2001 result apparently is wrong!

[1] I have only used the two calculation methods described.

There are clearly many topics in this paper which are so complicated that there is a great risk that you as an uneducated researcher will reach wrong conclusions. This risk I suppose is even greater by the topics I will now address: *black holes* and *gravitational waves*. However, this does not mean that I do not trust my conclusions at all. I am convinced that many of my arguments and conclusions in this paper – and *probably* also some of those which deals with the following topics – will turn out to be right (at least sometime in the future) – that there is something that can be used scientifically, if it is investigated seriously by relevant scientists.

What happens at the event horizon, and inside a 'black hole'?

According to GR experts, a person in a spaceship that is thought to fall freely through the event horizon of a black hole with an extremely large mass, will not notice it, and his clock will (measured by himself) go as normal. Then he and the spaceship will inevitably continue the fall and end in the so-called singularity.

Another thing that is claimed by relativity experts is that the area inside a black hole (behind the event horizon) is *empty*, that the whole mass of the black hole is located at/in the singularity, although they know that the equations of GR 'collapse' if one tries to calculate the physical conditions in the singularity.

But I do not agree with all these expert claims. It has not been taken into account that gravitational time dilation is a *physical* phenomenon, and that a person who is deeper in a gravitational field than another is more affected by the phenomenon.

We have two observers. One of them (A) is located very far from the event horizon of a supermassive black hole. The other (B) is in free fall, very close to the horizon, measured by A. We know that GR then predicts that B will *never* fall through the horizon, measured by A, while it will happen in finite time, measured by B himself. But my assertion is that GR can not trustworthy predict two completely different course of events in such a situation.[1]

[1] I am aware that GR experts argue that two different courses of events do not constitute a real paradox, as it is physically and in principle impossible for B to escape the black hole if he has first ended up behind the event horizon. And since, according to GR, he also can not in other ways communicate to B that he has 'penetrated' the horizon, when A remains on the other side, a real paradox should never arise.
That it is not possible (not even in principle) to test this claim does not make it more credible, in my eyes! And one might ask: *when, in the history of the universe*, is the 'history' of B divided into two versions, and what is the physical *cause* ?

Another outcome of the thought experiment is apparently obtained if we change the starting situation, so that there is now another black hole which approaches the first described, almost radially, but from the opposite side of where B is located. When the two black holes are sufficiently close to each other, it will (according to my interpretation of GR) mean that their event horizons will be deformed (i.e. widened, especially where they are closest to each other). And when they are close enough to each other, they will "merge" and B will end up behind the new event horizon. Apparently GR predicts that A and B will agree on this consequence for B (although they will strongly disagree on how long it will take) – otherwise a black hole with matter close to the event horizon, observed from the outside, could never grow so much that the horizon passed this matter, which apparently would prevent black holes from growing significantly, measured from the outside!

And, apparently, GR predicts that matter can only end up behind the event horizon of a black hole, for observers outside, if the horizon expands sufficiently!?

According to my interpretation of GR (*without quantum phenomena*), ***absolutely nothing* that is inside the event horizon can affect anything that is outside, *in any way***, since it would require a – locally measured – interaction speed greater than c.

According to the same theory, the *mass/energy* that is inside can therefore not affect matter outside *gravitationally!* It is not a useful counter-argument that it is through the *curvature of space-time* that the gravitational influence occurs, as it makes no sense (to me) that 'space-time' outside the event horizon can be *constantly* affected by space-time (or anything else) inside, without a *constant* transfer of 'information'. It also makes no sense to me when some relativity experts claim that gravity is not a force, while others argue that it is presumably transmitted by force particles (*gravitons*).

If coordinate time has already come to a complete standstill at a certain place, then it should apparently pass even "slower" when the horizon exceeds this place, but how can the coordinate time pass slower than infinitely slow?

This makes me think of a knowledge about black holes I gained many years ago. I devised two thought experiments, dealing with extremely long trains that apparently proved contradictions in the theory of relativity. I sent them to a physicist who, however, did not agree with this conclusion. Based on his answer, I concluded that GR requires that the coordinate time pass *backwards* sufficiently deep in an artificial gravitational field (which I later got confirmed via a serious and credible physics book). Later I concluded that the principle of equivalence necessitates that the same applies in the gravitational field of a black hole: behind the event horizon, the coordinate time *must* pass backwards, according to GR. But, as I have argued in this paper, gravitational time dilation in a natural gravitational field is not just a coordinate effect, but an unambiguous physical phenomenon. So how can time pass *physically* backwards behind the event horizon, and how can measuring rods have *negative* lengths, which apparently also is a prediction of the theory!??

I consider it likely that *quantum phenomena* will cause all electromagnetic processes to *physically stop* (stop working), both on the event horizon and behind it – that there is a limit to how slow and weak electromagnetic interactions can be.[1] However, this does not necessarily mean that *'time'* has come to a standstill. I consider it *probable* (but not clarified at all) that some physical processes do not stop, and that there are 'particles' and waves that interact so little (or not at all) with matter and gravitational fields that most can pass through a black hole, completely or almost completely undisturbed.

[1] If one imagined that there was a serious collision between two spaceships, close to the event horizon of a supermassive black hole, then for a distant observer it would be experienced as if it was happening in slow motion, and this observer might have difficulty understanding that the two spaceships would be severely damaged, or possibly totally destroyed. But GR must then predict that the electromagnetic, and other (but probably not *all*) forces, between the spacecraft's molecules, atoms and atomic nuclei, etc., would be very weakened, "measured" by a distant observer. To me, however, it has to be a *physical* weakening that would become *total* if the event horizon expanded so much that the spaceship ended up behind it. However, this does (by all accounts) not mean that the spacecraft's mass/energy disappears; it will *probably* be converted into other forms of energy!!

It seems to be a fact that "matter"/energy inside a black hole can interact [2] with matter and energy outside the event horizon. One explanation may be that the gravitational interaction speed is less *reduced* than the electromagnetic in gravitational fields. I have been considering whether this has been "confirmed" by scientific measurements, as I have read that a delay (of about 1.7 seconds) has been detected by gamma rays in relation to gravitational waves from merging neutron stars.**[18]** (However, I do not know if there can be completely different explanations for the difference in arrival time.)

[2] So influence each other (gravitationally) in *all* directions.

According to GR, the *locally measured* distance between a point on the event horizon of a black hole, and any point outside, is (in principle) *infinite*, *if* the measuring instruments are at rest in relation to the center of gravity of the black hole. So: no matter how close you get to the event horizon, the locally measured 'proper (*rest*-)distance' to it should still be infinite.[1] I can only interpret this as GR predicting that *no* objects or particles outside the horizon can be gravitationally affected by something that is on or behind the horizon (and vice versa), as the 'real'/'proper' distance, according to the theory, is infinite!?

[1] For me, it is a clear sign that the mathematics of GR is "collapsing" already at the event horizon, and not only at the 'singularity'!

Gravitational waves?

As I see it, there is strong experimental 'evidence' that gravitational waves exist! But the arguments I have presented against 'curved space' have convinced me that it is not 'space' that waves!

By gravitational waves, it is apparently (in addition to the purely dynamic influence on space and matter in it) the space-time *conditions* (the 'metric') close to the two sources of gravity that propagate (briefly) and "weakened" to other parts of the universe, according to GR!?

But how can the expansions and contractions of the LIGO arms be measured if the speed of light changes to the same degree? If you are inside a homogeneous spherical shell, you can (in principle) not measure that a standard measuring rods is (coordinate) contracted, because the (coordinate) speed of light (when you ignore the 'time effect') is correspondingly reduced, according to GR!?

According to Richard Feynman, the size of objects such as a 'rigid rod' does not change (of importance) if a gravitational wave (from a sufficiently distant source) hits it. In a letter to Victor Weisskopf, he described a gravitational wave detector: " It is simply two beads sliding freely (but with a small amount of friction) on a rigid rod. As the wave passes over the rod, atomic forces hold the length of the rod fixed, but the proper distance between the two beads oscillates." [19]

That is: according to GR, it is *'space'* that changes size under the influence of a gravitational wave, while objects/bodies (to a large extent) preserve their sizes [2] (locally measured). Therefore I must conclude that, according to GR, it should not be possible to measure any change in the arms of a gravity detector during a gravitational wave – neither when different parts of an arm are affected by different gravitational potentials from a wave, at the same time! – On the other hand, it should apparently be possible to measure changes in the distance between two 'test bodies' in outer space (if they are unaffected by other forces, and at rest relative to each other just before they are hit by a gravitational wave, according to GR.

[2] This confirms my previous conclusion that GR predicts that objects changes sizes *relative to* 'space' in gravitational fields, if the objects are moved to a place that is deeper / lower in the gravitational potential. (But I also concluded that the resizing of objects is *physical*, while the apparent change of 'space' is just relative.)

As I see it, the medium of gravitational waves is probably a kind of 'ether' (I call it: *'the gravitational ether'*). If this is true, waves in this ether should apparently (briefly) change the dimensions of bodies that the waves penetrate. I have got the idea that the reason why it has been possible to measure such waves, may be that the 'arms' of the LIGO detectors cannot change their lengths "sufficiently", in the time available before they, without this delay, would have regained their original lengths. The measured oscillations in the gravitational waves are shorter than 1/10 second (as far as I know), and since the arms of the detectors are several km. long, it does not seem unlikely to me that they can not manage to "adapt" to such relatively "rapid" oscillations, completely. If this is true, the effect of the changed speed of light will only be partially counteracted.[3]

[3] It cannot be the speed of electromagnetic interactions that determines how fast the LIGO arms can change their lengths - my conclusion is that it must be the speed of molecular pressure waves (sound waves).

One possible explanation for the LIGO's arms not being able to adapt completely, may be the following: I have concluded that the dynamical part of gravitational waves (*probably*) is caused by what creates *inertia*. If it is acceleration in relation to the local ether that causes inertia, then this inertia must cause the matter in a body to be accelerated by gravitational waves. But in that case it is not possible for the body to completely "follow" immediately,[1] as inertia, as you know, never is 100% (then it would not be possible to accelerate, in relation to the ether / inertial frames, at all). If it is a kind of ether that waves, and matter is this ether (*and* the electromagnetic ether) in an altered state (a special kind of ether-waves), then a physical body will still not change *density* as fast as the ether. I do not know how to calculate the extent to which molecules in a solid body 'follow' such density oscillations of the gravitational ether, or whether it is possible at all.

[1] This *may* affect the measurement results of the upcoming LISA experiments !? (In space, *inertia* is the only thing about gravitational waves that can move the mirrors, as I see it.)

I think that there is another possible explanation for *most* of the measured effect: the way the mirrors are hung: in thin and long threads, and other sophisticated technical devices, to minimize unwanted vibrations from the surroundings. These probably make it impossible for physical changes in the lengths of the LIGO arms, during a gravitational wave, to affect the mirrors so much that it neutralizes the effect of the altered speed of light! (But this explanation of course presupposes that it is not 'space' itself that waves, what I have full confidence in!)

Some thoughts on *inertial frames*:

One of the conditions for the theory of relativity to be consistent is that there are *infinitely* many inertial frames, with infinitely many directions, in even the smallest area of space – but for me this is ***impossible*** in the real world (and I suppose many physicists will agree). It also seems to contradict what I know about quantum mechanical phenomena.

According to GR, *local inertial frames* (*LIFs*) fall like free particles/objects in vacuum. If this is true it apparently means that LIFs can be 'captured' by gravitational fields: be in orbit, or have their relative directions and speeds changed. And apparently GR predicts that the accelerations of LIF's will be affected to some degree by the inertia of matter in a gravitational field (inside the matter) – especially in cases where the matter is extremely compressed.

Apparently GR predicts – at least *some* – *chaos* in LIF's relative movements, especially in an 'old' universe, and especially in extreme gravitational fields!? And besides, I will point out an effect that a black hole would apparently have on the total number of LIF's, relatively close to the event horizon. It is in such areas only LIF's moving *towards* the black hole that can exist there, according to my interpretation of GR. If inertial frames are free-falling, *all* LIF's from other directions must have been 'swallowed' by the black hole, and should then be 'lost' forever, for observers who are outside the horizon. And the closer to the event horizon a body is located, the fewer LIF's should be at that place. If it is acceleration in relation to the local LIF's that is the cause of inertia, then it should surely have measurable consequences if a large part of the local LIF's are gone [2] – in relation to the possibility that 'inertial frames' are *not* accelerated (falling) in gravitational fields.

[2] Even if there were infinitely many inertial frames, a large part of them (actually infinitely many) would still disappear in the black hole, and there would still be (all other things being equal) "missing" a large part of the 'gravitational unaffected' inertia.

However, there is apparently also an effect that *amplifies* inertia: the highly concentrated energy in space, which according to GR must exist near a black hole. (From an ether theory, it could be explained by that the ether must be assumed to be much denser, close to extremely strong sources of gravity.)

Some remarks on *gravitational potential*:

If you measure the frequency/wavelength from a light source that is located deeper in a gravitational field than the receiver you can establish that the light is red-shifted in relation to the frequency/wavelength, that is measured from a light source located at the same height as you [1] (if you are at rest relative to the source). However, according to a 'normal' interpretation of *GR*, the lengths of measuring rods and the rates of clocks are not *physically* affected by the gravitational potential where they are located (but for observers who are not at the same height in the gravitational field, they are *measured* to be affected). If that was correct, it would have to mean that the light was *physically* changed in the period from the emission to the reception. But this is, in my view, *wrong*, and I have concluded that the cause of the redshift is that the rate of "time" [2] is *physically* slower at the source than at the receiver! This is consistent with my previous conclusion (on page 14), that the speed of light is not affected by possible (?) freely falling inertial frames, or gravitational forces, in a gravitational field. The light does not lose energy when it moves away from the field source (only *apparently*), because the energy content of the photons is less, right from the start. This is also consistent with my conclusion that gravitational "time" effects are *physical*.

[1] However, this does not apply if the entire experiment is performed in a sufficiently small box / lab that is in free fall, according to GR.

[2] It is not necessarily 'time' that is affected but possibly only the speed of electromagnetic interactions.

Is the speed of light constant?

An observer is in a spaceship that has a constant distance to a light source, in a period when neither the spaceship nor the light source is affected by external forces, and they do not accelerate relative to the 'universe'. The observer measures the frequency of the light. Next, the spaceship's engines are started and it accelerates directly towards the light source. The engines are then turned off and the observer measures the frequency of the light again, but in such a situation the frequency will, as you know, be *increased*, what I interpret as the light waves/photons are hitting the receiver with greater energy. If this is a correct interpretation then I consider it a strong indication that the speed difference is increased, but that the measuring device just cannot measure it (for reasons explained by Lorentz ether theory)! One could also ask: why is an increase in the kinetic energy of the photons measured, if the speed difference is the same?

Is the ether refuted?

If you think that the ether was refuted many years ago, then the following quotes might make you change your mind:

In 1911, **Paul Langevin** wrote: **"A uniform translation in the aether has no experimental sense. But because of this it should not be concluded, as has sometimes happened prematurely, that the concept of aether must be abandoned, that the aether is non-existent and inaccessible to experiment. Only a uniform velocity relative to it cannot be detected, but any change of velocity .. has an absolute sense."** **[20]**

In 1913, **Henri Poincaré's** posthumous *Last Essays* were published and there he had restated his position: **"Today some physicists want to adopt a new convention. It is not that they are constrained to do so; they consider this new convention more convenient; that is all. And those who are not of this opinion can legitimately retain the old one."** **[20]**

In 1920, **Einstein** wrote /said: **"Recapitulating, we may say that according to the general theory of relativity space is endowed with physical qualities; in this sense, therefore, there exists an ether. According to the general theory of relativity space without ether is unthinkable; for in such space there not only would be no propagation of light, but also no possibility of existence for standards of space and time (measuring-rods and clocks), nor therefore any space-time intervals in the physical sense. But this ether may not be thought of as endowed with the quality characteristic of ponderable media, as consisting of parts which may be tracked through time. The idea of motion may not be applied to it. "** **[21]**

In 1921, **A.S. Eddington** wrote: **"This explanation was proposed by FitzGerald, and at first sight it seems a strange and arbitrary hypothesis. But it has been rendered very plausible by subsequent theoretical researches of Larmor and Lorentz. Under ordinary circumstances the form and size of a solid body is maintained by the forces of cohesion between its particles. What is the nature of cohesion? We guess that it is made up of electric forces between the molecules. But the aether is the medium in which electric force has its seat; hence it will not be a matter of indifference to these forces how the electric medium is flowing with respect to the molecules. When the flow changes there will be a readjustment of cohesive forces, and we must expect the body to take a new shape and size."** **[22]**

In 1951, **Paul Dirac** wrote: **"Physical knowledge has advanced much since 1905, notably by the arrival of quantum mechanics, and the situation has again changed. If one examines the question in the light of present-day knowledge, one finds that the aether is no longer ruled out by relativity, and good reasons can now be advanced for postulating an aether . . . . Thus, with the new theory of electrodynamics we are rather forced to have an aether"** **[23]**

Conclusions and comments:

The theory of relativity leads to predictions that are in conflict with the foundation of the theory!

When SR/GR based descriptions and calculations of the 'twin paradox' seem to be consistent, it is because coordinate-dependent effects are used to explain physical effects!

One of the problems for the theory of relativity in the interpretation of the twin paradox, is that it cannot explain in which time-interval/intervals the *physical* time dilation takes place, or what causes it. And this applies, regardless whether you use SR or GR.

It can be shown that SR predicts that the rates of clocks and the dimensions of physical objects, change in *physical* ways, when they are accelerated from one inertial frame to another, and that this leads to insoluble problems for the same theory.

The only realistic alternative to SR seems to be LET, or a theory that has much in common with LET.

GR contains several inconsistencies, but I perceive it nevertheless – partly – as a fantastic theory, which has been able to predict astronomical observations to a very impressive degree! One of the causes is presumably that GR is based on SR (which is based on the *Lorentz transformations*, which are a part of *Lorentz ether* *theory*), and the idea that 'space' has *physical* properties!? But several *expert-interpretations* of its equations are clearly *wrong*!

Although I am convinced that I am right in a significant part of my critique of the two theories of relativity, I am very aware that there are many questions about GR, and a possible alternative, to which I have not found useful answers yet. Eg. I do not know how an ether theory can be able to explain gravitational time dilation, not just qualitatively but also *quantitatively* [1] – or how the (Gravity probe B) experiments that apparently show that parts of 'space'/inertial frames are *'dragged'* by rotating gravitational sources, can be explained by an ether theory. Apparently it requires the ether to be a so-called 'superfluid' that can be accelerated by gravity, but this is contrary to my earlier conclusion that the ether must have a crystal-like structure that enables it to carry 'transverse waves' (this hypothesis requires *apparently* that matter is a kind of rotating / 'standing' waves in the ether, so that it can move without resistance by non-accelerating motion).

[1] I suppose that gravitational time dilation is due to that the ether is denser in gravitational fields and that this slows down the speed of electromagnetic (and perhaps all kinds) waves, which in turn slows down the speed of all physical / electromagnetic processes.

I hope this paper will inspire relativity experts and others to find solutions to these and many other apparent problems in the theory of relativity and possible alternatives to it!

References:

[1]: https://en.wikipedia.org/wiki/Principle_of_relativity

[2]: https://en.wikipedia.org/wiki/Experimental_testing_of_time_dilation

[3]: L. Marder, 'TIME AND THE SPACE-TRAVELLER', p. 114-15, University of Pennsylvania Press, 1971

[4]: https://en.wikipedia.org/wiki/Lorentz_ether_theory

[5]: "The Orbiting Clock Paradox: Should the Lorentzian View Be Preferred?" https://wiki.naturalphilosophy.org/index.php?title=The_Orbiting_Clock_Paradox:_Should_the_Lorentzian_View_Be_Preferred%3F

[6]: "Measurements of the lifetime of positive and negative muons at $\gamma \simeq 30$ in a circular orbit" / CERN Muon Storage Ring Collaboration - 1977. CERN Document Server

[7]: Relativistic Doppler effect - Wikipedia

[8]: https://vixra.org/pdf/1805.0411v3.pdf

[9]: https://en.wikipedia.org/wiki/Ehrenfest_paradox

[10]: http://www.astro.utu.fi/~cflynn/galdyn/lecture3.html

[11]: https://en.wikipedia.org/wiki/Inertial_frame_of_reference

[12]: https://arxiv.org/pdf/0905.2428.pdf

[13]: https://arxiv.org/ftp/arxiv/papers/1002/1002.4154.pdf

[14]: http://eotvos.dm.unipi.it/documents/EinsteinPapers/EinsteinInJapan1922.pdf

[15]: Irwin I. Shapiro, Phys. Rev. **145**, 1005 – Published 27 May 1966

[16]: Irwin I. Shapiro, Phys. Rev. **145**, 1006

[17]: Irwin I. Shapiro, Phys. Rev. **145**, 1010

[18]: *Doomed Neutron Stars Create Blast of Light and Gravitational Waves*, https://svs.gsfc.nasa.gov/12740

[19]: *Foreword to Feynman Lectures on Gravitation* (page 17)
https://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.147.9838

[20]: https://en.wikipedia.org/wiki/Twin_paradox

[21]: https://mathshistory.st-andrews.ac.uk/Extras/Einstein_ether/

[22]: A. S. Eddington: "SPACE TIME AND GRAVITATION", p. 19, CAMBRIDGE 1921

[23]: http://mountainman.com.au/aether_8.htm