Reinterpretation of Lorentz transformation according to Copenhagen School and The Quantization of Gravity

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Abstract— In this paper I propose a quantization of gravity which leads to photon mediates gravitation. My quantization of GR depends on the modified special relativity MSRT which introduces a new interpretation to the Lorentz transformation equations depending on quantum theory (Copenhagen school) [25, 26, 27, 43, 47]. In my new transformation I propose there is no space-time continuum as in SRT, it is only time and space is invariant. My new interpretation to the Lorentz transformation leads to the Lorentz transformation is vacuum energy dependent instead of the relative velocity in Einstein's interpretation to the Lorentz transformation equations in the SRT. Furthermore the Lorentz factor is equivalent to the refractive index in optics. In my interpretation to the Lorentz transformation I refuse the reciprocity principle which was adopted by Einstein in the SRT. Refusing the reciprocity principle in my theory leads to disappearing all the paradoxes in the SRT; the Twin paradox, Ehrenfest paradox, Ladder paradox and Bell's spaceship paradox. Furthermore, according to my interpretation I could interpret the experimental results of quantum tunneling and entanglement (spooky action), Casimir effect and Hartman effect. My new interpretation to the Lorentz transformation equations leads also to the wave-particle duality as in quantum theory, and thus agrees with Heisenberg uncertainty principle. The generalization of my transformation leads also the concept of acceleration or deceleration is vacuum fluctuations as in quantum field theory. In my proposed quantized force, the force is given as a function of frequency [1]. Where, in this paper I defined the relativistic momentum as a function of frequency equivalent to the relativistic kinetic energy held by a body and time, and then the quantized force is given as the first derivative of the momentum with respect to time. Subsequently I introduce Newton's second law as it is relativistic quantized force, and then I introduce the relativistic quantized inertial force, and then by my equivalence principle which agreed completely with the experimental results of QFT, I introduce the relativistic quantized gravitational force, and the quantized gravitational time dilation.

Index Terms— Special relativity, general relativity, Lorentz transformation equations, faster than light, quantum gravity.

Introduction

MY paper (The modified special relativity theory MSRT) [27, 47] is considered as a new understanding to the Lorentz transformation equations depending on the concepts of quantum theory (Copenhagen School). It is a new formulation to the time dilation, length contraction and the speed of light which are vacuum energy dependent. What I proposed in my modified Lorentz transformation is agreed and interpreting the experimental results of quantum tunneling (Gunter Nimtz experiments) and quantum entanglement. Furthermore, it is disappeared all the paradoxes in SRT. Recently, there are some voices in physics asking for the variability of the speed of light, one of them the Portuguese cosmologist and professor in Theoretical Physics at Imperial College London João Magueijo. In 1998, Magueijo teamed with Andreas Albrecht to work on the varying speed of light (VSL) theory of cosmology, which proposes that the speed of light was much higher in the early universe, of 60 orders of magnitude faster than its present value. This would explain the horizon problem (since distant regions of the expanding universe would have had time to interact and homogenize their properties), and is presented as an alternative to the more mainstream theory of cosmic inflation [36]. My new interpretation of the Lorentz transformation equations reconciles and interprets the variability of the speed of light in SRT which is vacuum energy dependent.

Also recently, two published papers in European Physical Journal D challenge established wisdom about the nature of vacuum. In one paper, Marcel Urban from the University of Paris-Sud, located in Orsay, France and his colleagues identified a quantum level mechanism for interpreting vacuum as being filled with pairs of virtual particles with fluctuating energy values. As a result, the inherent characteristics of vacuum, like the speed of light, may not be a constant after all, but fluctuate [35]. Meanwhile, in another study, Gerd Leuchs and Luis L. Sánchez-Soto, from the Max Planck Institute for the Physics of Light in Erlangen, Germany, suggest that physical constants, such as the speed of light and the so-called impedance of free space, are indications of the total number of elementary particles in nature [39]. Also, two separate research groups, one of which is from MIT, have

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presented evidence that wormholes — tunnels that may allow us to travel through time and space — are "powered" by quantum entanglement. Furthermore, one of the research groups also postulates the reverse — that quantum entangled particles are connected by miniature wormholes [33, 34]. These ideas are agreed and predicted in my MSRT.

The dependency of the speed of light on the vacuum energy is adopted in my interpretation to the Lorentz transformation equations, which is the lost key of unifying between quantum theory and relativity (special and general).

i. Theory

1.1 The interpretation of Lorentz transformation according to Copenhagen school

Suppose both the earth observer and the observer of the moving train will perform this thought experiment. As in fig. (1), at pylon A the train started to move with constant speed v, and at this moment the observer stationary on the moving train sent a ray of light from back to front of the moving train, and also at this time the observer on the ground sent a ray of light from pylon A to pylon B. The two rays of light are sent along the direction of the velocity of the train. Now suppose as in classical physics, at the moment that the ray of light arrives the front of the moving train for the observer on the moving train, at this moment the moving train passed a distance on the ground equals to the distance between the two pylons x_0, where according to classical physics the front of the moving train arrives pylon B on the ground for the observer on the moving train. In this case according to objectivity, the front of the moving train also arrives pylon B for the observer on the ground. That means according to objectivity, arriving the moving train to pylon B and at any distance on the ground is independent on the observer. From objectivity it is resulted the continuity in classical physics.

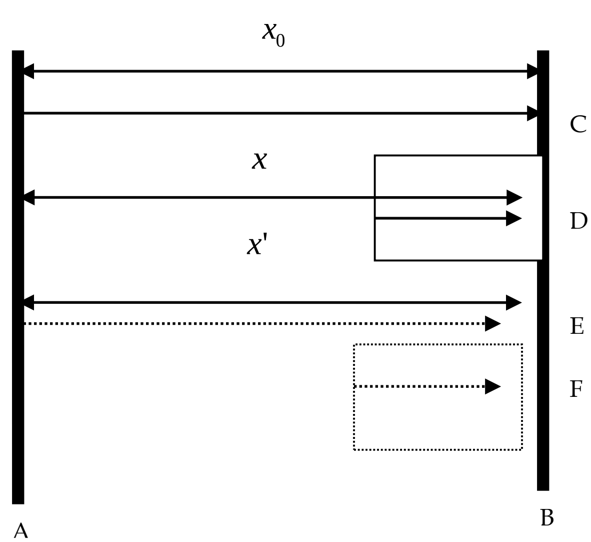

Fig. (1): at the moment that the train started at rest to move with speed v from pylon A to B, a ray of light was sent from pylon A to pylon B and at the same time a ray of light was sent inside the moving train from back to front. The distance between the two pylon is. x_0 .

According to my interpretation of the Lorentz transformation I propose that the space is invariant, and that means both the two observers on the ground and the observer on the moving train are agreed at the distance between the two pylons during the motion, and also they are agreed at the distance of the moving train same as if the moving train is stationary. Now for the observer on the ground when he sees the moving train arrives pylon B as illustrated in point D in fig. (1), and at this moment, it must the light beam which sent from pylon A arrives pylon B relative to him as illustrate in point C in fig. (1). In this case for the observer on the ground and according to Galilean transformation the light beam inside the moving train is at distance x from pylon A, where the light is not arrived the front of the moving train yet, while the front of the moving train arrived pylon B for him. From that we get the light beam is at distance given as according to Galilean transformation

$$x = x_0 - vt_0 \tag{1}$$

Here $t_0 = \frac{x_0}{c}$ where x_0 is the distance between the two pylons which is invariant as we proposed, and c is the speed of light in vacuum. Now as we have seen in fig. (1), for the observer on the ground, the light beam which is sent from pylon A arrived pylon B for him, while the light beam which is sent from back to the front of the moving train has not arrived the front yet, while the front arrived pylon B for him. That makes a problem according to Galilean transformation, where the speed of light is not the same outside the moving train and inside the moving train. Voigt [45, 46] proposed a transformation in case of time in order to keep on the constancy of the speed of light inside the moving train and outside, where in order to the speed of light to be the same outside and inside the moving train, in this case t must be as

$$t = t_0 - \frac{vx_0}{c^2} \tag{2}$$

In this case we get the Voigt's transformation [45.46] by considering $t_0 = t'$ and $x_0 = x'$. In this case we face a problem for the observer on the ground, that is, where when the front of the moving train arrives pylon B for him according to his time clock t_0, at this moment there is another time t given according to eq. (2). In order to solve the problem we must relate t_0 and x_0 according to the time of the clock of the moving train t', and the distance measured according to the observer on the moving train x' on the ground. In this case I propose this condition,

$$x' = \gamma^{-1} x_0 \tag{3}$$

and

$$t' = \gamma^{-1} t_0 \tag{4}$$

Where $\gamma^{-1} = \sqrt{1 - \frac{v^2}{c^2}}$.

That means by considering space is invariant, thus according to this condition when the observer on the ground sees the front of the moving train arrives pylon B, at time t_0 according to his ground clock, at this moment for the observer on the ground, the front of his moving train is not arrived yet pylon B, it is at distance $x' = \gamma^{-1} x_0$ from pylon A as in point F in fig. (F). From that we get

$$x = \gamma(x' - vt') \tag{5}$$

$$t = \gamma(t' - \frac{vx'}{c^2}) \tag{6}$$

According to that, during the motion, when the front of the moving train arrives pylon B for the observer on the moving train at this moment the light beam which is sent from the back will arrive the front of the moving train, and in this case we get $x' = x_0$ and $t' = t_0$. At this moment for the observer on the ground, the light beam arrives the front really, but the front of the moving train passed pylon B, where the front of the moving train now at distance $x = \gamma \ x_0 = \gamma \ x'$ from pylon A, and his clock registers now time $t = \gamma \ t_0 = \gamma \ t'$. At this moment the term $\frac{vx'}{c^2}$ which proposed by Voigt will be equal to zero according our new interpretation.

Now according to that the speed of light for the observer on the moving train is given according to

$$c'_{ob-train} = \frac{x'}{t'} = \frac{x_0}{t_0} = c$$

Which is the speed of light in vacuum.

For the observer on the ground we get

$$c'_{ob-ground} = \frac{x}{t} = \frac{\gamma x'}{\gamma t'} = \frac{\gamma x_0}{\gamma t_0} = c$$

Which is the speed of light in vacuum. But x here is the light path from pylon A to where is the front of the moving train now for the observer on the ground, where the front at this moment passed pylon B for the observer on the ground, and at this time his clock registers time $t = \gamma t'$ and this equation represents the time dilation of Einstein in his SRT.

According to our proposition of the invariance of the space, in this case the observer on the ground and the observer on the moving train will measure the same length of the moving train in direction of the velocity same as if the train is stationary. Now if we consider the length of the moving train is invariant, in this case we get the speed of light inside the moving train according to the local length of the moving train for the observer on the moving train which is equal to $x' = x_0 = L_0$, and from that we get $c'_{ob-tain} = c$ as we have seen previously. But for the observer on the ground is given according to the local length of the moving train on the ground which is equal to L_0, and thus from that we get

$$c'_{ob-ground} = \frac{L_0}{t} = \frac{L_0}{\gamma t'} = \gamma^{-1} c \qquad (7)$$

In this case according to eq. (7) we get, according to the local length of the moving train which is invariant in direction of the velocity, the measured light speed inside the moving train will be decreased for the observer on the ground according to the factor γ^{-1} which is the reciprocal of the Lorentz factor.

Now, from eqs. (5)&(6) and by considering y=y′ and z=z′ we the get the Lorentz transformation, where

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

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

$$y = y'$$

$$z = z'$$

Here we face a problem according to my interpretation of the Lorentz transformation, that is if we consider locally the local lengths of the moving train are equal, and thus by considering the invariance of space, that means $x_0 = y_0 = z_0$ which are invariance, thus when we send two light beams inside the moving train, one in the direction of the velocity of the moving train and the other in the y-direction, in this case, the light beam which is sent to y direction will arrive the other side of the moving train in y-direction before the light beam which is sent from back to front relative to the observer on the ground. That means the light speed will be different. While for the observer on the moving train the two rays of light will arrive at the same time. Thus in order to the keep on the constancy of the speed of light in all directions for both the two observers according to my new interpretation of the Lorentz transformation, we propose new transformation, that is, we multiply all the coordinates by the Lorentz factor, and in this case we get the transformation

$$x = \gamma^2(x' - vt')$$

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

$$y = \gamma\ y'$$

$$z = \gamma\ z'$$

According to this transformation we get the invariance of the speed of light in all directions when a light beam is sent from back to front in the direction of the velocity of the moving train. This transformation represents the transformation of the group, and it is leading to the wave-particle duality and Heisenberg uncertainty principle in case of considering space is invariant. In this case when the light beam arrives the front of the moving train during the motion without determining the location of the moving train at any point in space on the ground for the observer on the ground, in this case the light beam will arrive the front of the moving train at a time equal to $t = \gamma^2 t'$ according to the clock on the ground and thus the measured speed given according to this time is the group velocity according to the local length of the moving train which is invariant and equal to L_0, thus from that we get

$$c'_{ob-ground-group} = \frac{L_0}{t} = \frac{L_0}{\gamma^2 t'} = \gamma^{-2} c \tag{8}$$

According to this transformation during the motion, it is impossible that the two observers on the ground and the observer on the moving train are agreed at the location of the moving train at the same point on space on the ground at the same time because of time dilation, which is the core of Heisenberg uncertainty principle. x,y,z ,t in our new transformation represent the light path that is taken on the ground at time t for the observer on the ground by considering the light speed is the light speed in vacuum c.

Now the measured light speed according to eq. (7) represents the phase velocity, and in the case of making a measurement at a certain point in space on the ground (where is the front of the moving train arrives exactly on the ground for the observer on the ground when the light arrives the front of the moving train for the observer on the ground), in this case it is same of making a measurement in a linear dispersion according to my transformation and in this case the group velocity is equal to the phase velocity and it is given according to eq. (7). That is equivalent according to our new transformation to the collapse of the wave-function in quantum theory.

Now what about the light beam which is sent from pylon A to pylon B relative to the observer on the moving train. My theory predicts that the light beam which is sent from pylon A to pylon B on the ground will move at the same time with the light beam which is sent from back to front inside the moving train relative to the observer on the moving train, and thus when the front of the moving train arrives pylon B for the observer on the moving train, and then the light beam arrives the front for the observer on the moving train, at this time the light beam which is sent from pylon A to Pylon B will arrive pylon B also for the observer on the moving train. In this case the light speed for light beam which is sent from pylon A to pylon B is the same light speed of light beam which sent from back to front inside the moving train for the observer on the moving train, and thus it equals to c the speed of light in vacuum. This is the core of the invariance of the energy-momentum four-vector is associated with the fact that the rest mass of a particle is invariant under coordinate transformations.

Now what about if a light beam is sent in the opposite direction of the velocity as in fig. (2).

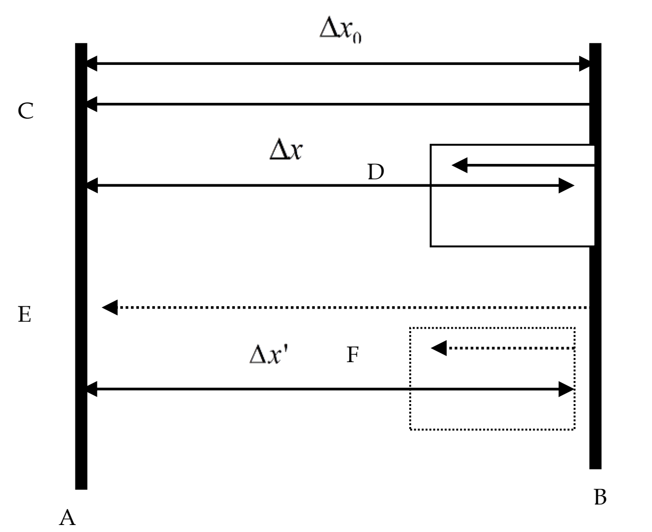

Fig. (2): The train started at rest to move from pylon A to Pylon B. At this moment a light beam was sent from front to back in the opposite direction of the velocity. Also a light beam was sent from pylon B to pylon A.

Now when the light beam is sent from the front to the back inside the moving train in the opposite direction of the velocity of the moving as in fig. (2), and at the same time a light beam is sent from pylon B to pylon A in the opposite direction of the velocity of the moving train. In this case for the light beam which is sent from front to back of the moving train relative to the observer on the ground we get according to Galilean transformation

$$x = x_0 + vt_0$$

And from Voigt's transformation we get

$$t = t_0 + \frac{vx_0}{c^2}$$

Now when we consider $x' = \gamma^{-1}x_0$ and $t' = \gamma^{-1}t_0$, then we get

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

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

From that we get also

$$c'_{ob-train} = \frac{x'}{t'} = \frac{x_0}{t_0} = c$$

And thus the phase velocity of the light beam inside the moving train for the observer on the ground for light beam which is sent from font to back in case of considering a measurement at a certain point in space on the ground is given as

$$c'_{ob-ground} = \frac{x}{t} = \frac{\gamma x'}{\gamma t'} = \frac{\gamma x_0}{\gamma t_0} = c$$

In this case when we determining the measurement at a certain point on space on the ground, that leads to collapse the wave-function, and then we determine the location of the front of the moving train with the light beam which arrives the front of the moving train at a certain point in space on the ground.

Now when we considering y and z in our new transformation we get

$$x = \gamma^2 (x' + vt')$$

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

$$y = \gamma \ y'$$

$$z = \gamma \ z'$$

Now without determining the measurement at any point in space on the ground, from that we get the group velocity for the observer on the ground for the light beam is given as

$$c'_{ob-ground-group} = \frac{L_0}{t} = \frac{L_0}{\gamma^2 t'} = \gamma^{-2} c$$

According to our new transformation, if a light beam is sent from back to front in the direction of the velocity inside the moving it will take the same time separation if the light beam is sent from front to back in the opposite direction of the velocity for the observer on the ground.

Now according to the wave-particle duality of my transformation, if instead of the light beam, a particle of mass m is sent inside the moving train from back to front or from front to back. Thus for the observer on the moving train, the velocity of the particle inside the moving train is given according to

$$v_p = \frac{\Delta x'}{\Delta t'} = \frac{L_0}{\Delta t'} = \frac{L_0}{\Delta t_0}$$

thus for the observer on the ground we get the phase velocity of the particle inside the moving train according to the local length of the moving train is given according to

$$v'_{ob-ground-phase} = \frac{L_0}{\Delta t} = \frac{L_0}{\gamma \Delta t'} = \gamma^{-1} v_p \tag{9}$$

and the group velocity is given according to

$$v'_{ob-ground-group} = \frac{L_0}{t} = \frac{L_0}{\gamma^2 t'} = \gamma^{-2} v_p \tag{10}$$

According to my transformation, we get the light moving inside the moving train for the observer on the ground same as to move inside a medium of refractive index greater than 1. From that we get the Helmholtz equation for phenomena periodic in time, with a frequency of $\nu = \omega / 2\pi$ inside the moving train as

$$\nabla^2 \phi_x(x) + \frac{\gamma^2 \omega^2}{c^2} \phi_x(x) = 0$$

Where γ is the Lorentz factor according to our new transformation. The phase velocity is given according $v_p = \omega / k$, while the group velocity is given according $v_g = \partial\omega / \partial k$. For a free, non-relativistic quantum mechanical particle of mass m, we have $E(k) = \hbar\omega(k) = \frac{\hbar^2 \omega^2}{2m}$. In case of linear dispersion same as when we make the measurement when determining the location of the moving train at a certain point in space on the ground, in this case we get the group velocity is equal to the phase velocity. In case of nonlinear dispersion (when the light starts to exit the boundaries of the moving train), in this case so even if we start with a fairly localized "particle", it will soon loose this localization. We can calculate the group velocity for this dispersion as

$$v_g = \frac{\partial \omega(k)}{\partial k} = \frac{\hbar k}{m}$$

and this is perfectly consistent with the movement of a semi-classical particle for which the momentum is $p = \hbar k$ and the group velocity thus $p/m = v_g$. This is exactly what we predicted in our new transformations when we approximated the Lorentz factor in case of low velocities.

1.2 The Length Contraction According to MSRT

To understand the concept of the length contraction according to our new transformation [25, 26, 27, 43], let's assume that, Sally is driving a train with constant velocity 0.87c between the two pylons A&B, and the distance between the two pylons is 100 m. let's assume also at the moment of reaching the train at pylon B, Sara who was stationary on the ground could stop the train instantaneously by a remote control. In this case we neglect the deceleration because this case is equivalent to some cases in quantum as we shall see in following.

Thus, in this case we consider the velocity of the train is changed from 0.87c to zero in a zero time separation at the moment of reaching to Pylon B. Thus, by this condition we have

$$v = 0 \text{ at } L = 0$$
$$v = 0.87c \text{ at } 0<L\leq 100 \text{ m}$$
$$v = 0 \text{ at } L = 100 \text{ m}$$

The concept of the length contraction which is adopted by our new transformation is agreed with the concepts, principles and laws of quantum theory (Copenhagen School). In this case we refused the objectivity which is adopted in classical physics, and then we refused the concept of space-time continuum that resulted in SRT of Einstein by considering space is invariant, and thus we refuse the reciprocity in our new transformation.

Subsequently, according to MSRT {27} during the motion, when Sara sees the train reached to pylon B, at this moment Sally will not see the train reached to pylon B, it is still in the middle of her trip at 50 m from pylon A, and thus it is still approaching to the second pylon B. Subsequently, according to this interpretation, when Sara sees the moving train at a distance x, at this moment Sally will see her moving train is at the distance $x' = \sqrt{1 - \frac{v^2}{c^2}}\, x$. This interpretation is agreed with the concept of Heisenberg to the wave function, where the observer has the main formation of the phenomenon. And by this interpretation, Sally and Sara create their own pictures about the location of the moving train. Now, for Sara, the measured velocity of the moving train is given as $v = \frac{\Delta x}{\Delta t} = 0.87c$ which is equal to the equivalent velocity of the kinetic energy owned by the moving train. For Sally (who is the driver of the train) there are two states that the train existed instantaneously, the first one is the state of motion, and the measured velocity of the train at this state for Sally is given as

$$v' = \frac{\Delta x'}{\Delta t'} = \frac{\sqrt{1 - \frac{v^2}{c^2}}\,\Delta x}{\sqrt{1 - \frac{v^2}{c^2}}\,\Delta t} = v = 0.87c$$

And this measured velocity is equal to the measured velocity equivalent to the kinetic energy owned by the moving train. The other state is the state of stationary, and the predicted velocity of the train for Sally at this state is given as

$$v' = \frac{\Delta L'}{\Delta t'} = \frac{\Delta L}{\sqrt{1-\frac{v^2}{c^2}}\Delta t} = \frac{v}{\sqrt{1-\frac{v^2}{c^2}}} = \frac{0.87c}{\sqrt{1-(0.87)^2}} = 1.74c$$

Those two states of the train are separated by a distance equals to 50m, where Sally will think her train passed this distance in a zero time separation as seen in fig. 3, and then Sally will think the distance of 100m was passed by her train with velocity equals to 1.74c which is greater than the speed of light in vacuum. This is equivalent according to my transformations for the observer on the moving train it is equivalent to the refractive index (the Lorentz factor) of the ground to be purely imaginary relative to him when his train stops. Then the solution of Helmholtz's equation is called an evanescent mode.

This measured velocity is not real, as we have seen the train hasn't moved with speed greater than the speed of light in vacuum locally for Sara, but because of the time dilation, and as we have seen in eqs. (3)&(4), events are occurring in the frame of the moving train in a slower rate than on the earth surface, and then the clock of the moving train will compute a time separation of the event less than the earth clock. The difference of time between what is computed by the train clock of Sally at the state of stationary, and what is computed by the earth clock of Sara for the train to pass the distance 100m, we find this difference is negative, and this difference led Sally to think her train passed the distance 100m between the two pylons with speed greater than the speed of light in vacuum. From fig. 3, Sally would confirm that the distance between the interval $50<x'<100$m was not passed by her train. Her train was transformed from 50m to 100m in a zero time separation. For Sally time is contracted!

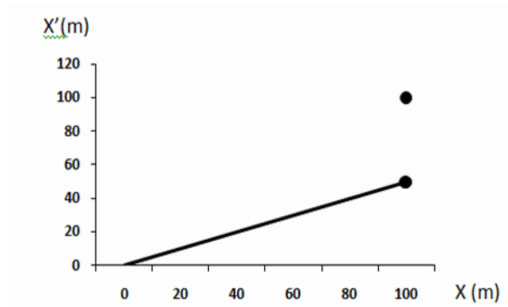

Fig. 3 illustrates the relationship between x and x′

There is another consequence that produced by adopting this interpretation of the length contraction by MSRT [25, 26, 27, 43]. It is; how does Sally see the motion of Sara's ground clock comparing to her clock during the motion. According to MSRT [25, 26, 27, 43], Sally will see the motion of the earth clock of Sara is moving in a similar rate to her moving train clock, and by adopting this principle let's study the following thought experiment.

Suppose Sally during the motion of her train is looking at the stationary ground clock of Sara by applying this condition

$$v = 0 \text{ at } \Delta t_{Sara} = 0$$

$$v = 0.87c \text{ at } 0 < \Delta t_{Sara} \le 4 \text{ years.}$$

$$v = 0 \text{ at } \Delta t_{Sara} > 4 \text{ years}$$

Where Δt_{Sara} is the reading of Sara from her clock. We can draw Δt_{Sara} versus Δt_{Sally} as in fig. 4, where Δt_{Sally} is the reading of Sally from the clock of Sara. From fig. 4, we find two straight lines; the first one is for 0< $\Delta t_{Sara} \leq 4 years$ and its slope is equal to 0.5. The second line is for Δt_{Sara}>4 years, and its slope is equal to 1. We find from fig.4, the years between 2< $\Delta t_{Sara} \leq 4$ years would not be determined by Sally, where her train was stopped at Δt_{Sara}>4 years, and thus she would find that Sara is living the years at Δt_{Sara}>4 years, while her last reading was equal to 2 years. That means the events were lived by Sara between 2< $\Delta t_{Sara} \leq 4$ years were not be received by Sally during her motion.

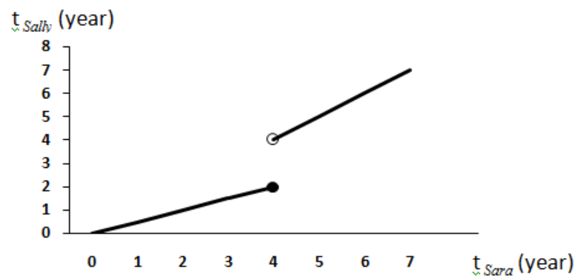

Fig. 4 t (Sara) versus t (Sally).

From the fig. 4 we get, the observer is the main participant in formulation of the phenomenon, where each one creates his own clock picture during the motion although they used the same clock. That is in contrast with the objective existence of the phenomenon.

As we have seen, in my interpretation to the Lorentz transformation we refused the reciprocity principle which was adopted by Einstein in the SRT. Refusing the reciprocity principle in my theory leads to disappearing all the paradoxes in the SRT; the Twin paradox, Ehrenfest paradox, Ladder paradox and Bell's spaceship paradox. Furthermore, according to my interpretation we could interpret the experimental results of quantum tunneling and entanglement (spooky action), Casimir effect and Hartman. In our new transformation we refuse objectivity which was adopted in classical physics and in SRT interpretation of the Lorentz transformation. Because of objectivity in SRT, we call SRT and GR is classical theory.

ii. The Quantization of Gravity

Introduction

We have seen previously a new interpretation for the Lorentz transformation equations, which is leading to the Lorentz transformation is vacuum energy dependent instead of the relative velocity in SRT, and the Lorentz factor is equivalent to the refractive index in optics. In the previous sections, we have proposed an inertial frame of reference. That means the frame is moving with constant velocity or stationary. Now if the frame is accelerated or decelerated, then according to our new transformation the vacuum energy will be changed, and that is equivalent to the fluctuations of the vacuum as in quantum theory. This change in the vacuum energy of the accelerated or decelerated frame is controlled by quantum laws, and the Lorentz factor equivalent to the difference of infinities as in the case of Casimir effect as we shall see in the following sections in my equivalence principle. This difference of the vacuum energy maybe negative which leading to faster than light as in the case of refractive index less than 1, or positive which leading to time dilation, and the decreasing of the speed of light as in optics in the case of refractive index greater than 1.

2.1 The Relativistic Quantized Force

Newton's Second Law of motion defined that the force acts on a body equals to the product of the rest mass of the body with its acceleration [9], and the acceleration is given in classical physics as the second derivative of the distance with respect to time. When Einstein reached to his special theory of relativity in 1905, he reached to the measuring of the relativistic mass, which indicates that the mass of the body increased with increasing the speed of the body [4,7,15]. Einstein depends on his relativistic equations derivation on the classical physical conceptions, which depend on the determinism, causality, continuity, and objectivity [11,12], and thus depending on the possibility of measuring the velocity and the position of the particle simultaneously [4,7,11,12,15]. And depending on these concepts Einstein interpreted the Lorentz transformation equations in his SRT in the case of inertial frames of reference. But Heisenberg uncertainty principle and the Copenhagen school assure the impossibility of measuring the velocity and the position simultaneously according to quantum theory. And then quantum theory proved the uncausality, indeterminism and the discontinuity in the micro world. That was violating the concepts and principles of the Einstein's interpretation to the Lorentz interpretation in the SRT [1,2,5,12,14]. We conclude from that according to quantum theory and the Heisenberg uncertainty principle, for measuring the velocity or the momentum for any body, we should know the energy equivalent to the relativistic kinetic energy held by this body, or the equivalent frequency for this energy. Since, according to the uncertainty principle, it is possible measuring the momentum and the energy simultaneously, therefore it is possible expressing the momentum in terms of the equivalent frequency of this energy to this body [1,2,5,12,14]. The force that affected on a body is given through the momentum first derivative with respect to time. Subsequently, we can express the momentum of the body in terms of frequency and time, and then we can get the applied force as the first derivative of the momentum with respect to time. Then we get the applied force in terms of equivalent frequency to the energy which coring by the body.

The cycle number of a standing electromagnetic wave in terms of time [8] is given by the relation

$$n = \nu\ t \tag{2.1.1}$$

Where n is the cycle number at a time t, and ν is the wave frequency[8]. The time t in eq. (5.1.1) is defined by the relation

$$t = N\left(\frac{1}{2\nu}\right) \tag{2.1.2}$$

where

$$N = 1,\ 2,\ 3,\ ....,\ \frac{2\nu}{\nu_u}$$

Where ν_u is the frequency unit, where $\nu_u = \dfrac{1}{t_u}$, and t_u is the time unit. From the eqs. (2.1.1) and (2.1.2) we get

$$n = \frac{N}{2} \tag{2.1.3}$$

We find from eq. (2.1.3) that n takes the values $\frac{1}{2},\ 1,\ \frac{3}{2},\ 2,\ .....,\ \frac{\nu}{\nu_u}$. Since the frequency is defined as the number in the unit of time, subsequently, when $t = t_u$ in eq. (2.1.2) we get

$$N = 2\ \nu\ t_u \tag{2.1.4}$$

and from this we g

$$n = \frac{\nu}{\nu_u} \tag{2.1.5}$$

The energy of the electromagnetic wave is defined by the relation

$$E = h\nu \tag{2.1.6}$$

Where E is the energy and h is Plank's constant [5,6], and from eqs. (2.1.4) and (5.1.5) we get

$$E = \frac{N}{2} \; h\nu_u = nh\nu_u$$

And by putting $H = h\nu_u$, we get

$$E = N\frac{H}{2} \tag{2.1.7}$$

And also

$$E = nH \tag{2.1.8}$$

Equation (2.1.7) indicates that, the energy of the standing electromagnetic wave takes integral value of $\frac{H}{2}$, and from that we can get the minimum energy $E_{\min}$ for the stating electromagnetic wave, and that is when $N = 1$, where we get

$$E_{\min} = \frac{H}{2}$$

when the energy value equals to H, it is called $H - energy$, where $H = 6.626\times10^{-34}$ joule, and the equivalent mass to the $H - energy$ is given by

$$m_H = \frac{H}{c^2} \tag{2.1.9}$$

Where m_H is the equivalent mass for $H - energy$, and the equivalent mass is called $H - particle$. The relativistic kinetic energy E_k [15] for a body moving with constant velocity V is given by

$$E_k = \frac{m_0c^2}{\sqrt{1-\frac{V^2}{c^2}}} - m_0c^2$$

Here we used V (Capital letter) to indicates for velocity, and ν to indicates it to frequency.
And by substituting the value $E_k = nH$ as in eq. (2.1.8), and $m_0c^2 = n_0H$ in the last equation we get

$$nH = \frac{n_0H}{\sqrt{1-\frac{V^2}{c^2}}} - n_0H \tag{2.1.10}$$

And from (2.1.10), we get

$$\frac{n_0}{\sqrt{1-\frac{V^2}{c^2}}} = n_0 + n \tag{2.1.11}$$

multiplying both sides of equation (2.1.11) by m_H, we get

$$\frac{n_0m_H}{\sqrt{1-\frac{V^2}{c^2}}} = m_H\left(n_0 + n\right) \tag{2.1.12}$$

and from eq. (2.1.12) $m = \frac{n_0 m_H}{\sqrt{1 - \frac{V^2}{c^2}}}$, where m is a relativistic mass of the moving body, therefore we get

$$m = m_H \left(n_0 + n\right) \tag{2.1.13}$$

and by solving eq. (2.1.11) in terms of the velocity, we get

$$V = \pm \sqrt{\frac{n^2 + 2nn_0}{\left(n + n_0\right)^2}}\ c \tag{2.1.14}$$

Now, when a body absorbs energy with frequency ν so the velocity of this body in terms of time is given by substituting the value of n from eq. (2.1.1) in the eq. (2.1.14), we get

$$V = \pm \left[\frac{\left(\nu\ t\right)^2 + 2\left(\nu\ t\right)n_0}{[(\nu\ t) + n_0]^2}\right]^{\frac{1}{2}} c \tag{2.1.15}$$

and also we can express eq. (2.1.13) in terms of time, where we get

$$m = m_H (n_0 + \nu\ t) \tag{2.1.16}$$

The relativistic momentum [21] for a body moving with constant velocity V is given by the relation

$$P = mV$$

where P is the momentum, and from eqs. (2.1.15) and (2.1.16) we can get the momentum in terms of time, where we have

$$P = \pm\ m_H\ c\sqrt{(\nu\ t)^2 + 2(\nu\ t)n_0} \tag{2.1.17}$$

Newton's second law of motion is given by the relation

$$F = \frac{dP}{dt}$$

where F is the force. and by deriving eq. (2.1.17) with respect of time, we get

$$F = \pm m_H c\left[\frac{\nu^2 t + \nu\ n_0}{\sqrt{(\nu\ t)^2 + 2(\nu\ t)n_0}}\right] \tag{2.1.18}$$

and by multiplying equation (2.1.18) by $\frac{c}{c}$ we get

$$F = \pm\ m_H c^2\left[\frac{(\nu\ t) + n_0}{\sqrt{(\nu\ t)^2 + 2(\nu\ t)n_0}}\right]\frac{1}{c} \tag{2.1.19}$$

and from eq. (2.1.15) we have $\frac{1}{V} = \left[\frac{(\nu\ t) + n_0}{\sqrt{(\nu\ t)^2 + 2(\nu\ t)n_0}}\right]\frac{1}{c}$, and from eq. (2.1.9), we have $H = m_H c^2$. Now by substituting these values in eq. (2.1.19) we get

$$F = \pm\frac{H\nu}{V} \tag{2.1.20}$$

Equation (2.1.20) expresses about the affected force on a body, when the body changes its velocity from zero to V , when it absorbs a photon with frequency ν, and we find the dimension of eq. (2.1.20) is MLT^{-2} which means force, and by taking the positive value of eq. (2.1.20), we get

$$F = \frac{H\nu}{V} \tag{2.1.21}$$

Equation (2.1.21) agrees with the equation of describing the momentum of the photon in quantum theory, where the momentum of a photon is $P = \frac{h\nu}{c}$, and this agrees with the core of wave-particle duality.

Now suppose a body starts at rest $(V = 0)$, and after it absorbed a photon with frequency ν_1, its velocity became V_1, and according to the eq. (2.1.21), the force affected on the body is F_1, where $F_1 = \frac{H\nu_1}{V_1}$ and then after it absorbed another photon with frequency ν_2 therefore the body should move with a total velocity V (because of the absorption the two photons ν_1 and ν_2). So the total force affected on the body is

$$F = \frac{H(\nu_1 + \nu_2)}{V}$$

The affected force on the body as a result of the absorption of the second photon ν_2 is F_2 where

$$F_2 = F - F_1 \tag{2.1.22}$$

Equation (2.1.22) is very important for understanding the equivalence principle of my theory to compare it with Einstein's equivalence principle in GR.

2.2 **The Relativistic Quantized Inertail Force**

As we know from the Quantum Theory that the energy is photons having a rest mass equals to zero [1,2,5,12,14]. We can express the photon energy by the relation

$$E = h\nu \tag{2.2.1}$$

Where E is the photon energy, h is plank's constant and ν is the wave frequency [5,6]. And from the equivalence of mass and energy, we can get the equivalent mass m to a photon having energy E as

$$m = \frac{h\nu}{c^2} \tag{2.2.2}$$

Now suppose a train moving with constant velocity V (remember we use in this section and in the others V-capital letter to define the velocity, and ν to define to the frequency), as we have from the special relativity theory of Einstein the clock motion of the moving train should be slower than the clock motion of the earth observer for the observer of the earth surface which that agrees with my interpretation to the Lorentz transformation, whereas if the earth observer measured the time interval Δt via his earth clock, then he will measure the time interval $\Delta t'$ via the clock of the moving train, where $\Delta t' = \sqrt{1 - \frac{V^2}{c^2}}\,\Delta t$. And the wave frequency is defined as the cycle number in a unit of time, and subsequently the wave frequency which exists on the earth surface according to the earth observer is given by the relation

$$\nu = \frac{1}{\Delta t_0} \tag{2.2.3}$$

And now if this wave entered inside the moving train, then, the wave frequency becomes ν' according to the earth observer, where

$$\nu' = \frac{1}{\Delta t} = \frac{\sqrt{1-\frac{V^2}{c^2}}}{\Delta t_0}$$

And from that we get

$$\nu' = \sqrt{1-\frac{V^2}{c^2}}\ \nu \tag{2.2.4}$$

Equation (2.2.4) indicates that the wave frequency inside the moving train should be less than outside the train on the earth surface by the factor of $\sqrt{1-\frac{V^2}{c^2}}$ for the observer on the ground. Subsequently the endured energy E' through this photon inside the moving train is given by

$$E' = h\nu' = \sqrt{1-\frac{V^2}{c^2}}\ h\nu$$

And from eq. (2.2.1), we get

$$E' = \sqrt{1-\frac{V^2}{c^2}}\ E \tag{2.2.5}$$

Equation (2.2.5) represents the endured energy inside the frame of the moving train according to the reference frame of the earth surface in terms of the photon energy E. The difference of the endured energy ΔE of the moving train from its rest on the earth surface and its motion with constant velocity V is given by the relation

$$\Delta E = E\left[1-\sqrt{1-\frac{V^2}{c^2}}\right] \tag{2.2.6}$$

We have reached in the preceding section to a new formula for understanding the quantization of force, where the force acts on the body when its velocity changes from 0 to V is given by the relation $F = \frac{H\nu}{V}$.

Now suppose a stationary train on the earth surface and a rider is living inside it, Now if this train absorbs an energy of frequency ν, then the speed of this train will change from $0\ to\ V$, thus, the affected force on this train is given by the relation $F = \frac{H\nu}{V}$ according to the stationary earth observer, in this case there is a force affected on the rider pushing him to the opposite direction of the train's speed change. This force is called "inertial force". Subsequently, according to this force the rider's speed should be changed also from $0\ to\ V_r$ locally, whereas in this case V_r should be equal to V (the speed of the train). We can get this change of the velocity of the train's rider from $0\ to\ V_r$ under the affect of inertial force whereas V_r should be equal to V by applying the two conditions

1. The kinetic energy E_k that is equivalent to the rider's speed V_r is given as

$$E_k = E_0(1-\gamma^{-1})$$

Where $\gamma^{-1} = \sqrt{1-\frac{V^2}{c^2}}$, and E_0 is the equivalent energy of the rider's rest mass, where $E_0 = m_0 c^2$. We can express the kinetic energy in the last equation in the terms of the number of $H - energy$, where we have

$$n = n_0(1-\gamma^{-1}) \tag{2.2.7}$$

Where n is the number of $H - energy$ which is equivalent to the kinetic energy, and n_0 is the number of $H - particle$ or the number of the $H - energy$ which equivalent to the rider's rest mass.

2. The endured rest mass inside the train in terms of the rider's rest mass is m_0' given according to eq. (2.2.5), where we have

$$m_0' = \gamma^{-1} m_0$$

And we can express the last equation in terms of $H - particle$ or $H - energy$, where we have

$$n_0' = \gamma^{-1} n_0$$

Where n_0' is the number of $H - particle$ or the number of $H - energy$ which is equivalent to the endured rest mass , thus, from eq. (2.2.7) we can write the last equation as

$$n_0' = n_0 - n$$

Now according to these two conditions, we can get the measured speed V_r locally of a rider under the affect of the inertial force according to the observer inside the train by eq. (2.1.14), where we have

$$V_r = \sqrt{\frac{n^2 + 2nn_0'}{(n+n_0')^2}}\ c = \sqrt{\frac{n^2 + 2n(n_0 - n)}{[n+(n_0-n)]^2}}\ c$$

by substituting $n_0' = n_0 - n$, we get

$$V_r = \sqrt{\frac{2nn_0 - n^2}{n_0^{\ 2}}}\ c = \sqrt{\frac{2n}{n_0} - \frac{n^2}{n_0^{\ 2}}}\ c$$

And from eq. (2.2.7) we get

$$V_r = \sqrt{\frac{2n_0(1-\gamma^{-1})}{n_0} - \frac{n_0^{\ 2}(1-\gamma^{-1})^2}{n_0^{\ 2}}}\ c$$

And from that we get

$$V_r = \sqrt{1-\gamma^{-2}}\ c \tag{2.2.8}$$

And by substituting the value of $\gamma^{-2} = 1 - \frac{V^2}{c^2}$ in the last equation we get

$$V_r = V \tag{2.2.9}$$

We get from eq. (2.2.9) that the change in the measurement of the train's rider speed under the effect of the inertial force is from $0\ to\ V$ locally and it is the same change of the train's speed, but it is in the opposite direction. Therefore we get the inertial force F_i which acts on the train's rider locally, whereas from eq. (2.1.21) we have

$$F_i = \frac{H\nu}{V} = \frac{H\nu_0(1-\gamma^{-1})}{V} \tag{2.2.10}$$

Now for an observer on the ground, if the change of the speed of the rider locally under the effect of the inertial force is from $0\ to\ V$, then for the observer on the ground the change of the speed of the rider is from 0 to $\gamma^{-1}V$ as from eq. (9) in my interpretation of the Lorentz transformation equations, thus the measured inertial force F_i' affected on the rider of the train for the observer on the ground is given as

$$F_i' = \frac{H\nu_0(1-\gamma^{-1})}{\gamma^{-1}V} \tag{2.2.11}$$

The quantized inertial force according to the group velocity is given according to eq. (10), where we get

$$F_i' = \frac{H\nu_0(1-\gamma^{-1})}{\gamma^{-2}V} \tag{2.2.12}$$

2.3. The Relativistic Quantized Gravitational Force and the Quantized Gravitational Time Dilation

The relativistic quantized inertial force locally is given according to the equation (2.2.10), where

$$F_i = \frac{H\nu_0(1-\gamma^{-1})}{V}$$

Now, according to my equivalence principle, the inertial force is equivalent to the gravitational force locally. That means when the velocity of the train changes from 0 to V, then locally the velocity of the rider on the train will change from 0 to V also as a result of the inertial force. Thus by my equivalence principle we can use equation (2.2.10) for computing the gravitational force. Here locally we have

$$V_r = V = V_{escape}$$

given as in eq. (2.2.8).

Now if a body of rest mass m_0 is located at a gravitational field of big mass M. Thus by my equivalence principle, the kinetic energy equivalent to the change of the velocity of the body locally from 0 when it is located at a distance equals to infinity from the big mass M to $V_r = V = V_{escape}$ at radius r from the center of the big mass M is E given by

$$E = m_0c^2(1-\gamma^{-1}) \tag{2.3.1}$$

Equation (6.2.1) indicates us according to my equivalence principle, a part of the rest mass of the free falling object in gravity will change to energy (photons), and these photons are not radiated and give the object the kinetic energy equivalent to the escape velocity at any point in the space locally, and the total relativistic mass is always equal to the rest mass of the object.

Now if we consider this energy is equal to the gravitational potential energy, from that we get

$$\frac{GMm_0}{r} = m_0c^2(1-\gamma^{-1})$$

G is the gravitational constant
M is the mass of the gravitational field
m is the mass of the body
r is the distance between the body and the mass M

Thus we can solve the equation above to get the Lorentz factor γ^{-1} of gravity where

$$\gamma^{-1} = 1 - \frac{GM}{c^2r} \tag{2.3.2}$$

From that we can get the gravitational time dilation, whereas, if clock 1 is located at a distance r exactly (phase velocity) from the center of the mass M, thus the time that is measured by this clock is $\Delta t'$ for an observer located at r=infinity compared to the time Δt of clock 2 located at r=infinity from the center of mass M, whereas

$$\Delta t' = \gamma^{-1} \Delta t$$

Thus

$$\Delta t' = \left[1 - \frac{GM}{c^2 r}\right] \Delta t \tag{2.3.3}$$

In this case that is measured according to eq. (2.3.3) is according to phase velocity.

Now if we consider $\gamma^{-1} = 0$, then we can compute the radius that the big mass M should be compressed to be transformed to a black hole. This radius is known as the Schwarzschild radius. Thus

$$1 - \frac{GM}{c^2 r_s} = 0$$

Thus

$$r_s = \frac{GM}{c^2} \tag{2.3. 4}$$

Whereas r_s is the Schwarzschild radius [22].

Now we can compute r_s for the earth where

$$r_s = 0.00443184\text{m}$$

Now if we consider for earth $\gamma^{-1} = 1 - \dfrac{GM}{c^2 R}$, where R is the radius of the earth, and M is its mass. Thus by taking

$$M = 5.98 \times 10^{24} kg$$
$$G = 6.67 \times 10^{-11} N \ m^2 kg^{-2}$$
$$R = 6.38 \times 10^6 m$$
$$C = 3.0 \times 10^8 m/s$$

Then $\gamma^{-1} = 1 - (6.95 \times 10^{-10}) \approx 0.9999999993053535$ at a certain point in space on the ground according to phase velocity.

From that we can get the gravitational time dilation of clock1 located on the earth surface comparing to clock2 located at infinity from the earth for an observer located at infinity as in equation (2.3.3) whereas

$$\Delta t' = 0.9999999993053535 \Delta \text{t}$$

From that if clock2 registered one second for an observer at infinity, at this moment clock1 will register 0.9999999993053535 second for an observer located at infinity.

In this case the difference of time is 6.946646×10^{-10} second. But for an observer located on the earth surface looking at clock 2 located at infinity, he will get that clock 2 is moving in a similar rate of his clock on the earth surface, where clock 2 is not moving in a slower rate than of his earth clock according to my new interpretation to the Lorentz transformation equations, where according to my transformation I refuse the reciprocity principle in Einstein's SRT. This leads the observer on the earth surface to measure the possibility of faster than light (review fig. (2) and how the possibility of measuring faster than light in my theory [25, 26, 43]).

In the equivalence principle of my theory, the time dilation of the clock on the earth surface is produced as the clock on the ground is moving with speed equals to the escape velocity given according to eq. (2.2.8), which is agreed completely with the core of the The Pound-Rebka experiment [44]. Proponents of the theory of General Relativity offer three different conflicting explanations of the results of the The Pound-Rebka experiment that are said to be equivalent to each other and therefore all equally correct. All make the claim that the results of the Pound-Rebka Experiment are "proof" of the Equivalence Principle even though nothing in these measurements suggests any need for the Equivalence Principle. Also according to my interpretation to the Lorentz transformation equations it is possible measuring a speed of light to be faster than c [25, 26, 43]. The possibility of superluminal photon propagation in gravitational fields is one of the most remarkable predictions of quantum field theory in curved spacetime. It appears that real photons propagating in a variety of background spacetimes may, depending on their direction and polarisation, travel with speeds exceeding the normal speed of light c. This phenomenon was discovered by Drummond and Hathrell in 1980 [31]. It is a quantum effect induced by vacuum polarisation and implies that the Principle of Equivalence in GR is violated in interacting quantum field theories such as QED. But according to my interpretation to the Lorentz transformation equations and my equivalence principle this problem is solved.

The relativistic escape velocity locally of a body to be free from the earth gravity is given by equation (2.2.8), where $V_{escape} = \sqrt{1-\gamma^{-2}}c$. Thus the relativistic escape velocity locally on the earth is $V_{escape} = 11182$ m/s . The force that is exerted on a body of mass 1 kg to move from 0 to V_{escape} locally is given by the equation (2.2.10) where $F = 5590.98$ Newtons . This result is half the classical result. That refers to the relativistic quantized derivation of the momentum in my model [5,6] and that related to the phase velocity as in eq. (2.2.10). Now according to eq. (2.2.11) according to the group velocity, where the classical velocity is equal to the group velocity we get F=11182 Newtons.

According to Einstein's equivalence principle, treating light as a quantum object, the change in a photon's velocity depends on the strength of the gravitational field, whereas on classical acceleration.

For an observer located at infinity from the earth, the measured escape velocity for an object located on earth is less than the escape velocity locally by a factor of γ^{-1} as in eq. (10), where the phase velocity is given according to

$$V'_{escape-phase} = \gamma^{-1}\sqrt{1-\gamma^{-2}}c \tag{2.3.6}$$

In this case and according to eq. (2.3.6), there must be a measured red shift in the kinetic energy of an object to be free from gravity for an observer located at infinity. This measured escape velocity is at a certain point in space on the gravitational field. But during the motion without determining any local point in space the decrease in the kinetic energy is depending on the group velocity where

$$V'_{escape-group} = \gamma^{2}\sqrt{1-\gamma^{-2}}c$$

And by considering $\gamma^{-1} = \left(1 - \frac{GM}{c^2 r}\right)$ we get

$$V'_{escape} = \left(1 - \frac{GM}{c^2 r}\right)^2 \sqrt{\frac{2GM}{r} - \frac{G^2 M^2}{c^4 r^2}} \tag{2.3.7}$$

Which can be approximate in case of weak gravitation field as

$$V'_{escape} = \left(1 - \frac{2GM}{c^2 r}\right)\sqrt{\frac{2GM}{r}}$$

And in this case we could interpret the precession of Mercury exactly according to our new transformation by considering space is invariant according to my transformation and thus considering the time dilation according to group transformation. Furthermore this equation accounts for the pioneer anomaly exactly. As we have seen in our new transformation there is no space-time continuum, it is only time and space is invariant.

Now the decrease in the light speed according to the phase velocity by determining an exact point in space in the gravitational field as in Pond and Rebka experiment is given according to the phase velocity where

$$c' = \gamma^{-1} c = \left(1 - \frac{GM}{c^2 r}\right) c \tag{2.3.8}$$

But according to group velocity we get

$$c' = \gamma^{-2} c = \left(1 - \frac{GM}{c^2 r}\right)^2 c \tag{2.3.9}$$

Which accounts for the light bending by gravity exactly according to the group velocity, where eq.(2.3.9) can be approximated in case of weak gravitational field as

$$c' = \left(1 - \frac{2GM}{c^2 r}\right) c$$

In case of nonlinear dispersion as in weak gravitational field and according to our equivalence principle, the classical velocity is defined as the group velocity $v_g = \partial\omega(k)/\partial k = \hbar k/m$, and this is perfectly consistent with the movement of a semi-classical particle for which the momentum is $p = \hbar k$ and the group velocity thus $p/m = v_g$.

My exact solution to the Pioneer 10/11 anomaly is also good proof to the validity of my quantization of GR [28]. And that leads to solving the energy momentum problem in GR.

Franson [32] calculated that, treating light as a quantum object, the change in a photon's velocity depends not on the strength of the gravitational field, but on the gravitational potential itself. However, this leads to a violation of Einstein's equivalence principle – that gravity and acceleration are indistinguishable – because, in a gravitational field, the gravitational potential is created along with mass, whereas in a frame of reference accelerating in free fall, it is not. Therefore, one could distinguish gravity from acceleration by whether a photon slows down or not when it undergoes particle–antiparticle creation. As we have seen previously, Frason's calculations is agreed completely with my equivalence principle.

Suppose a particle fell in a Schwarzschild radius, thus according to my equivalence principle, that is equivalent as the velocity of the moving train changes from 0 to c the speed of the light in vacuum, and thus the velocity of the rider will change locally from 0 to c also. Thus, the applied force F_g on the particle locally at the Schwarzschild radius is given according to eq. (2.2.10) where

$$F_g = \frac{H v_0}{c}$$

Here ν_0 is the equivalent frequency of the rest mass energy of the particle, where in the Schwarzschild radius $\gamma^{-1} = 0$, and thus according to eq. (2.3.1) all the rest mass of the particle will change to photons, and then the particle will move in the speed of light locally and from eq. (2.2.8) the escape velocity of the particle is c locally. Thus the applied gravitational force locally on the particle equals to the force of light as in the equation above. Now, suppose the velocity of the train is changed from 0 to c, in this case there an inertial force let the velocity of the rider on the train to change also from 0 to c locally. Thus, for an observer on the ground, the change of the velocity of the rider under the effect of the inertial force will be from 0 to $\sqrt{1-\frac{V^2}{c^2}}c = 0$, where $V = c$.

This case is equivalent for an observer located at infinity or on earth from the black hole, as a particle fell in the back hole at the Schwarzschild radius, and then according to my equivalence principle the escape velocity of the particle will change from 0 when the particle is located at infinity to $\gamma^{-1}c = 0$ as the result of the red-shift caused by the black hole gravitational field seen by an observer located on the ground or in infinity from the black hole.

Thus from eqs. (2.2.11) or (2.2.12), the applied gravitational force on the particle fell at the Schwarzschild radius is equal to infinity for an observer located at infinity or on earth. The Schwarzschild radius in my theory is given according to eq. (2.3.4).

Finally, as we have seen in my proposed quantization of gravity, there is no graviton! Photon mediates gravitation!

ACKNOWLEDGEMEN

Thanks God!

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