How to test Lorentz ether theory against the theory of relativity

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Abstract:

In this paper I show several ways to test Lorentz ether theory – and a new method to test *general relativity*'s equivalence principle.

According to relativity experts, it is *impossible* to distinguish between *special relativity* (SR) and *Lorentz ether theory* (LET), by physical experiments. One of these experts was the English astronomer, physicist and mathematician, A.S. Eddington. In the book "Space Time and Gravitation" (1921), he wrote the following about the ether theory, the Lorentz–FitzGerald contraction, and the Michelson-Morley experiment:

"The Michelson-Morley experiment has thus failed to detect our motion through the aether, because the effect looked for – the delay of one of the light waves – is exactly compensated by an automatic contraction of the matter forming the apparatus. Other ingenious experiments have been tried, electrical and optical experiments of a more technical nature. They likewise have failed, because there is always an automatic compensation somewhere. We now believe there is something in the nature of things which inevitably makes these compensations, so that it will never be possible to determine our motion through the aether." **[1]**

"Because everything is altered in the same way, nothing appears to be altered at all." **[2]**

In a Wikipedia article about *'the twin paradox'* it is described like this:

"In the relativity of Poincaré and Hendrik Lorentz, which assumes an absolute (though experimentally indiscernible) frame of reference, no twin paradox arises due to the fact that clock slowing (along with length contraction and velocity) is regarded as an actuality, hence the actual time differential between the reunited clocks.
That interpretation of relativity, which John A. Wheeler calls "ether theory B (length contraction plus time contraction)", did not gain as much attraction as Einstein's, which simply disregarded any deeper reality behind the symmetrical measurements across inertial frames. There is no physical test which distinguishes one interpretation from the other." **[3]**

According to the experts, it is therefore *in principle* impossible to measure motion relative to the ether, or by other means clarify whether it is SR or LET, which is in accordance (or *most* in accordance) with reality. But having thought much about this issue, I have concluded, that *not* everything is altered in the same way, and that it *is* possible to test LET.

One way you can easily realize that the two theories will not always predict the same experimental results, and that it, according to LET, *is* possible to measure direct effects of altered movement through a possible ether (at least in principle), is the following:

If you in a laboratory have a measuring rod which, in a horizontally position, is attached (rotatable) to a point which is equidistant from the ends of the rod, you can imagine (or calculate) what, according to LET, will happen to the molecules of the rod, at different distances from its center, if it is turned in the horizontally plane, from a position perpendicular to the laboratory's thought movement through the ether, to be parallel to this movement (it is here assumed that the laboratory does not accelerate significantly in relation to 'the fixed stars', during the experiment).

Since, according to LET, it is a *physical* contraction, it is clear, that not all the molecules of the measuring rod will be subjected to the same physical acceleration during the process of contraction, and that the molecules farthest away from "the center" of the rod, will be subjected to the greatest accelerations.

The inertial forces that certain parts of the measuring rod is exposed to, due to the contraction, should (as I see it) be measurable *in principle* – and if the lab have a sufficiently high speed, relative to the ether, it will also be possible to measure the effect in practice (although the rod, after the contraction, will still be measured to have the same length as before, in the laboratory). *And it is obvious that SR never will predict such an effect!*

Let us try to look at the same effect in a different context. First another Eddington quote:

"There are other natural forces which have not as yet been recognised as coming within the electromagnetic scheme – gravitation, for example – and for these other tests are required. Indeed we were scarcely justified in stating above that the diameter of the earth would contract 2½ inches, because the figure of the earth is determined mainly by gravitation, whereas the Michelson-Morley experiment relates to bodies held together by cohesion. There is fair evidence of a rather technical kind that the compensation exist also for phenomena in which gravitation is concerned; and we shall assume that the principle covers all the forces of nature." **[4]**

If Eddington was right, the whole globe is probably physically length-contracted. And if it is true that you can use the speed of the Earth, in relation to 'the cosmic microwave background' (CMB), as an indicator of its speed through the ether (what some physicists believe **[5]**), the speed should be about 370 km./s., in the direction of the constellation Leo. This velocity should, according to LET, have the result that Earth's radius is shortened by about 5 meters, in the direction of movement.

It is clear that the direction of the Earth's rotation axis, with respect to the direction of the movement through the ether, also has significance according to LET, and I have (based on the available information) *estimated* that parts of the Earth's surface, *at most* will lower/rise about 4.5 meters, in the span of 6 hours. In case that this estimate is not entirely wrong, it can not be done without a *changed* gravitational acceleration, measured on the surface of the Earth (if one can measure the acceleration precisely enough and can 'filter out' all disturbing effects).

If this effect exists, it should result in a *changed* gravitational acceleration during the contraction and subsequent expansion of the Earth, during Earth's rotation. And I have calculated the maximum change in gravitational acceleration (at the surface), if the Earth's radius (in a particular direction) is contracted by 4 meters, to be approx.: +/- 0,000.000.017 m/s^2, and such a change should be measurable with modern gravity meters!

It has therefore surprised me that measurements of the gravitational acceleration on Earth, have not already demonstrated this effect, apparently,[1] and I have considered possible explanations for it. One possibility seems to be the fact that most of the Earth's matter is under high pressure, which *possibly* (?) changes the

'Lorentz effect' on this matter. The gravitational forces of the Earth cannot reduce the contraction itself (at least not *directly*), but apparently they will counteract and delay the (by Lorentz predicted) subsequent expansion. Of course, great forces are needed to raise the Earth's surface (and a large part of the internal matter) by several meters, in the course of approx. 6 hours (1/4 sidereal day [2]).

[1] I have not myself found data on gravitational anomalies that can be explained by the effect in question, or found information about that others should have discovered such data.

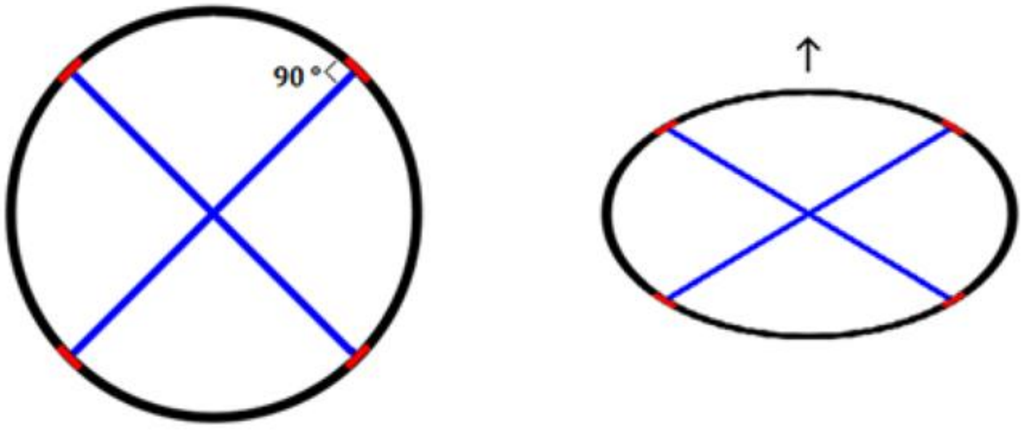
[2] Time scale that is based on Earth's rate of rotation measured relative to the 'fixed stars'

Furthermore, it is my conclusion that the 'pressure waves', that a possible Lorentz contraction and expansion cause, cannot have the same speed as the well-known pressure waves (*seismic waves*) in the Earth's interior, since the Lorentz effect requires that the distance between the Earth's molecules changes *physically*, in longer time. And the speed must (as I see it) be influenced by whether the waves move *in* the direction of the field, or the opposite.

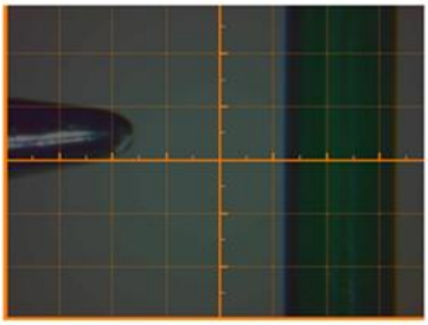
I hope that scientists who know more about these things, than I do, will make more reliable calculations and judgment of this! – If experts can find no plausible explanation (consistent with Lorentz's ether theory) for the failure to detect this predicted effect, then apparently that would be a major problem for the credibility of the theory! However, I find it very difficult to believe that Lorentz's ether theory should be completely wrong, since its predictions are consistent with extremely many experiments (presumably *at least* as many as SR), and since it also does not contain clear and indisputable inconsistencies, as SR do, I don't see any alternative.

A possible explanation for the "missing" effect could perhaps be that you (against expectation) cannot from the CMB radiation get information about the Earth's speed and direction through the ether, and that the Earth's rotation axis has a direction which makes the sought Lorentz effect much smaller than expected!?

But *if* the Earth is *considerably* physically deformed as a result of Lorentz contraction, it apparently give us another opportunity to prove the existence of the ether, as it may cause the surface of the Earth to change direction, relative to the direction of the local gravitational field of the Earth, as seen in the following illustration, that shows two rings, one of which is Lorentz contracted:



Eddington would expect that any influence of such directional changes would be neutralized by effects on the measuring equipment, or by other effects (*what I consider to be most likely*), but I have not found such, so far. Below are some photos from experiments where I tried to measure changes in the local direction of gravity using a plumb, suspended in a thin fishing line, and immersed in a glass of syrup.



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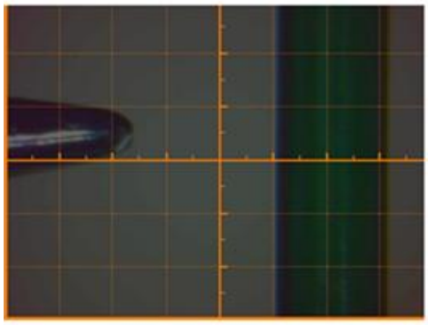

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To magnify the effect, I used an electronic microscope, and in some of the experiments I placed a needle close to the fishing line to minimize misinterpretation of the microscope images, which sometimes showed significantly larger apparent changes of direction than the one seen above. I found that the relative motion of the *moon* could be registered in this way, but gave up the experiments when some calculations convinced me that it would require some of the best scientific instruments and equipment, to be able to detect the ether in this way, if at all possible.

Here is another idea (which, however, have common features with some of the first mentioned proposals) to measure the effect of the Earth's motion through a possible ether: I think that it should be possible to utilize that a physical Lorentz contraction cannot be infinitely fast (*what several physicists concluded many years ago*), and probably should be slower than the speed of sound in the material in question. Since the outermost parts of a solid body must necessarily be accelerated more than the inner parts, by a Lorentz contraction /expansion, I have concluded that such physical effects have to depend on chain reactions (pressure waves) in the material.

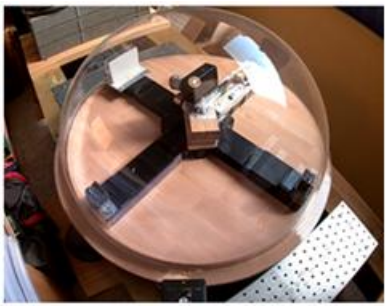
What really should happen to the different molecules of a physical object, during a Lorentz contraction / expansion, according to LET, will presumably be very complicated to calculate with great precision, since (apparently) there will be created many individual 'pressure waves', which will interfere with each other. But, so far, my conclusion is that the contraction cannot happen faster than the speed of sound in the material in question, and probably will occur with less speed, because I suspect that the many waves will partly counteract each other and thereby delay the overall length change – what I, however, will leave to physicists to clarify.

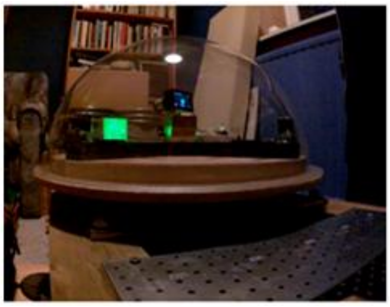
If I am right that it should happen at the speed of sound, or less, this seemingly opens an opportunity to make an alternative 'Michelson-Morley experiment', with a rotating interferometer, where there is not time enough for the interferometer-arms to contract, to the same extent as they would if the interferometer did not rotate so fast. Consequently an interferometer arm will only be *partially* Lorentz contracted, when it has the direction that, during the rotation of the interferometer, is closest to the movement direction of the laboratory through the ether – which must result in, that it will take a longer time (measured in the laboratory) for the light to travel the distance of an interferometer arm, back and forth, than when the direction is completely, or almost, perpendicular to the Earth's motion through the ether. – In the last mentioned case, the delay of also the *expansion* of an interferometer arm, will mean that it will here take *less* time for the light to move back and forth, and the two effects will therefore *reinforce* each other!

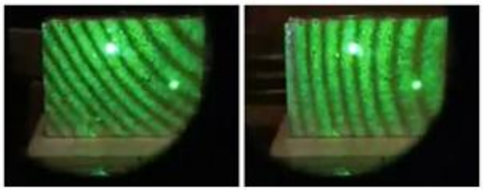
In order to observe possible changes in the interference pattern from the rapidly rotating interferometer, you could use a high-speed video-camera. Or maybe you can detect differences between the travel times of the two light beams, with sufficiently accurate time-measuring devices (if technically possible).

In order to make the possible output greater, you could let the interferometer arms consist of a material, that has a slow sonic speed, for example vulcanized rubber or cork **[6]**. In 2016-17 I carried out such experiments (see photos). Although I concluded in advance that it is very unlikely that the speed of the Earth, relative to the average speed of the ether [1], is so high that this medium can be detected in this way.

[1] Even if the ether, overall, has the same speed relative to the Earth, or possibly is "at rest" in relation to the local microwave background (i.e. when it has the same temperature in all directions, as measured in a 'SR inertial frame'), I conclude that *ether waves* and other quantum phenomena will cause the smallest parts of the ether to be in motion relative to each other.







The interference pattern at two different rotational speeds

By using magnets to transfer the power from the motor to the plate with the interferometer, I stabilized the interference pattern so much that the plate (50 cm. in diameter) could make more than 3 revolutions per sec., without the pattern being "destroyed". On the other hand, there were some rhythmic disturbances of the pattern that I could not eliminate – usually 3 oscillations per round, and independent of what time of day the experiment was carried out, which convinced me that it had nothing to do with the speed of the Earth through the ether. (I have saved some slow motion footage from these experiments on my computer.)

I have considered possible options to enhance the effect, among other things: to attach heavy 'weights' /objects to the ends of the interferometer arms, such that the Lorentz contractions of the arms are delayed.

When I, on the internet, tried to find out if others had done similar experiments, I found articles which showed that several physicists had come to the same conclusion as I: that it is possible to perform experiments that can distinguish between LET and SR. As early as 1980, an article **[7]** by an American physicist, Kenneth R. Atkins, was published about such possible experiments. And in 1986, the renowned theoretical physicist, F. Winterberg published an article entitled: "A Crucial Test for Einstein's Special Theory of Relativity Against the Lorentz-Poincare Ether Theory of Relativity" **[8]**. In the same year, an article was published by Chalmers W. Sherwin, entitled: "New experimental test of Lorentz's theory of relativity" **[9]**. The article describes some experiment results which apparently contradict the Lorentz ether theory, but – as far as I can see – there is a serious flaw in the way the experiments were carried out.

In Sherwin's experiments, a heavy plate and two smaller masses, one of which was an accelerometer, were rotated around the center of the entire mass. All three masses were attached to a 'quill shaft' which, by means of a motor, made the whole mass rotate. In the article, Sherwin explained why LET predicts that the accelerometer will be *non-uniformly* [2] accelerated during rotation, even at uniform angular velocity (but depending on the direction of the axis of rotation relative to the direction of movement through the ether). I agree, but see it as a mistake that the accelerometer was attached by means of a *spring*. If it had been a "Michelson-Morley experiment" with a rapidly rotating interferometer, then the searched effect would presumably be *enhanced*, if the mirrors were attached to springs, as this would delay the length changes of the interferometer's arms – but if it is a changing *acceleration* of a rapidly rotating structure you are trying to measure, then the delay will *reduce* the acceleration and the expected effect (as I see it).

[2] Sherwin wrote: "... the Lorentz theory uniquely predicts that the transient stress does not have time to be fully relieved, and the outer end should inscribe an elliptical path ..."

It should also be mentioned that a GPS Consultant, *Ronald R. Hatch*, claimed that: "the fault with Sherwin's expected results was, in fact, that he ignored the increase of mass with velocity". **[10]** (I must add that I do not understand his reasoning for this conclusion.) – Hopefully experts will clarify these questions soon.

If there is an 'ether' not entirely different from the one Lorentz imagined, and today's best accelerometers are used to search for effects of the Earth's motion through it, my calculations show that it should absolutely be possible, and I consider it for being the most promising method, that I know of.

Finally, I will show a new way to test *general relativity*.

A logical consequence of the correctness of the equivalence principle must be that it is the acceleration of the measuring device, relative to the local inertial frames that creates both gravitational time dilation and gravitational redshift. During the acceleration the observer/measuring device constantly changes inertial frame, which according to GR/SR results in changed *simultaneity perception/measurements*.[1] In free fall there is no acceleration relative to the local inertial frames, according to GR, and therefore there should also be no gravitational redshift, or measurable difference in the rate of 'time', or the speed of light, in a sufficiently homogeneous "field" area (which, measured/observed in free fall, contains no gravitational field, according to GR.

[1] However, in a natural gravitational field this "rule" can only apply in sufficiently homogeneous field areas, because a clock in the center of a globe (where there is no 'gravity'), runs physically slower than a clock located far away from the globe and other sources of gravity. The gravitational time dilation effects must then (according to GR) be due to the accelerations of the inertial frames between the two clocks.

If you could place an atomic clock at the Earth's center of gravity, and compare its ticking rate with the ticking rate of an atomic clock on the International Space Station (*here disregarding the speed effect*), then, according to experts, you would find that the clock at the center of the Earth runs slower. Since the effect is not 'symmetrical', and since none of the clocks are accelerating relative to the local inertial frames (according to GR), I can only conclude that GR predicts that a clock which is placed lower in a gravitational potential, than another, is running *physically* slower (at least if the clocks are at rest relative to each other)! A clock on the International Space Station runs physically slower than a clock located far away from significant gravitational fields (if the two clocks are at rest relative to each other). A clock that is located 10 meters below the space station runs physically slower than a clock which is inside the space station.

A Wikipedia article describes the effect this way:

"Gravitational time dilation is at play e.g. for ISS astronauts. While the astronauts' relative velocity slows down their time, the reduced gravitational influence at their location speeds it up, although at a lesser degree.

Contrarily to velocity time dilation, in which both observers measure the other as aging slower (a reciprocal effect), gravitational time dilation is not reciprocal. This means that with gravitational time dilation both observers agree that the clock nearer the center of the gravitational field is slower in rate, and they agree on the ratio of the difference." **[11]**

Therefore I conclude, that if we have two atomic clocks (that are at rest relative to each other) inside the International Space Station, then the clock which is closest to Earth will be measured to run at the slowest rate.[1] However, if this is true, it will contradict the equivalence principle,[2] and thus GR, since according to this theory you should not be able to measure gravitational time dilation inside a freely falling closed room, if the gravitational field is sufficiently homogeneous inside it [3] (and thus without tidal forces of importance).

[1] If the space station is at an altitude of 400 km. above Earth's surface, and the height difference of the two atomic clocks is 2 meters, my calculations show that the difference in their times will be 4E-13 sec., after 30 min. – what should be possible to measure with some of the best atomic clocks.

[2] There are several versions of this principle, but it will certainly be contrary to *'the strong equivalence principle'*.

[3] Wikipedia: "So the original equivalence principle, as described by Einstein, concluded that free-fall and inertial motion were physically equivalent." **[12]**

I conclude that – ***at least*** **– 'the strong equivalence principle' thereby already has been** ***disproved***, but think that it should be tested in any case, e.g. on the *International Space Station*, where two synchronized atomic clocks, placed at different heights (e.g. 2 meters difference), should be able to clarify whether there is a difference in the rate of the clocks, even if they are in free fall. The clocks are first synchronized and after a while (e.g. 10 min.) their times are compared.[4] In my opinion, you cannot be absolutely sure that it is sufficient if you measure that there is no gravitational redshift (/ blueshift) – this is no guarantee that there is no gravitational time dilation, since the device which measures the frequency during free fall, accelerates relative to the 'universe'/ether, which may (?) have an impact on the outcome.

[4] If you keep the two clocks at the same height difference (if possible) and distance from each other, during the experiment, then of course they cannot be in 100% free fall, but in the described case it will be so close to 100% that it has no measurable effect on the result, at least if the experiment is sufficiently short-lived. And besides, according to scientific experiments **[13]**, *acceleration* of a clock has no impact on the time dilation it is affected by.

Apparently, relativity experts consider gravitational time dilation and the reduced speed of electromagnetic waves in gravitational fields to be just *coordinate* effects [5] as these cannot be measured *'locally'* – which, however, absolutely does not prove or make probable, that they are not physical. If they were just coordinate effects, then the age difference between the two brothers in the 'twin paradox' would also have to be just a coordinate effect (which of course it is not). After all, the twin who has aged the least at the reunion, can nor – 'locally', in his own reference frame – measure that he is affected by time dilation during the journey.[6]

[5] Wikipedia: "In 1924, Arthur Eddington showed that the singularity disappeared after a change of coordinates (see Eddington–Finkelstein coordinates), although it took until 1933 for Georges Lemaître to realize that this meant the singularity at the Schwarzschild radius was a non-physical coordinate singularity." **[14]**

[6] To perhaps make my conclusion of the comparison more obvious, you could imagine that one twin is on a space station while the other makes one or more orbits around it, using the engines of a spaceship. Then the orbiting twin will be *deepest* in an (artificial) gravitational field, according to GR, and the difference in the aging of the two brothers will in such a case be just as 'physical' (coordinate independent) as the difference in the original 'twin paradox', *according to* GR.

An important part of GR is the *assertion* /*axiom* that inertial frames are 'free-falling' in gravitational fields (that free-fall *is* inertial motion). Another important assertion is that the *speed* of electromagnetic waves is *physically* unaffected by gravitational fields, and that gravitational redshift is only due to light losing energy on its way up through the field – but this is contrary to the experiments which show that atomic clocks on the Earth's surface run coordinate-independently slower than clocks located higher in this gravitational field. – In addition, both of these claims are contrary to my conclusions in the paper: "*Fundamental inconsistencies in the theory of relativity*". **[15]**

Sources:

[1] A. S. Eddington: "*SPACE TIME AND GRAVITATION*", p. 20, CAMBRIDGE 1921

[2] A. S. Eddington: "*SPACE TIME AND GRAVITATION*", p. 22

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

[4] A. S. Eddington: "*SPACE TIME AND GRAVITATION*", p. 21

[5] M. Consoli and E. Costanzo: "Indications for a preferred reference frame from an ether-drift experiment", arXiv:gr-qc/0511160v1

[6] http://www.engineeringtoolbox.com/sound-speed-solids-d_713.html
http://www.schoolphysics.org/data/Speed_of_sound/index.html

[7] Kenneth R. Atkins, *Lorentz ether theory versus relativity – The possibility of new experimental evidence*, Physics Letters A, Volume 80, Issue 4, 8 December 1980, Pages 243-245

[8] F. Winterberg, *A Crucial Test for Einstein's Special Theory of Relativity Against the Lorentz-Poincare Ether Theory of Relativity*, Zeitschrift für Naturforschung A, 41 a, 1261 -1266 (1986)

[9] Chalmers W. Sherwin, *New experimental test of Lorentz's theory of relativity*, Phys. Rev. A **35**, 3650 – Published 1 May 1987

[10] Ronald R. Hatch: *A modified Lorentz ether and Sherwin's experiment*, https://www.naturalphilosophy.org/pdf/abstracts/abstracts_2885.pdf

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

[12] https://en.wikipedia.org/wiki/Equivalence_principle

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

[14] https://en.wikipedia.org/wiki/Black_hole

[15] https://www.vixra.org/pdf/2207.0088v1.pdf