

Mysticism in Relativity

Introduction and relevance

Many people write and publish books about Einstein's Relativity, while few people fully understand Relativity (possibly nobody). The authors of this article do not fully understand Relativity, in spite of 15 years of research.

What makes it difficult, is that Einstein changed his mind several times. This article is not about Einstein's formulas or whether he was right or wrong, but the strange messages of many authors about Relativity, including messages of Einstein himself, Noether, and Hilbert. All these messages have in common that the wording is not easily understood, creating mysticism in Relativity.

The full knowledge of Einstein's Relativity ended with his death in 1955. The authors are convinced that nobody since then can claim the knowledge of the full package. Nothing to be ashamed about when you are interested in Relativity. Einstein's death and the limited knowledge of professors of Relativity have created so much mystic literature, that it has become a life of its own, like weed in the garden of physics. Let us look at some of this mysticism.

Einstein's changes of mind on Special Relativity

In 1905, Einstein was the first to see that the speed of light is the same to all observers. It took many years before the scientific community accepted this analysis. Our current definition of the unit meter confirms the constant speed of light in vacuum. This is why the speed of light has no decimals. However, Einstein changed his mind as early as in 1907, just two years later! He then claimed that the speed of light depends on the strength of the gravitational field with the following message¹:

["The principle of the constancy of the velocity of light holds good according to this theory in a different form from that which usually underlies the ordinary theory of relativity"](#).

This major change of mind is a blow to all relativists who studied his theory of Special Relativity (SR) only. Readers ask themselves till today, what then is the speed of light in gravitation? Given that there is gravitation everywhere in the universe, what remains in practice of the constancy of the speed of light? Using the Schwarzschild Solution on earth's surface, the speed of light is not the *defined* 299,792,458 [m/s] but 0.2 (horizontal) and 0.4 (vertical) [m/s] less!

That was not the only change of mind of Einstein that is devastating to people who limit themselves to SR. SR is based on the Lorentz transformation of two Euclidean reference frames K and K' that speed away from each other. When he published his final document about his theory of General Relativity² (GR) in 1916, he stated in paragraph 3:

["...Hence Euclidean geometry does not apply to K'...."](#)

Not being Euclidean means that the laws of physics including geometry are no longer applicable! Those who have studied SR, are now stuck with a Lorentz transformation in 1905, which is no longer supported by Einstein from 1916 onwards!

¹ Einstein A, "On the influence of gravitation on the propagation of light", 1907

² Einstein A, "The Foundation of the General Theory of Relativity", Annalen der Physik' 1916

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Einstein switched from the Lorentz transformation to the Minkowski formula in paragraph 4 of his 1916 document about GR, stating:

“By the Special theory of Relativity the expression

$$ds^2 = -dX_1^2 - dX_2^2 - dX_3^2 + dX_4^2 \quad (1)$$

then has a value which is independent of the orientation of the local system of co-ordinates and is ascertainable by measurements of space and time.”

His very first formula of his 1916 document describes SR by the Minkowski formula, a formula between a proper (moving) observer and a Euclidean reference frame, no longer using the Lorentz transformation. So now the Ehrenfest paradox is solved: all four dimensions dilate the same. Finally, to obliterate his own SR of 1905, he states in paragraph 22 after formula (72):

“Thus the clock goes more slowly if set up in the neighborhood of ponderable masses”

This takes away the last straw of his original SR, which assumed the equality of reference frames. From now on, the reference frame with the most mass determines the clock speed of the (proper) reference frame with less mass. Now also the clock, twin and ladder paradoxes disappear like snow under the sun. However the mysticism about SR keeps lingering on for those that have never read his GR document of 1916.

For them, the measurement experiments of Relativity, like the Hafele-Keating experiment and Muons (particles created by the solar wind) reaching the surface, should be convincing: reference frames are not equal but depend on mass content.

Mysticism created by Einstein’s change of mind on GR

In his original document of GR of 1916, he repeatedly confirms the demand of the determinant of the covariant metric tensor to be minus one: $g = -1$ as defined in paragraph 8:

“But if $-g$ is always finite and positive, it is natural to settle the choice of co-ordinates a posteriori in such a way that this quantity is always equal to unity”

This article is not about the complicated mathematics of tensors, it is about an important change of mind of Einstein about $g = -1$ affecting the outcome of the Schwarzschild Solution. In paragraph 12 formula (44) and the following text, Einstein explains the necessity of $g = -1$, a necessity repeated in formula (47), (47a), (52), and (53) in the paragraphs to follow. However, at the end of paragraph 19 of his final document of 1916, he abandons the $g = -1$ demand in a single footnote:

“At the abandonment of the choice of co-ordinates with $g = -1$, there remain *four* functions of space with liberty of choice, corresponding to the four arbitrary functions at our disposal in the choice of co-ordinates”

This footnote came too late for Karl Schwarzschild, he died before the final document of GR came out in 1916. Karl based his *exact* solution on $g = -1$, but would certainly have corrected his solution if

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he would have been alive in 1917. The first to redo the effects of a mass-point (Karl Schwarzschild's first solution) was J. Droste in 1917.

He did not come to the same outcome as Karl Schwarzschild did, but found it necessary to get rid of the transversal term, which was originally based on $g = -1$. Why? Did he want a similar outcome as Karl Schwarzschild? Did he assume that the transversal term should not be there as it is also not present in SR based on the (outdated) Lorentz transformation? We will never know, but this reemphasizes that Relativity is as much mysticism in semantics as mathematics.

After Droste, copying went on from each other (with copy mistakes), all trying to make a variable disappear (the influence of gravitation in the transversal direction). These are examples of strange quotes explaining the disappearance:

Droste in 1917: "...we are at liberty to choose instead of r a new variable which will be such a variable of r , that in ds^2 the coefficient of the square of its differential becomes unity"³.

Eddington in 1922: "There is no reason to regard r in (38.12) as more immediate the counterpart of r in (38.11) than r/l is... We shall here choose and accordingly drop the suffix,..."⁴.

Many followed, many years later:

Misner, Thorne, en Wheeler in 1970: "...With this choice of the radial coordinate and with the primes dropped, equation (23.3) reduces to...."⁵.

Gary Oas in 2005: "In fact, we can limit this to $W = X = 1$ without loss of generality"⁶.

All of these authors wanted to get rid of the transversal term in the Schwarzschild Solution that was based on $g = -1$ (Eddington: $r/l = r$ or Oas: $W = X = 1$). Amazingly, these authors prefer to copy Schwarzschild and each other, above reading carefully Einstein's document or thinking for themselves. This strengthens us in the belief that nobody fully understands Einstein's Relativity.

Mysticism created by unsolicited coordinate transformations

Although Einstein withdrew his $g = -1$ demand in a single footnote, his "relativity principle" as described in paragraph 4 was not withdrawn and is thus still valid:

"These can no longer be dependent on the orientation and the state of motion of the 'local' system of co-ordinates, for ds^2 is a quantity ascertainable by rod-clock measurements of point events infinitely proximate in space-time, and defined independently of any particular choice of co-ordinates".⁷

In other words, whatever the coordinate system transformation you apply, the measurable " ds " must remain the same. Reformulated, the time difference on a local (proper) clock must remain the same. The coordinate manipulations of the above mentioned authors do change the clock measurements, and are thus not allowed. This is an issue to be corrected. Another case of disallowed coordinate

³ Droste J. KNAW proceedings 191, 1917 page 199.

⁴ Eddington A. "The Mathematical Theory of Relativity", 1922 after formula (38.13).

⁵ Misner, Thorne, and Wheeler, "Gravitation", 1970 between formula (23.6) and formula (23.7).

⁶ OAS G. "Full derivation of the Schwarzschild Solution" Harvard Summer School (Pdf), 2005.

⁷ Einstein A. "The General Theory", Annalen der Physik, 49, 1916 paragraph 4 formula (3) and following.

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transformations is Kip Thorne's "tortoise" or "Eddington /Finkelstein coordinates", *assuming* that a radius of a black hole can get smaller than its Schwarzschild radius and *assuming* that this coordinate transformation is allowed based on the relativity principle.

Taking mysticism out of Relativity with Noether's theorem

Noether's theorem of energy and momentum conservation plays a key role in physics. Without energy and momentum conservation, we would not have neutrinos and Higgs particles. Noether's theorem requires reference frames to be the same everywhere (homogenous) and the same in all directions (isotropy) in order to prove momentum conservation. To prove energy conservation, the space-time reference frame must have the same laws of physics and the same constants of nature throughout. Einstein's Relativity does not answer to Noether's theorem:

*"Hilbert announces his assertion to the effect that the failure of proper laws of conservation of energy is a characteristic feature of the general theory of relativity"*⁸

In other words, professor Hilbert and Noether question energy conservation in Einstein's Relativity. Hilbert and Noether were the only ones that fully understood Einstein's GR! The authors use Noether's theorem to repair the (repeatedly badly copied) Schwarzschild Solution and Robertson-Walker Solution to Einstein's GR to take mysticism out of Relativity. The repair includes the definition of curved space-time within a Euclidean reference frame, satisfying both Einstein's curved space-time as well as Noether's theorem.

Consequences

Taking Einstein's document on GR of 1916 seriously and switching to Minkowski's formula, repairs SR and solves its paradoxes. Replacing the $g = -1$ demand by Einstein's relativity principle of paragraph 4 and Noether's theorem, allows us to repair the Schwarzschild Solution and the Robertson-Walker Solution.

This results in black holes without singularities and a universal model in which energy is conserved without "dark energy". A new universal model of which Einstein, Minkowski, Robertson and Walker, Noether, and Hilbert would be proud of. This model explains the Pioneer 10&11 anomaly and the era of cosmic inflation and is supported by the observations of fast star formation of distant galaxies.

More information?

Our three books (www.loop-doctor.nl) describe the repair of Einstein's Relativity for Noether's theorem in full detail. We hope you get as many "aha" experiences as we did,

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⁸ Noether E. "Invariant variation problems" translated by Tavel M. TTSP 1971 p. 186-207