Zero-Point Field is the Cause for the Lorentz Transformations and Leads to Find Misconceptions about the Special Relativity

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Abstract – *Since the introduction of Special theory of Relativity (SR), Lorentz invariance has been a fundamental part of our description of nature. Over the past decades, this (Lorentz invariance) was tested and verified by many research groups and almost no Lorentz violation have been found. However, when we look at the Lorentz transformations, we can mathematically find that they are not symmetrical relations. In fact, the inertial frames are not symmetrical in relation to each other and as a result, there must be a reference frame. If the inertial frames are symmetrical in relation to each other, as the SR argues, some paradoxes and contradictions are happened. Hence, we need to find the misconceptions in this theory. Many researches up to now, focused on Zero-Point Field (ZPF) as a cause for many physical phenomena like mass, inertia, and gravity. One can argue that the Lorentz transformations can be applied only for the inertial frames, moving inside the ZPF and the inertial frames, being at rest in relation to the ZPF, must not bear the Lorentz transformations. In addition, we have found that the SR and General Relativity (GR) are not two separated concepts. They are one thing and the space-time of them are the same. In both cases, it is the ZPF, which curves around the accelerated body or a gravitational mass, causing changes in the body's length, time, and mass.*

Keywords: *Special relativity; space-time; zero-point field; inertial frames; Lorentz transformations; general relativity*.

1. Introduction

SR is a theory, which is based on the Relativity principle that indicates all physical laws are invariant for different inertial frames, and there is no superior inertial frame (general covariance). According to this principle, the speed of light is the same (constant *c*) for all observers, regardless of their motion relative to the light source. SR theory uses the Lorentz transformations to the inertial frames to convert their coordinates to each other. The theory also says if a body (S' inertial frame) is moving with a constant speed in vacuum in relation to an observer at rest (S inertial frame), his measurement shows that the length (L) of the moving body is contracted, its time (t) is dilated and its mass (m) is increased according to the Lorentz equations. In fact, the transformation of the moving frame is dependent to its velocity [1-3].

Besides, based on the SR, from the view of S' observer, the situation is completely the same. It means, he feels himself at rest and thinks the S frame is moving with a constant speed, being under Lorentz transformations. Hence, SR argues that S and S' frames are symmetrical in relation to each other.

Since the introduction of SR, Lorentz invariance has been a fundamental part of our description of nature. Michelson-Morley and Kennedy-Thorndike experiments are the famous tests of Lorentz violation [4-5].

The Hafele-Keating experiment, in which they took atomic clocks aboard commercial airliners and compared them with stationary clocks when they reunited, is another test of the SR and Lorentz invariance [6]. Increasing the lifetime of the moving pions and muons and particle acceleration test in the accelerators are amongst the other experiments about the Lorentz violation [3].

Besides, over the past decades, there has been tremendous interest to test Lorentz invariance, because many unifying proposals allow Lorentz symmetry and charge-parity-time (CPT) symmetry to be broken, with observable effects appearing at the Planck scale (5.4×10^{-44} s, 1.6×10^{-35} m, and 1.2×10^{19} GeV). For instance, Moritz Nagel et al. use ultra-stable oscillator frequency sources to perform a modern Michelson-Morley experiment and make the most precise direct terrestrial test of Lorentz violation for the photon, constraining Lorentz violating orientation-dependent relative frequency changes $D\nu/\nu$ to $9.2\pm10.7\times10^{-19}$ [7].

Sanner et al. experimentally demonstrate agreement between two single-ion optical clocks at the 10^{-18} level, directly validating their uncertainty budgets, over a six-month comparison period [8]. Aartsen et al. performed one of the most precise tests of space-time symmetry in the neutrino sector to date. They used high-energy atmospheric neutrinos observed at the Ice Cube Neutrino Observatory to search for anomalous neutrino oscillations as signals of Lorentz violation. They found no evidence for such phenomena [9].

Kostelecky argued that Lorentz violation could occur in the pure-gravity and matter-gravity sectors. The no-go result shows it must be spontaneous, so the coefficients for Lorentz violation must originate as dynamical fields. Each coefficient field can therefore be written as the sum of the vacuum coefficient for Lorentz violation and a fluctuation [10]. Arkani et al. studied the universal low-energy dynamics associated with the spontaneous breaking of Lorentz invariance down to spatial rotations [11].

If we precisely analyze the above-mentioned Lorentz invariance tests, we will find that in all of them, the Lorentz relations have been tested (test the speed of light for different inertial frames) to conclude the invariance of the light speed or the invariance of physical laws for various inertial frames. From this view, the Lorentz relations causes the physical laws to be invariance because almost all tests at lower or even high energies causes no violation of the Lorentz transformations. However, as we will present in this study, the Lorentz transformations are mathematically and physically not symmetrical, although, under these relations, the physical laws are invariant.

Moreover, from the first introduction of the SR, many physicists like Lorentz, Lodge, Michelson and the others were unsatisfied with the rejection of the Ether, and preferred to interpret the Lorentz transformation based on the existence of a preferred frame of reference, as in the Ether-based theories of Lorentz, Larmor, and Poincare. However, the idea of Ether, hidden from any observation, was not supported by the mainstream scientific community. Therefore, the Ether theory of Lorentz and Poincare was superseded by Einstein's SR, which was subsequently formulated in the framework of four-dimensional space-time by Minkowski [12-14]. Nevertheless, Einstein himself accepted the Ether to some extent after his theory of General Relativity (GR). He wrote (1920): “We may say that according to the general theory of relativity space is endowed with physical qualities; in this sense, therefore, there exists 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. However, 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” [15].

In addition, attempts to introduce some sort of relativistic Ether (consistent with relativity) into modern physics such as by Paul Dirac in relation to quantum mechanics were not supported by the scientific community [16]. Smoot described his own experiments on the cosmic microwave background radiation anisotropy as "New Ether drift experiments" [17].

Dingle, using a mathematical/ physical method, showed that the symmetrical observations of the inertial observers are contradictory and hence, he rejected the SR theory but kept the Lorentz theory, intact. He wrote (1967): “There is existing experimental evidence for Einstein’s theory that does not give exactly the same support (whatever that may be) to a quite different theory advanced earlier by Lorentz. Both theories have the same mathematical structure but give it quite different physical interpretations. The physical differences between the theories are profound. Lorentz ascribes the contraction of rods and slowing down of clocks to an ad hoc physical effect of the Ether on moving bodies…. Einestien theory is a logical deduction from two postulates: (a) the postulate of relativity- the absence of an absolute standard of rest, that is of an Ether, and (b) the postulate that the velocity of light in space is *c*, what ever the motion of its source. Lorentz’s theory denies (a) and accepts (b)” [18].

Puthoff et al. argue that the vacuum is characterized by parameters and structure that leave no doubt that it constitutes an energetic and structured medium in its own right. Within the context of quantum theory, the vacuum is the seat of energetic particle and field fluctuations, and within the context of general relativity, the vacuum is the seat of a space-time structure (metric) that encodes the distribution of matter and energy. They also indicate that the ZPF is considered as a Lorentz invariant electromagnetic component of Dirac’s Ether [19]. Haisch et al. considered the ZPF as a responsible for inertia, gravitation, mass, and many other physical properties. They wrote (1997): "The ZPF is light waves and therefore, it is not akin to the mysterious substance called ether in the late-nineteenth century. Moreover, the ZPF is Lorentz invariant, a crucially important property. Being Lorentz invariant it cannot and does not act as a universal frame of rest for rectilinear motion (which we do not want in physics). However, it does provide a universal frame of rest vis-à-vis acceleration. Contrary to a widespread belief, acceleration in general is not relative in general relativistic mechanics; only gravitational acceleration is relative. In today's physics one does need a type of 'absolute space': viz: one that is absolute with respect to acceleration, but not with respect to rest or uniform motion" [20]. They also added: "ZPF acceleration can be intuitively understood as follows. A drag force exists for particle motion in any ordinary radiation field, since in the rest frame of the particle, the higher the velocity, the greater will be the opposing radiation pressure owing to the Doppler shift, which increases the opposing drag strength of the radiation field in the direction of motion and decreases it in the opposite direction…. General relativity and quantum physics are at present irreconcilable, therefore something substantive is either wrong or missing in our understanding of one or both" [20].

Alcubierre derived a space-time metric motivated by cosmological inflation that would allow arbitrarily short travel times between two distant points in space. The behavior of the warp drive metric provides for the simultaneous expansion of space behind the spacecraft and a corresponding contraction of space in front of the spacecraft [21].

Our purpose in this research is finding the role of ZPF in Lorentz transformations and searching for misconceptions about the SR and symmetry of the Lorentz transformations. We believe that although the physical laws are invariance under the Lorentz transformations, these equations are not symmetrical, which means that inertial frames are not symmetrical and what is symmetrical in fact, is the ZPF or space-time. For simplicity, we have used the easy mathematics of SR/GR and intentionally neglected to apply 4-vectors, tensors, or variant/covariant mathematics, since; simple equations are completely applicable and more understandable for our purpose.

2. Materials and methods

2.1 Asymmetry of the Lorentz transformations

In this section, we will provide two methods to prove that the Lorentz relations are mathematically/ physically asymmetric.

Proof #1

Suppose S is a stationary frame and S' is a moving frame with the velocity v to the right, as shown in the Fig. 1. In fact, v vector is defined as the vector of the S' velocity which its direction is to the right. The Lorentz transformations are as followed:

$$x' = \gamma(x - vt) \tag{1}$$

$$(\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} = \frac{1}{\sqrt{1-\beta^2}})$$

$$t' = \gamma\left(t - \frac{vx}{c^2}\right) \tag{2}$$

We have no work with the observations of the observers in relation to each other. It must be noted that since the S' frame is moving in *x* direction, only, the coordinates *y* and *z* are zero and they are not considered in our analysis (in the Einstein's paper, the formulas were written for *x* direction only).

We just want to find the inverse relations by algebra

$$\rightarrow \quad \frac{x'}{\gamma} = x - vt \quad \rightarrow \quad x = \frac{x'}{\gamma} + vt \qquad \text{(A)}$$

$$\rightarrow \quad \frac{t'}{\gamma} = t - \frac{vx}{c^2} \quad \rightarrow \quad t = \frac{t'}{\gamma} + \frac{vx}{c^2} \qquad \text{(B)}$$

$$from\ (A) and\ (B) \rightarrow x = \frac{x'}{\gamma} + vt = \frac{x'}{\gamma} + v\left(\frac{t'}{\gamma} + \frac{vx}{c^2}\right) = \frac{x'}{\gamma} + v\frac{t'}{\gamma} + v\frac{vx}{c^2} \rightarrow$$

$$x = \frac{1}{\gamma}(x' + vt') + v\frac{vx}{c^2} \rightarrow x - v\frac{vx}{c^2} = \frac{1}{\gamma}(x' + vt')$$

$$\rightarrow \quad x\left(1-\frac{v^2}{c^2}\right)=\frac{1}{\gamma}(x'+vt')$$

$$\gamma=\frac{1}{\sqrt{1-\frac{v^2}{c^2}}} \quad \rightarrow \quad 1-\frac{v^2}{c^2}=\frac{1}{\gamma^2} \quad \Rightarrow$$

$$x\left(1-\frac{v^2}{c^2}\right)=\frac{1}{\gamma}(x'+vt') = \; x\,\frac{1}{\gamma^2}=\frac{1}{\gamma}(x'+vt') \; \Rightarrow$$

$$x=\gamma\,(x'+vt') \tag{3}$$

In addition:

$$from\ (A) \rightarrow \; t=\frac{t'}{\gamma}+\frac{vx}{c^2} \longrightarrow \; t=\frac{t'}{\gamma}+\frac{v\,\gamma\,(x'+vt')}{c^2}=\frac{t'}{\gamma}+\frac{v\,\gamma x'}{c^2}+\frac{v^2\gamma t'}{c^2} \longrightarrow$$

$$t=\; t'\left(\frac{1}{\gamma}+\frac{v^2\gamma}{c^2}\right)+\frac{v\,\gamma x'}{c^2}$$

$$1-\frac{v^2}{c^2}=\frac{1}{\gamma^2} \;\rightarrow\; \frac{v^2}{c^2}=1-\frac{1}{\gamma^2} \quad \Longrightarrow$$

$$t=\; t'\left(\frac{1}{\gamma}+(1-\frac{1}{\gamma^2})\gamma\right)+\frac{v\,\gamma x'}{c^2}=t'\left(\frac{1}{\gamma}+(\gamma-\frac{1}{\gamma})\right)+\frac{v\,\gamma x'}{c^2}=t'\gamma+\frac{v\,\gamma x'}{c^2} \Rightarrow$$

$$t=\gamma\left(t'+\frac{vx'}{c^2}\right) \tag{4}$$

As can be seen, because Eqs. (3) and (4) are not the same as Eqs. (1) and (2), respectively, when the primed and unprimed parameters are interchanged, the Lorentz equations are not symmetrical. In fact, they were symmetrical if and only if we achieved the following formulas from algebra:

$$x=\;\gamma\,(x'-vt')$$

$$t=\gamma\left(t'-\frac{vx'}{c^2}\right)$$

However, what we achieved are the Eqs. (3) and (4), instead. At this stage, some people like Rindler [22] expressed that the sign of v must be changed in Eqs. (3) and (4) (v reversal) because these equations are for when the S' observer views the S frame. Nonetheless, this statement is completely wrong (for 100% percent), since, before we prove these formulas, we defined the v vector as: <u>the vector of the S' velocity which its direction is to the right</u>. We have used the algebra to achieve these formulas and in mathematics, we can not change the vector's sign.

To clarify this, we bring an example:

Suppose the S frame is stationary and the S' frame is moving to the right (positive x axis) with a constant velocity v =10^8 m/s. When the center of coordinates (zero point) of these frames is coincided with together, a light signal is propagated from this point spherically as indicated in the Fig. 1. At this moment, the clocks of both S and S' observers which have already adjusted together, start to work. We want to calculate the light coordinate in both S and S' frames after 2 ms.

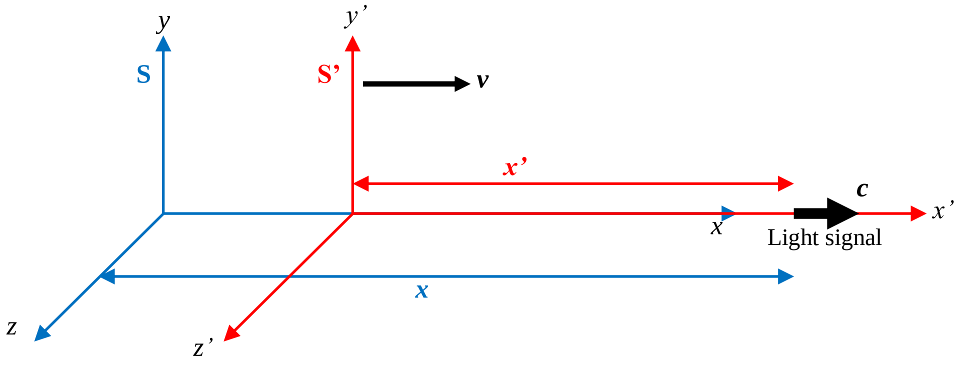

Fig. 1. The inertial frames S and S' and the coordinate of the light signal in each of those frames.

In the S frame:

$t = 2$ ms

$x = ct = 3 \times 10^8 \times 2 \times 10^{-3} = 6 \times 10^{-5}\text{m} = 600$ km

In the S' frame, with employing the Lorentz transformations, we obtain

$x' = \gamma\,(x - vt) = 424$ km $\;(\gamma = 1.06)$

$t' = \gamma\left(t - \frac{vx}{c^2}\right) = 1.41$ s

This reveals that while the S observer reads 2 ms on his clock and measures 600 km for the coordinates of the light signal, he thinks the S' observer should record 1.41 ms and measures 424 km for the light ray coordinates. This indicates the S' frame length is contracted and its time is dilated in the direction of its motion. Now, let us consider the reverse situation when the S' observer reads 2 ms,

In the S' frame:

$t' = 2$ ms

$x' = ct' = 600$ km

In the S frame, with employing the inverse Lorentz transformations one can obtain

$x = \gamma(600 + vt') = 900$ km

$t = \gamma\left(2 + \frac{vx'}{c^2}\right) = 3$ ms

As is obvious graphically, since, this result is compatible with the real position of the light signal propagation, IT IS A CORRECT ANSWER. However, if the v reversal, as suggested by Rindler is applied (to make the Lorentz transformations symmetrical), it leads to the wrong answer,

$x = \gamma\,(600 - vt') \Rightarrow\; x = 424$ km

$t = \gamma\left(2 - \frac{vx'}{c^2}\right) \Rightarrow\; t = 1.41$ ms

In fact, if both of these observers use the Lorentz relations to achieve the coordinates of each other's, one of them achieve the wrong results. Hence, we can argue that the inverse Lorentz relations are not the same as the main Lorentz relations and as a result, the Lorentz formulas are not symmetrical and both of these inertial observers can not use the Lorentz transformations. Only one of them can use such relations and the other one has to apply the inverse Lorentz relation with $+\,v$ sign (not change it to $-\,v$). In addition, we have to say that the following relations

$T' = \gamma T$

$L' = \frac{L}{\gamma}$

could not be reversed to

$T = \gamma T'$

$L = \frac{L'}{\gamma}$

Proof #2

In the Lorentz equations, the direction of motion is not important. It means, whether the S' is moving to the right or to the left, the S observer applies the Lorentz relations without changing the sign of v. Therefore, we could argue that v is a scalar not a vector quantity in the Lorentz relations. Hence, when these relations are inversed, only the quantity of v is important not its direction and we must not change the sign of v. Thence, because the inversed equations are different with the main Lorentz equations, we must not consider them as symmetrical with each other.

2.2 Are the physical laws invariant in spite of the asymmetry of the Lorentz transformations?

The necessary and enough condition for the constancy of the light speed (to be equal to c) in inertial frames S and S' are the Lorentz formulations (Eqs. 1 and 2). In fact, the integrity of the tests for these formulas (as verified by many tests, up to now) guarantees that the physical laws are invariant for the mentioned inertial frames. On the other hand, S and S' are symmetrical if in addition to the Lorentz relations, we have the inverse Lorentz relations (Eqs. 3 and 4) with the sign – for v:

$$x = \gamma(x' - vt')$$

$$t = \gamma\left(t' - \frac{vx'}{c^2}\right)$$

As we have proved already, we are not able to establish such equations because they are contradictory. Thence, we can claim that although the physical laws are invariant in various inertial frames (covariant principle), the inertial frames are not symmetrical. In literatures, the Lorentz invariance (covariant principle or relativity principle) and symmetry of the Lorentz relations are mistakenly supposed to be the same thing, but as indicated, they are two different things. All of the experiments about the Lorentz violation, performed, up to now, are in fact the tests for the constancy of the light speed and Lorentz invariance for different inertial frames, not the symmetry of those frames with together. If a moving observer in vacuum sense himself, stationary, he will make some mistakes in measuring and understanding the physical laws and parameters.

3. Results and discussions

3.1 What problems and contradictions are anticipated if the inertial frames are supposed to be symmetrical and if the ZPF is ignored?

3.1.1 Twin and Ladder paradoxes, being real contradictions

The twin paradox is a thought experiment in SR, involving identical twins, one of whom makes a journey into space in a high-speed rocket and returns home to find that the twin who remained on Earth has aged more. This result appears puzzling because each twin sees the other twin as moving, and so, because of an incorrect and naive application of time dilation and the principle of relativity, each should paradoxically find the other to have aged less.

However, some scientists believe this scenario can be resolved within the standard framework of SR: the travelling twin's trajectory involves two different inertial frames, one for the outbound journey and one for the inbound journey. Some of them suggest that the twin on the rocket is undergoing acceleration, which makes him a non-inertial observer. In both views, they think there is no symmetry between the space-time paths of the twins. Therefore, they reject this as a real logical contradiction [2].

These ideas tried to reject the twin paradox as they convert it to a none symmetrical system, but they intermittently neglect the symmetry between twin's frames, as SR emphasizes, for the constant-velocity stage of the rocket motion, being much longer stage in this travel. From one of the brother's view, the other one's clock must be dilated in the constant-velocity stage of the rocket and when the travelling brother comes back, either of these twins believe the other one is younger. Therefore, this is a real contradictory in SR.

The Ladder paradox is absolutely similar to the Twin paradox and comes from the symmetry of the inertial frames as the SR argues.

3.1.2 SR does not explain why the physical properties of the moving bodies are transformed

In SR, the S observer thinks the length of the moving body (S') is contracted, its time is dilated and its mass is increased with the Lorentz factor. The S' observer thinks the same about the S body. Hence, in the SR aspect, everything is relative. However, if these physical changes are real as demonstrated by the tests in accelerators, in the airplanes or etc, the question is that why these physical changes must be occurred for a moving body. SR has no answer to this question. In this theory, at the higher velocities, change in length, mass and time of the moving body is happened without a reasonable cause. The main problem is that, if the motion is the only reason for the slower working of a moving clock or contracting the length of the moving body, this is the breach of the mass-energy conservation law, because, no energy is applied to dilate the moving clock and contract the body's length. Einstein wrote in his book (1920):

"A body moving with the velocity v, which absorbs an amount of energy E_0 in the form of radiation without suffering an alteration in velocity in the process, has, as a consequence, its energy increased by an amount γE_0" [3].

With no doubt, it is obvious that in this statement, the "mass-energy conservation law" is breached, unless an external factor from the vacuum causes a rise in the internal energy of the body from E_0 to γE_0.

Furthermore, as we know, from the general relativity (GR), the clocks are dilated and the length are contracted whenever they are located in a gravitational field. In fact, in GR, there is a physical reason for these changes: The gravitational energy works to make the clocks, slowed down and to contract the length. In a gravitational field, biological activities of the organisms are dilated as well. Nevertheless, there is no physical reason for such transformations in the SR.

3.1.3 SR can not explain why the light speed (c) is the limiting speed

The answer of SR to the question: why the light speed should be the limiting speed? is that: as the velocity of the body goes higher, the mass of the body is increasing with the Lorentz factor. At the speed of light (c), the body mass becomes infinite, as the gamma factor is infinite in this velocity.

Nevertheless, this answer is not comprehensive at all, because the main question is what causes the mass increase at the higher velocities, resulting the infinity of mass at the light speed.

3.1.4 SR could not elaborate why the body motion becomes wavy form at the higher velocities

According to the accepted theory of the Louis De Broglie, a body, moving in the vacuum with high velocity, experiences a waveform departure with the wavelength:

$$\lambda = \frac{h}{\gamma m v} \tag{5}$$

This formula indicates that the wavelength (λ) of a moving body depends on its mass (m) and velocity (v). However, the SR theory has no convincing explanation about this wavy form motion of the body at the higher velocities. Nonetheless, in a real universe, there must be a logical reason for this phenomenon.

3.1.5 Defective explanation of the SR and GR theories about the origin of space-time curvature around the masses

Based on GR, space-time bends around the masses. As the mass quantity becomes higher, the space-time curvature around it gets higher, proportionally. As a result, the light bends whenever it passes from the vicinity of the large masses [3].

However, in SR, the surrounding environment is supposed to be the empty space and the Ether is neglected. The interrogation comes here is that how the empty space-time bends around the masses? In fact, based on the modern laws of physics, the observable/detectable materials of the universe are composed of either fermions or bosons. Only fermions and bosons can have mutual interaction with each other (only a material is capable of affecting on the other material). If we assume an empty space around the masses, the curvature of space-time around them would be meaningless. Hence, space-time is bent around the masses only and if only it composed of some kinds of material (fermions and/or bosons). This surrounding material was already called Ether. Today, because this term is outmoded, it is called ZPF. The effect between a material mass and the ZPF builds a kind of force, called "gravity", as mentioned by some researches like Haisch, Rueda and Puthoff [19-20].

3.1.6 SR has a relative view to the vacuum and Unruh effect

The "Unruh effect" is a surprising prediction of quantum field theory (QFT). From the SR point of view, it is interpreted as such: an accelerating observer senses that the empty space (vacuum) contains a gas of particles at a temperature proportional to the acceleration. With application of Rindler coordinates and QFT relations for vacuum, it is proved that the particle temperature is increased based to the following formula:

$$T = \frac{\hbar a}{2\pi c k_B} \tag{6}$$

where $\hbar$ is the reduced Planck constant, a is the local acceleration, c is the speed of light, and k_B is the Boltzmann constant.

However, based on the SR interpretation, the observer at rest does not have such an experience and he does not believe that the vacuum contains a gas of particles, but this view of SR contradicts with the QFT. In QFT, the vacuum is not empty. It has the lowest possible energy level and contains some quantums creating and disappearing permanently. This view of QFT to the vacuum, is not relative (does not depend to the inertial observers' view) and that makes a paradox with SR.

3.1.7 Misconception of SR with regard to the electric and magnetic fields

It is true that the Maxwell equations are invariant for different inertial frames under the Lorentz transformations, but, the problem comes whenever we want to apply the Lorentz formulas from the sight of the S' observer (moving observer in the vacuum). From his view, a pure electric or magnetic field in an inertial frame could be appeared in the other inertial frame in the form of both electric and magnetic fields [2].
To clarify this, we will analyze two examples:

Example #1:

This example was presented in the book of Resnick (1968): Suppose a long stationary wire in the rest frame S (the net charge in any volume of wire is zero) containing electric current with the speed u of electrons, moving to the right and a stationary charged particle q^+ on the y axis with the distance r from the wire as shown in the Fig. 2. S' frame is also moving with speed u to the right [2].

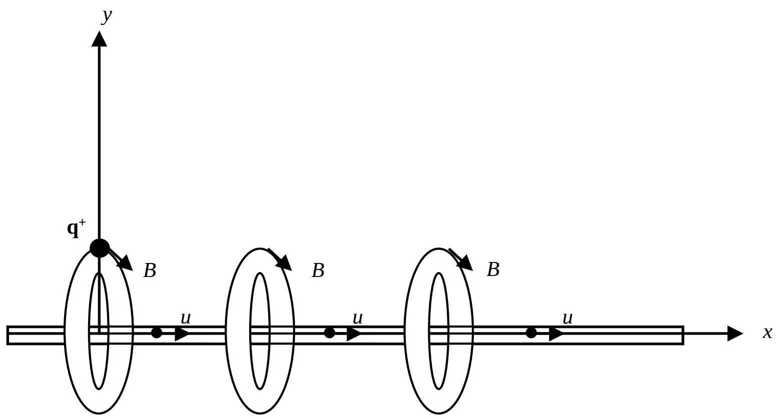

Fig. 2. A stationary wire in the rest frame S, containing electric current and a stationary charged particle q^+ on the y axis with the distance r from the wire [2].

Resnick stated: "from the view of the S' observer, the electrons of the wire are stationary while the positive charges (protons or positive ions) of wire are moving to the left with the speed u" [2]. However, this is something paradoxical, since as far as we know from the solid-state physics, protons are bonded inside the nucleus and ionized atoms/molecules are bonded inside the atomic/molecular metallic structure and could not flow like electrons inside the metallic solid systems.

Resnick added: "while the S observer sees the wire is neutral, the S' observer [after applying the Lorentz transformations] finds the wire to be positively charged" [2]. As could be obviously found, this is also contradictory because it definitely breaches the "law of charge invariance" for two inertial frames S and S'. Here, Resnick tries to rationalize this paradox with expressing that: "what about the charge invariance then. Is the total charge in S' different from that in S? No, it is not. In a complete circuit, the direction of motion of the electrons is different in different parts of the circuit. Hence, one segment of the wire maybe positively charged in S' and another segment negatively charged. The circuit as a hole, however, remains electrically neutral" [2].

Nevertheless, his rationalization is not logical, since we have not a circuit here. There is only a piece of wire in which an electrical current can be created inside it by a moving magnet around it. Therefore, the total part of the wire, from the S' observer's perspective, is positively charged which is a violation of the charge invariance.

Besides, Resnick indicates that from the view of the S observer, the wire takes the magnetic field, only, while the observer of the S' frame believes the wire contains both magnetic and electric field (both observers agree that the total electric/magnetic force on the charge q^+ is zero). Because of the following reasons, the magnetic and electric fields are not exactly the same:

- In the normal condition, the electric field can be appeared in the monopole form but the magnetic field is only appeared in the dipole form. Although, monopole magnetic field was predicted by some scientists like P. Dirac and it has been reported in some condensed matter systems and high energy conditions, it has not been observed at least in the normal situations, yet [23-26].
- Electric field affects on both stationary and moving electric charges but the magnetic field influences only on the moving electric charges, and on the ferromagnetic materials, as well, whether they have electric charge or not.

In another example, we will show that the invariance of the Maxwell equations is violated, if we consider the S and S' frame as symmetrical with each other:

<u>Example #2</u>

Suppose the S observer is looking to a piece of ferromagnetic neutral metal at rest in the vacuum. Besides, he sees a row of electrons around the metal piece, moving to the right with the speed v. According to the SR, the electrons would be contracted in length but their number is remained constant. The moving row of electrons make an electric field (E_e) and a magnetic field (B_e) around itself. Hence, a magnetic force is applied on the metal piece, but, since the metal piece has no electric charge, from the moving electrons, no electric force is applied on it. Thus, for the forces, exerted on the metal piece, one can write:

$$E = E_e \rightarrow \mathrm{F_E} = 0$$

$$B = B_e \rightarrow F_B = F_{B_e}$$

The S' observer, moving to the right with the speed v, however, thinks the row of electrons are stationary and the neutral metal piece is moving to the left with the speed v. Hence, from this observer's view, electrons make an electric field around themselves (E'_e), but, they have no magnetic field because they are at rest. Hence, the applied forces on the metal piece would be:

$$E' = E'_e \rightarrow \mathrm{F_{E'}} = 0$$

$$B' = 0 \rightarrow \mathrm{F_{B'}} = 0$$

As can be clearly seen, the invariance of the Maxwell equations under the Lorentz transformations is violated in this example. Why this is happened? Because of the wrong assumption in SR that tells the inertial frames are symmetrical and equivalent in relation to each other. In fact, the Maxwell equations are invariant in both inertial frames, but if the S' observer (moving observer in the vacuum) supposes himself at rest, he makes big mistakes to detect and apply the true laws of physics.

3.2 ZPF is responsible for the Lorentz transformations

To prove this claim, first we must consider the QFT perspective, regarding to the vacuum. In this view, the vacuum is not empty and it is filled with virtual particles, being in a continuous state of fluctuation. The laws of quantum mechanics as applied to electromagnetic radiation, force the existence of a background sea of ZPF radiation. The electromagnetic field is analogous to a mechanical harmonic oscillator, since, the electric and magnetic fields, E and B, are modes of oscillating plane waves. Each mode of oscillation of the electromagnetic field has a minimum energy of $h\nu/2$. The volumetric density of modes between frequencies ν and $\nu+d\nu$ is given by the density of states function $N\nu d\nu = (8\pi\nu^2/c^3)d\nu$ [27].

As already stated, acceleration is not relative in general relativistic mechanics; only gravitational acceleration is relative. Mashhoon states (1994): ''Absolute space-time must be invoked to explain inertial accelerations....general relativity renders the acceleration of gravity relative, while maintaining the absolute character of any non-gravitational acceleration''[28].

Haisch et al also considered the inertia as a reaction force from the ZPF, being relativistic, too. They assumed that the material objects at the most fundamental level are made of positively and negatively charged entities, referred as Partons, capable of interacting with the ZPF at all frequencies up to the size of the Parton, assumed to be the Plank length λ_P [29]. They have stated (1997): "The Lorentz invariant

ZPF provides this, and in providing, this gives rise to inertia. The inertia of matter may be due to a Lorentz force-like electromagnetic interaction between charge at the quark or fundamental lepton level and the ZPF"…Matter and the concept of mass would appear to be secondary phenomena arising out of charge–ZPF interactions [20]. They also wrote (1998): Two independent approaches have demonstrated how a reaction force proportional to acceleration ($f_r = m_{zp}a$) arises out of the properties of the ZPF. The first approach (HRP) was based upon a simplified model for how accelerated idealized quarks and electrons would interact with the ZPF….If the quarks and electrons in such an accelerating object scatter this asymmetric radiation, an acceleration dependent reaction force f_r arises. In fact, in this new analysis, the f_r is the space part of a relativistic four-vector so that the resulting equation of motion is not simply the classical $f = ma$ expression, but rather the properly relativistic $F = dP/d\tau$ equation (that reduces exactly to $f = ma$ for sub relativistic velocities) [27].

Haisch et al also pointed out that the Davies-Unruh and the inertia effect are both due to distortion of the ZPF as observed from an accelerated frame [29]. As McCrea has argued [30], this places the ZPF in the role of a kind of universal clock governing seemingly spontaneous phenomena.

The above-mentioned ideas suggest that the reaction of the ZPF results in inertia for the accelerating bodies. According to the equivalence principle of GR, the condition of an accelerating body is exactly the same as it is inside a gravitational field with the same acceleration. This suggests that an accelerating body can curve the space-time (ZPF) around itself and this curvature of ZPF causes inertia (a reaction force against acceleration) as some scientists suggested. It also triggers the idea that ZPF reaction, acting on the accelerating bodies causes the Lorentz transformations, acting on it. That is because we can prove that the Lorentz factor in SR is nothing except the GR factor, which means the curvature of the ZPF around the accelerated body causes a gravitational field around it, which increases the mass of that body, dilate the time and contract the length of that body with the Lorentz factor. It is worth noting that, in SR, there is no logical/ physical reason for the Lorentz transformations act on the length, time, and mass of the moving body.

3.2.1 Proof that Lorentz gamma factor in SR is nothing except the GR factor; proof of clock postulate:

In a gravitational field with the acceleration g, we would have the GR factor [3],

$$\gamma_{GR} = 1 + \frac{gx}{c^2} \tag{7}$$

The gravitational energy causes the time contraction, length shortening and mass increase in the direction of the gravitational field with this factor. Besides, a common equation used to determine the gravitational time dilation is derived from the "Schwarzschild metric [31],

$$\gamma_{GR} = \frac{1}{\sqrt{1 - \frac{2Gm}{rc^2}}} = \frac{1}{\sqrt{1 - \frac{r_s}{r}}} \tag{8}$$

where, r is the radial coordinate of the observer within the gravitational field, $G = gr^2/m$ is the Gravitational constant and $r_s = 2Gm/c^2$ is the Schwarzschild radius of the mass (m).

Suppose the S observer applies a constant acceleration a to a body (S') and maintain it constant (despite of the fact that with increasing the velocity, the mass of the body increases with γ factor, resulting the more force is required to constantly accelerate the body). He can apply the Newtonian classical formula $v^2 = 2ax$ to compute the quantity of the distance x of the S' body. This relation can be applied for the higher velocities because, it is derived from the equations $v = at + v_0$ and $x = \frac{v+v_0}{2}t + x_0$ in which the parameters of these relations (v, t, x, a) are measured in the S frame (Only the formula $F=ma$ is not applicable for the S observer because the amount of m rises with the γ factor while the body is speeding up). The Lorentz factor can be approximated using the Maclaurin series. Hence, we have:

$$\gamma_{SR} = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} = 1 + \frac{1}{2}(\frac{v}{c})^2$$

If instead of v^2, we replace it with $2ax$ in the γ_{SR} relation, and put $g=a$ in the γ_{GR} formula, for an accelerated body we obtain:

$$\gamma_{SR} = 1 + \frac{1}{2}\left(\frac{v}{c}\right)^2 = 1 + \frac{ax}{c^2} = \gamma_{GR} \Rightarrow \boldsymbol{\gamma_{SR} = \gamma_{GR}} \quad (9)$$

In addition, the same rule is governed for the γ_{GR} of the "Schwarzschild metric". If v is replaced by $\sqrt{2ar}$ in γ_{SR} relation and G is replaced by $(gr^2)/m = (ar^2)/m$ in the γ_{GR} formula for an accelerated body, then we obtain:

$$\gamma_{SR} = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} = \frac{1}{\sqrt{1 - \frac{2ar}{c^2}}}$$

$$\gamma_{GR} = \frac{1}{\sqrt{1 - \frac{2Gm}{rc^2}}} = \frac{1}{\sqrt{1 - \frac{2\left(\frac{ar^2}{m}\right).m}{rc^2}}} = \frac{1}{\sqrt{1 - \frac{2ar}{c^2}}} \Rightarrow \boldsymbol{\gamma_{SR} = \gamma_{GR}}$$

This demonstrates that the Lorentz factor in SR is nothing except the GR factor, exerted on the body inside a gravitational field with the same acceleration.

The above-mentioned proof of $\gamma_{SR} = \gamma_{GR}$ is infact the proof of the "clock postulate". Don Koks stated in his paper (1998) about this postulate: "The "clock postulate" says even when the moving clock accelerates, the ratio of the rate of our clocks compared to its rate is still γ_{SR}. That is, this ratio depends only on v, and does not depend on acceleration at all. The clock postulate also implies that the amount of shortening of a moving rod is independent of its acceleration and that the relativistic mass of a moving object, also doesn't depend on its acceleration….The clock postulate is not meant to be obvious, and it can't be proved….Sometimes people say "But if a clock's rate isn't affected by its acceleration, doesn't that mean the Equivalence Principle comes out wrong? If the Equivalence Principle says that a gravitational field is akin to acceleration, shouldn't that imply that a clock isn't affected by a gravitational field, even though the textbooks say it is?" [32].

The clock postulate has been tested carefully by a group of scientists in 1977 in a Muon storage ring: Muons of momentum 3.094 GeV/c (γ=29.3; $B=v/c$=0.9994) circulate on orbits of 14 m diameter in a uniform magnetic field and a weak focusing electric field. Scientists concluded that even under accelerations of $10^{18}\, g$, the acceleration had no effect on the Muon lifetime (time dilation) and only the Lorentz γ factor of SR was influential [33].

The above-mentioned proof of $\gamma_{SR} = \gamma_{GR} = \gamma$ demonstrates strongly that the time dilation of the moving bodies in SR and GR is one thing, not two separate things. There is only one γ factor.

Besides, $\gamma_{SR} = \gamma_{GR}$ proves that the body which is accelerating inside the ZPF undergoes the Lorentz transformation due to the curved ZPF (space-time) which makes a gravity around it by increasing m to γm. In fact, the ZPF inertia is not constant $F= ma$ and it is increasing according to the Lorentz transformations while the body is speeding up ($F_{\parallel} = \gamma^3 m_0 a_{\parallel}$).

At the speed c, the inertia becomes infinite, but here we have a reason for that: ZPF reaction against the body becomes infinite at the speed c.

It should be added that, the moving observer (S' observer) in the acceleration step of his journey, will feel the Lorentz transformation on his body, but during the constant velocity step, he will not bear any kind of transformations.

4. Conclusion

- As mathematically demonstrated, the physical laws are invariant under the Lorentz transformations only and only if the inertial frames are not symmetrical. If the inertial frames are supposed to be symmetrical, the physical laws are not invariant under these equations.
- From the beginning of SR introduction till now, many scientists have mentioned some faults, inconsistencies, paradoxes and contradictions in the theory of relativity. I have provided some other contradictions with a profound thinking about those ones. They may have been found in the other literatures but I have gathered and added some important ones.
- It was investigated that the ZPF is responsible for the Lorentz transformations. That is because the changes in moving body's properties (length, time, mass) must have a reason, arising from the vacuum

and also, it was demonstrated that since the Lorentz equations are asymmetrical, only the inertial frame, moving inside the ZPF (the reference frame) tolerates the Lorentz transformations.

- It was proved physically and mathematically that Lorentz gamma factor in SR is nothing except the GR factor. This means that the SR and GR are not two separated concepts. In fact, in both cases, it is the ZPF which curves around the accelerated body or a gravitational mass, causing the changes in body's length, time and mass.
- All the experimental tests agree with the above-mentioned claims. For instance, the atomic clock inside the moving high-speed airplane is dilated with the gamma factor, but the stationary atomic clock on the earth is not dilated. The researchers test the Lorentz formulas for the moving frames and get results for the Lorenz invariance of the inertial frames. However, they have ignored to test the Lorentz formulas from the view of the moving observer who thinks he is at rest according to what the SR says. Therefore, what they actually achieved is the Lorentz invariance not the symmetry of the inertial frames.
- What is symmetrical is in fact, ZPF or space-time, which is an absolute frame and the inertial frames are in equivalence with it. ZPF is Lorentz invariant during the constant velocity step of a moving frame (S') but during the acceleration step, ZPF is not Lorentz invariant and the accelerating observer feels the acceleration, because of the inertia that is a reaction from the ZPF. Hence, when he reaches to the speed v, he knows that he is moving with this velocity. If he does not understand and thinks he is at rest, he will make some mistakes to measure the physical quantities of the other inertial frames. In another word, if the relativity principle as Einstein says, means that all physical laws are invariant for different inertial frames, this is acceptable. However, if this reveals that, there is no absolute frame and each frame's observer thinks he is at rest; this makes some faults/contradictions and could not be an appropriate statement.

Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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