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Does Relativistic Electrodynamics Need (SRT)?-I

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Abstract

One shows that all factors that seem to require Maxwell's field equations to be invariant under Lorentz transformations [(Einstein's relativity), [1]] can be derived from assumptions [2] different from those of Einstein. In general, we start with the physical law equations [3, 4] and apply relativity principle to them. With this approach, Einstein's relativity (SRT) is reformulated in a simple form that has dynamical application [5] without the use of the Lorentz transformations (LT) and their kinematical contradictions.

1. Introduction:

Since the appearance of Einstein's relativity, an important question was raised: Is matter (energy) and its laws the controlling factor or is it the frame containing it? In other words, is SRT a property characterizing matter (energy) or is it imposed on matter (energy) and its dynamics?

Einstein actually adopted the hypothesis that the frame containing matter is the controlling factor, and the space-time continuum was formulated and was expressed by LT. The space-time continuum becomes physical obeying the relativity principle in that time responds to relativistic movement by dilation and space responds by contraction. Although SRT has been presented as the unique solution, many physicists [6,7,8] have tried, and are trying, to eliminate LT and its role from the main body of SRT. This is because they know something must be wrong with SRT if LT expressions and their kinematical effects yield real dynamics variables. Yet one finds many alternative theories are put forward to replace SRT. SRT has been known since its introducion as a unifying theory. It unified space and time, matter and energy, and it became the basis for other unifying theories. Therefore, alternative theories have to concentrate on the shortcomings of SRT in that this theory modified space-time properties and presented this as the sole solution.

Alternative theories should unify and show that SRT does not. SRT has removed the barrier between matter and energy, but it created a new barrier which can not be transcended according to this theory. This barrier separates what is known as classical physics from the relativistic physical domain. Classical physics can not transcend the barrier but relativistic physics can absorb it through approximation. In this case, LT becomes Galilean. In my papers, we start with the laws of classical physics and apply them to all particle velocities, i.e. we expand the appropriateness of these laws to deal with relativistic phenomena. This can not be achieved unless we adopt the principle of invariance for physical laws as they apply to inertial frames, regardless of the coordinate transformations. In this way, we can formulate SRT starting from a mechanical base [4] instead of restricting it solely to an electromagnetic base [1]. The claim that Newton’s second law is close to relativistic law is not quite accurate. It is more accurate to say, that Newton’s second law has been applied in the absence of the concept of "the change of mass".

This means that using the concept of "change of mass" to the problem along with Newton’s second law allows all the relations in relativistic mechanics to be re-derived without using SRT.

2 – Energy, Mass, Momentum, Velocity and Electromagnetic Trans formation Relations.

Modern physics uses Einstein’s relativistic postulate. An equation which relates physical quantities measured from different reference frames represents a relativistic transformation equation. Starting from Einstein's approach (establishing the kinematics involving the modification of length, time and light speed, then adding dynamics),. Note that many approaches to deriving the relativistic transformation equations appeared after Einstein, but all had as a starting point, the time dilation formula [9,10] or the relativistic addition of velocities [11].

The initial laws in classical and relativistic mechanics have the same form, i.e.

$$\mathbf{F} = \frac{d\mathbf{p}}{dt}\ ,\ \frac{d\varepsilon}{dt} = \mathbf{F}\mathbf{v} \quad \textbf{(1)}$$

but in classical mechanics , the mass does not depend on velocity.

As demonstrated in [4] and contrary to what is often claimed in SRT, the relativistic expression was derived starting from the classical laws i.e.

$$\mathbf{F} = \frac{d\mathbf{p}}{dt}\ ,\ \frac{d\varepsilon}{dt} = \mathbf{F}\mathbf{v} \quad \textbf{(2)}$$

and the relativity principle. The analogy between electromagnetic and inertial forces helps to extend this approach into electromagnetism. Therefore in the present paper we continue this method for the case of charged particle q moving with velocity $\mathbf{v}$ in the frame S, subject to an electric field **E** and a magnetic flux density **B**. We find that Eqs. (2) yield:

$$\frac{d\mathbf{p}}{dt} = q(\mathbf{E} + \mathbf{v}\times\mathbf{B})\ ,\ \frac{d\varepsilon}{dt} = q\mathbf{E}\mathbf{v} \quad \textbf{(3)}$$

The Cartesian components of Eqs. (3) in frame S are

$$\frac{dp_x}{dt} = q(E_x + V_y B_z - V_z B_y) \quad (4a)$$

$$\frac{dp_y}{dt} = q(E_y + V_z B_x - V_x B_z) \quad \textbf{(4b)}$$

$$\frac{dp_z}{dt} = q(E_z + V_x B_y - V_y B_x) \quad \textbf{(4c)}$$

$$\frac{d\varepsilon}{dt} = q(E_x V_x + E_y V_y + E_z V_z) \quad \textbf{(4d)}$$

Starting from Eqs. (4a,4d), we multiply Eq.(4d) with $\frac{u}{c^2}$ and then subtract the result from Eq.(4a). Following the approach used in [3], we have

$$P'_x = \gamma(P_x - \frac{u}{c^2}\varepsilon) \text{ (5a) }, \quad V'_y = \frac{V_y}{\gamma\left(1 - \frac{uV_x}{c^2}\right)} \textbf{ (6b)}$$

$$V'_z = \frac{V_z}{\gamma\left(1 - \frac{uV_x}{c^2}\right)} \textbf{ (6c)}$$

And

$$E'_x = E_x, \; B'_y = \gamma\left(B_y + \frac{u}{c^2}E_z\right), \; B'_z = \gamma\left(B_z - \frac{u}{c^2}E_y\right), \; dt' = \gamma dt(1 - \frac{uV_x}{c^2})$$

We start once again with Eqs.(4a,4d), but now multiply Eq. (4a) with – u and add it to (4d). Following the approach used in ref. [3], we get

$$\varepsilon' = \gamma(\varepsilon - uP_x) \text{ (5b) }, \quad V'_x = \frac{V_x - u}{1 - \frac{uV_x}{c^2}} \textbf{ (6a)}$$

And

$$E'_y = \gamma(E_y - uB_z), \; E'_z = \gamma(E_z + uB_y)$$

The scalar factor γ can be fixed by applying the relativity principle to Eq.(6b) see also ref. [3], so we get

$$\gamma^2\left(1 - \frac{u^2}{c^2}\right) = 1 \text{ (a) or } \gamma = \frac{1}{\sqrt{1 - \frac{u^2}{c^2}}} \text{ (b) } \textbf{(7)}$$

Now starting from Eq. (7b) and using Eq. (7a). Following the approach in [3], we have

$$P'_y = P_y \text{ (5c) }, \; B'_x = B_x$$

In a similar way, if we start from Eq. (4c), we have

$$P'_z = P_z \textbf{ (5d)}$$

The conventional way to derive the relativistic transformation equations of energy- momentum is to consider a collision between two particles from two inertial reference frames and impose momentum and energy conservation [12]. As well as the conventional way to derive the relativistic transformation, equations of the components of the electric field and magnetic field are obtained by **starting** with the transformation equations for the components of the force [13]. Now the conventional definition of momentum in frames S and S' i.e. $\mathbf{P} = m\mathbf{v}$ and $\mathbf{P}' = m'\mathbf{v}'$, will lead to the true relativistic expression for mass and energy.

As we know, Eqs. (6) are equivalent to

$$\frac{1}{\sqrt{1-\frac{V'^2}{c^2}}} = \frac{\left(1-\frac{uV_x}{c^2}\right)}{\sqrt{1-\frac{u^2}{c^2}}\sqrt{1-\frac{V^2}{c^2}}} \quad \text{(a)} \qquad \frac{V'_x}{\sqrt{1-\frac{V'^2}{c^2}}} = \frac{V_x - u}{\sqrt{1-\frac{u^2}{c^2}}\sqrt{1-\frac{V^2}{c^2}}} \quad \text{(b) (8)}$$

Multiplying Eqs. (8) with m_0, and comparing both Eqs. (8), with (5a) and (5b), we deduce

$$m = \frac{m_0}{\sqrt{1-\frac{V^2}{c^2}}}, \quad \varepsilon = mc^2 \quad \textbf{(9)}$$

And

$$m' = \frac{m_0}{\sqrt{1-\frac{V'^2}{c^2}}}, \quad \varepsilon' = m'c^2$$

It is simple to show that Eqs. (5, 9) lead to

$$\varepsilon'^2 - c^2\boldsymbol{P}'^2 = \varepsilon^2 - c^2\boldsymbol{P}^2 = m_0^2c^4 \quad \textbf{(10)}$$

Conclusion

The result of the Michelson – Morley's experiment raised two questions:

1- Does the ether exist?
2 – If not, then to what is the speed of light relatively? SRT provided a dubious answer:

Regardless of the nature of light and the existence of ether; all physical laws of nature should conform to LT. Einstein's approach may have eliminated doubts about the invariance of light speed, but the following question remains:

If the space – time dependence photon is:

$$c = \frac{dx}{dt} = \frac{dx'}{dt'} \quad \textbf{(11)}$$

Then the modification of space – time with relative motion is required to maintain a constant light speed as Eq. (11) state. In our proposal, LT and preferred reference frames are not required. Depending on this formulation we derived the Doppler relations for light [5]. The intrinsic properties of light (v, k) may possibly be the cause of Doppler shift that satisfies this relation,

$$c = \lambda v = \lambda' v'$$

This means that the light varies its frequency through Doppler relations to insure that its velocity remains constant at c.

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