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On Fermilab's discovery that mass doesn't change with velocity

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On Fermilab's website, Don Lincoln decrees that in the Fermilab accelerator, the mass of particles don't change with velocity. However, at the same time, he sustains that this would not affect the validity of the Special Relativity Theory (SR). We will see in this paper that the claim of a velocity-dependent mass is the very essence of Einstein's SR, and that the abolition of this claim means the abolition of the SR. It is however proven that a coordinate system transform based upon the retardation of gravity field with the speed of light is a correct alternative to SR.

Keywords: relativity theory, coordinate system transform, Jefimenko transform, Heaviside, gravitomagnetism.

1. Fermilab's findings

Fermilab is the abbreviation of "Fermi National Accelerator Laboratory" in the USA. It maintains a website, "Fermilab Today". In an article, "Proving special relativity", Don Lincoln explains in the "episode 2" [1] which energies are required to accelerate a proton to high speeds.

Accelerator	Energy (EV)	Velocity (% of speed of light)
Cockcroft-Walton	750,000	4%
Linac	400,000,000	71%
Booster	8,000,000,000	99.4%
Main Injector	120,000,000,000	99.997%
Tevatron	1,000,000,000,000	99.99995%
LHC	7,000,000,000,000	99.9999991%

Table 1

Important increases of energy are required to obtain, with raising more efforts, a higher velocity of the protons. However, Lincoln firmly supports that there is only one mass, the rest mass, and that the mass doesn't increase with velocity.

Regarding the affirmation "mass increases as things go faster", he says: "I admit I have uttered those words myself, but the statement is actually wrong and so can be misleading." Furthermore, he writes: "They use the phrase "relativistic mass" to label this fallacious idea of increasing mass."

The title of the article however: "Proving special relativity" suggests something quite different. But as we will see in the next paragraph, it is instead clear that a fundamental property of the SR has been falsified by Fermilab.

2. A variable mass is a fundamental claim of SR

In his 1905 paper "Zur Elektrodynamik bewegter Körper" [2] (On the electrodynamics of moving bodies) Einstein comes to a velocity-dependent longitudinal mass of:

$$m_{\parallel} = \frac{m_0}{\left(\sqrt{1-v^2/c^2}\right)^3} \quad (1)$$

and a transverse mass of: $m_{\perp} = \frac{m_0}{1-v^2/c^2}$ (2)

We chose the usual notation for the 'rest mass'.

Einstein confirms his point of view in "Ist die Trägheit eines Körpers von seinem Energieinhalt abhängig?" [3] in 1905 (Does the Inertia of a Body Depend upon its Energy-Content), by writing (own translation): "if the energy changes, the mass will change as well".

3. The energy-mass equivalence is wrong.

According to the findings of Fermilab, $E \neq mc^2$ in the sense of an interchangeability between energy and mass, because the kinetic energy is not transformable in mass. Only the bonding energies seem to be interchangeable with mass. This important consequence again invalidates a crucial claim of SR.

4. The "Principle of Relativity"

Now the question raises if the SR should be only changed and improved or if it should be abolished and replaced by another theory. Therefore we look at the two SR postulates [2].

- the same laws of electrodynamics and optics will be valid for all frames of reference for which the equations of mechanics hold good.

- light is always propagated in empty space with a definite velocity c which is independent of the state of motion of the emitting body.

We will not analyze these postulates in terms of their theoretical value but in terms of whether or not these are proven facts.

5. The Sagnac effect: does it disprove SR?

The second postulate, the constancy of the speed of light has never been proven. On the contrary, the Sagnac effect shows that in a rotating system, the constancy of light is violated.

In his paper, Doug Marett [4] shows that this has nothing to do with the objection of relativity proponents who pretend that SR is not meant to be valid in rotating systems. The fact is that the second postulate is not allowed to depend from the system at all, by definition!

As Caligiuri [5] puts it concerning the GPS system: "A correct interpretation of light behaviour can be achieved only within a theory based on absolute simultaneity (i.e. that defined with respect a preferred inertial frame) in which, as occurs in the GPS, the clocks rates are adjusted not as a function of their relative velocity but of the velocity of each of them with respect the preferred (nearly) inertial Earth - centred non rotating inertial frame."

6. The time-dilatation: does it occur as SR says?

As far as needed, let me remind that also other deduced effects from SR are disputed. In laboratories, it hasn't been possible to prove the time dilatation, but the increased life time of the pions (pions) at high velocities has been taken as an indirect proof. However, other explanations for the longer life time of pions exist that are at least equally plausible [6].

The two clocks of Hafele and Keating, moving in opposite directions about the Earth, have experienced similar motions as the Sagnac effect with respect to the stationary earth bound clock. The clock experiments didn't follow the twin paradox presumption. Doug Marett pointed out that "if their motions were truly 'relative', then by the rules of SR both should arrive back at the starting point having experienced the same amount of time dilatation in the same direction. The actual result was that one travelled clock increased in its time rate and the other decreased."

7. A correct electromagnetic coordinate system transform

So, the mathematics that Einstein used for his coordinate system transform possibly was correct, but the interpretation he gave it wasn't. In other words, since the second postulate is proven wrong, maybe there is another way to address the issue, without the need of the postulates, and which obtain the correct results.

The brilliant scientist who did the most exciting research in that domain is Prof. Oleg Jefimenko. He has performed the electromagnetic coordinate system transform, just by taking into consideration the retardation of the electromagnetic fields at the speed of light. It is known that for an electromagnetic system, there exists an equivalence whether the source moves or the re-

ceptor. In both cases, the appropriate Maxwell equation will be used and will find the same final forces acting.

In his book [7] he calculated the 'relativistic' coordinate system transforms of electric fields and magnetic fields, for velocities and accelerations.

Furthermore, he calculated the 'relativistic Lorentz force' as follows. The Lorentz force is:

$$\mathbf{F} = q(\mathbf{E} + \mathbf{u} \times \mathbf{B}) \quad (3)$$

For the moving inertial frame with velocity \mathbf{v} , we get:

$$\mathbf{F}' = q(\mathbf{E}' + \mathbf{u}' \times \mathbf{B}') \quad (4)$$

in which the primes are the notation for the moving frame. When substituting the values of the electric and the magnetic field for the moving frame, as he found earlier based upon the retardation of the fields with the speed of light, he finds the following Lorentz forces in terms of the forces in the moving frame:

$$F_x = F'_x - \frac{v}{c^2(1+vu'_x/c^2)}(u'_y F'_y + u'_z F'_z) \quad (5)$$

$$F_y = \frac{1}{\gamma(1+vu'_x/c^2)} F'_y \quad (6)$$

$$F_z = \frac{1}{\gamma(1+vu'_x/c^2)} F'_z \quad (7)$$

$$\text{wherein} \quad \gamma = \frac{1}{(1-v^2/c^2)^{1/2}} \quad (8)$$

Hence, if one wants to calculate the Lorentz forces that one will find at a distance from a moving electromagnetic system, the results are given above.

Then, Jefimenko finds the 'relativistic mechanics' by calculating the Newtonian force that will be found by observing a moving frame at a distance that obeys:

$$F'_x = ma'_x \quad (9)$$

$$\text{He finds:} \quad F_x = \gamma^3 ma_x \quad (10)$$

$$F_y = \gamma ma_y \quad \text{and} \quad F_z = \gamma ma_z \quad (11)$$

Based upon these results, it is possible to find the apparent mass increase due to velocity, the same way Einstein did.

The results are:

$$m_{\parallel} = \frac{m_0}{(\sqrt{1-v^2/c^2})^3} \quad (12)$$

$$\text{and a transverse mass of:} \quad m_{\perp} = \frac{m_0}{\sqrt{1-v^2/c^2}} \quad (13)$$

Remark that (13) differs from (2).

As we can see, out of the former equations it is clear that it is not allowed to just add a factor γ or γ^{-1} to classic equations, in order to supposedly make them 'relativistic', as many relativity proponents do. Moreover, SR comes to a wrong result.

This being said, and since in reality mass doesn't increase with velocity, we rather should look at the increased kinetic energy.

On the other hand, for the impulse moment, the equations become recognizable. The result is:

$$\mathbf{p} = \frac{m \mathbf{v}}{(1 - v^2/c^2)^{1/2}} \quad (12)$$

And for the total energy, he gets:

$$W = \frac{m c^2}{(1 - v^2/c^2)^{1/2}} \quad (13)$$

We wrote W instead of E to show the difference with the SR interpretation.

8. Proof that the Lorentz length contraction is fictive.

With his book [7], Jefimenko has proven that the 'relativistic' equations based upon retardation of the electromagnetic fields and retarded positions are correct. The interpretation is however not the Einsteinian one. Fermilab found that the mass increase with velocity is fictitious, and Jefimenko brings evidence that the length contraction is fictitious as well.

The retarded field for a static electric field of a moving electric charge is given by the Heaviside equation [8], which also has been deduced on the basis of the retarded fields and positions:

$$\mathbf{E}|_{p_1, t_1} = \frac{q(1 - v^2/c^2)\mathbf{r}_0}{4\pi\epsilon_0 r_0^3 [1 - (v^2/c^2)\sin^2\theta]^{3/2}} \Big|_{p_1, t_1} \quad (14)$$

wherein the right hand is the value of the present position and r_0 the distance between the present position of the source and the observer, and θ is the present angle between the velocity vector and the observer (Fig.1).

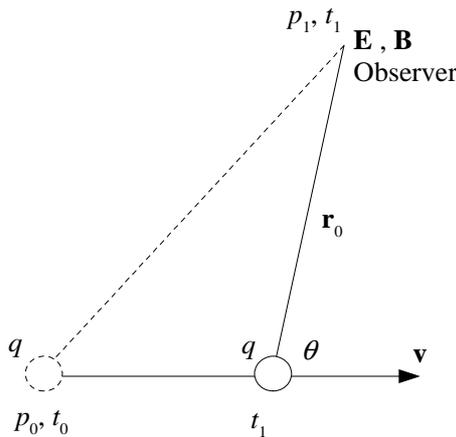


Fig.1. Explanation of the symbols in eq.(14).

When the moving charge of fig.1 is replaced by a rod with a length λ parallel to its line of motion, many relativistic proponents would apply the Lorentz contraction to the rod. By apply-

ing the retarded equations however, a additional length contraction would lead to wrong results. The retarded fields and positions suffice to get the right result.

In other words, by calculating in detail the retarded 'relativity' equations, Jefimenko proves that the Lorentz length contraction is fictitious. How can he be so sure? In fact, he first has calculated the field of a moving line charge by using the 'relativistic' transformations of positions and fields, by integrating the Heaviside equation (14) over the length λ . This gives basically the same result as when the field is calculated directly with the full length of the rod.

Intuitively, one can say that if a rod is many kilometers long and travels at a high speed, where exactly will the Lorentz contraction occur? At the rod's beginning, at its end? The answer always will be absurd. If there would be any contraction at all, it would be very locally for every single particle, without any global effect.

9. The Compton effect

The success of the explanation of the Compton effect by SR is nearly its sole remaining strength. But of course, this explanation doesn't rest upon either of the postulates of SR, because the effect occurs at one single place at a time and it doesn't compare several situations as required in the postulates. It is a purely local effect.

But also here, based upon his own approach, Jefimenko finds the same equation for the Compton effect:

$$\lambda' - \lambda = \frac{h}{m_e c} (1 - \cos\theta) \quad (15)$$

wherein λ is the initial wavelength, λ' is the wavelength after scattering, h is the Planck constant, m_e is the electron rest mass, c is the speed of light, and θ is the scattering angle.

10. Discussion and Conclusion

Being a Public Service, Fermilab urgently needs, after its findings, to take its responsibility in further questioning the usefulness of SR, and at least severely correct it according to their own findings of a fixed mass content, independent from its velocity.

However, this control work has yet been effectuated. The second postulate is proven wrong because of the Sagnac effect. The SR interpretation of a length contraction is proven wrong by Jefimenko and the SR time dilatation is disputed by experiment. The interpretation of the increased lifetime of pi-mesons (pions) can easily be explained by the gravitational contraction field occurring at high velocities [5].

Einstein has made a first attempt for a coordinate system transform and has tried to deduce a number of predictions from it. Unfortunately, both the deductions and the predictions are found wrong.

The thing is that the establishment knows very well that all these issues occur and that they invalidate SR. However, the same establishment stubbornly refuse to draw conclusions and to apply the correct theory instead of SR. The scientific domains of theoretical gravity [9], theoretical astronomy [10] and theoretical cosmology [11] experience a total standstill for decades. Technological progress however will deprive bit by bit SR's and GR's

right of survival, which is so anxiously maintained by certain groups.

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