Relative Transformation of Matter Motion Based on the Arbitrary Wave Velocity

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***Abstract*—Albert Einstein proposed the special relativity under the condition that using light wave as the signal and the propagation velocity of light wave in vacuum is a constant. According to the special relativity, Albert Einstein concluded that the rest mass of photon is zero and the velocity of any matter could not exceed that of light. These conclusions are doubted by many experimental phenomenons. In this paper, the wave that could carry arbitrary signals was used to transfer information. Assuming the velocity of the wave is a constant, the parameters of matter motion was calculated with the Lorentz transform. The results show that rest mass of photon may be not zero, when the wave with a velocity exceeding that of light is used as the propagation carrier. And also, obtain the conclusion that the powerful gravitation would change the density distribution of photon in the universe. The light wave will change the direction of propagation according to the density distribution of photon. As a result, the route of light propagation will change too. Photons will be attracted into the black hole continually by its limitless attraction force. In addition, wave propagating though photons could not escape the gravitation of the black hole.**

***Index Terms*—Arbitrary wave, constant velocity of light, lorentz transform, rest mass of photon, photon independent of light wave.**

I. Introduction

Albert Einstein proposed two hypotheses in the paper of "On the Electrodynamics of Moving Bodies". First, the law affecting the state of physical system is independent of which one was used as the frame of reference between two coordinate systems at relatively uniform motion. Second, the velocity of light propagating in empty space is a definite value C which is independent of the state of motion of the emitting body[1]. In this regard, all inertial frames are equivalent and the velocity of light in vacuum is a constant independent of the inertial frame. Based on these two hypotheses, the equation of special relativity is proposed though the Lorentz transform for the dynam parameters of matter motion [2-3]. Abundant experimental and theoretical research demonstrates the correction of special relativity. Based on this theory, it is obtained the conclusion that the velocity of matter in nature cannot exceed the velocity of light, which resulting at the research of faster-than-light is in a difficult position[4-8]. In this regard, in this paper the mechanical parameters of matter motion are calculated with the Lorentz transform and the results will offer some contributions for the research in the area of faster-than-light.

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II. Hypothesis of Relativity Based on the Arbitrary Matter Wave

The law which the state of physical system flows is independent of which one was used as the frame of reference between two coordinate systems at relatively uniform motion. Arbitrary wave that could carry signal is defined as relatively transform wave, hereinafter referred to as "relatively wave". The velocity of relatively wave is a defined value as V which is independent on the wave resource and the motion state of motion body.

III. Relatively Transformation for Matter Motion under Relatively Wave

A. Coordinate Transformation

The change type of coordinate change type based on the arbitrary wave velocity can be defined as follows:

$$\begin{cases} X = \dfrac{x-ut}{\sqrt{1-\dfrac{u^2}{V^2}}} \\ Y = y \\ Z = z \\ T = \dfrac{t-\dfrac{ux}{V^2}}{\sqrt{1-\dfrac{u^2}{V^2}}} \end{cases} \tag{1}$$

B. Change of Speed

$$\begin{cases} v(X) = \dfrac{dX}{dT} = \dfrac{v(x)-u}{1-\dfrac{v(x)u}{V^2}} \\ v(Y) = \dfrac{dY}{dT} = \dfrac{v(y)\sqrt{1-\dfrac{u^2}{V^2}}}{1-\dfrac{uv(x)}{V^2}} \\ v(Z) = \dfrac{dZ}{dT} = \dfrac{v(z)\sqrt{1-\dfrac{u^2}{V^2}}}{1-\dfrac{uv(x)}{V^2}} \end{cases} \tag{2}$$

C. Change of Length

Supposed that B coordinate system is moving relative to A coordinate system, a slender rod with legh of 1m parallels with X axle and sited in the B coordinate system and is moveing at a speed of u. According to the formula of $X = \dfrac{x-ut}{\sqrt{1-\dfrac{u^2}{V^2}}}$, ΔX can be defined as $\Delta X = \dfrac{\overset{\Delta}{x}-u\overset{\Delta}{t}}{\sqrt{1-\dfrac{u^2}{V^2}}}$. Meanwhile, measure the coordinates of the slender rod'ends using the

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relativity wave, i.e., make the $\Delta t = 0$, therefore:

$$\Delta X = \frac{\Delta x}{\sqrt{1-\frac{u^2}{V^2}}} \quad , \quad \Delta L = \Delta l\sqrt{1-\frac{u^2}{V^2}} \tag{3}$$

D. Change of Time Interval

Based on the reversible change of coordinate change:

$$t = \frac{T-\frac{uX}{V^2}}{\sqrt{1-\frac{u^2}{V^2}}},$$

therefore:

$$\Delta t = \frac{\Delta T-\frac{u\Delta X}{V^2}}{\sqrt{1-\frac{u^2}{V^2}}}$$

When measure the time at the same place, ΔX is equal to zero and thus:

$$\Delta T = \Delta t\sqrt{1-\frac{u^2}{V^2}} \tag{4}$$

E. Change of Wave's Doppler

In the B coordinate system which is moving relative to A coordinate system, a wave source produces signal at the original point and a detector was placed at the original point of A coordinate system. And two clocks adjusted by relativity wave were placed at the same sites of the two coordinates. Supposed that: the frequency of wave source in the B coordinate system is $\nu(B)$ and wave number is N; the measured time of B coordinate system is $\Delta T(B)$. According to the Change of time interval, the clock time of A coordinate system should be defined as follow:

$$\Delta t(A) = \frac{\Delta T(B)}{\sqrt{1-\frac{u^2}{V^2}}} \tag{5}$$

The detector firstly receives the signal at the time of $t_1 + \frac{x}{V}$ and finally stops receiving the signal at the time of $t_2 + \frac{x+u\Delta t(A)}{V}$. Thus:

$$\Delta t(N) = (1+\frac{u}{V})\Delta t(A) \tag{6}$$

In term of the assumption that the motion does not influence the wave number of wave signal, and thus the wave number transmitted from wave source is identical with the wave number received by detector as Eq. (7).

$$\nu(B)\Delta t(B) = \nu(A)\Delta t(N) \tag{7}$$

Thus, Eq. (8) is obtained by the combination of Eqs. (5)-(7)

$$\nu(A) = \nu(B)\sqrt{\frac{V-u}{V+u}} \tag{8}$$

In addition, Eq. (9) can be obtained according to the principle of wave velocity unchanged.

$$\lambda(A) = \lambda(B)\sqrt{\frac{V+u}{V-u}} \tag{9}$$

F. Relationship of Momentum and Energy at Relativistic Wave Velocity

In Newtonian mechanics, the expression of momentum can be written as $p=mu$, however, in term of lorentz transformation, the equivalent expression of relativity theory cannot be obtained. Therefore, the expressions of momentum still remains as p=mu, i.e., $F = \frac{d(mu)}{dt}$, and Eq. (10) can be deduced in light of principles of momentum conservation and relativity.

$$m_u = \frac{m_0}{\sqrt{1-\frac{u^2}{V^2}}} \tag{10}$$

where m_0 is the mass of particle in state of rest, and is called rest mass; m_0 is the mass of kinetic particle with a velocity of u, and is called relativity mass.

Relativity momentum can be expressed via Eq. (11).

$$p = m_u u = \frac{m_0 u}{\sqrt{1-\frac{u^2}{V^2}}} \tag{11}$$

In term of the expression of relativity momentum, $F=dp/dt$ is obtained, and it is the definition of fore. Therefore, mass energy equation is deduced as Eq. (12).

$$E_k = mV^2 - m_0V^2 \tag{12}$$

The total energy of relativity and the relationship of momentum and energy can be expressed as Eq. (13) and Eq. (14), respectively.

$$E = mV^2 \tag{13}$$

$$E^2 = V^2p^2 + m_0V^4 \tag{14}$$

IV. Discussion

A. When the Relativity Wave Velocity (V) Greater than Light Velocity(C)

According to $m_u = \frac{m_0}{\sqrt{1-\frac{u^2}{V^2}}}$, when the relativity wave velocity (V) is greater than light velocity(C), the rest mass of photon can be described as Eq. (15)

$$m_0 = m_C\sqrt{1-\frac{C^2}{V_2}} \tag{15}$$

where, m_C is the massof photons with the speed of light waves motion.

Therefore, the rest mass of photon is not to be zero, although the photon moves with light velocity, and the following conclusions can be drawn as below:

1) As previously mentioned above that the rest mass of photon is not being zero, and thus the photon can be treated as a material object, namely it is substantive even though in the absence of light wave.
2) The constant of experimental testing light velocity refer to the velocity of light is unchanged rather than of photon.
3) The energy of light wave is decreased, i.e. is consumed in propagation, since the rest mass of photon is not being zero.
4) The photon will undergo the gravitational interaction from bulk object including “black hole”, and then the photons of density gradient will be caused due to the rest mass of photon is not being zero.
5) The object is enable to spread electromagnetic wave due to it contains photon, and therefore the object has different photon density, and it has different propagation velocity and direction for light wave. This is an explanation for light refraction.
6) The light wave is transmitted by photons with a group kind, i.e. “wave bag”, in which each photon has different velocity.
7) The light velocity is unable to be detected, and whether it can be spread in a vacuum, since the actual vacuum is nonexistent. Therefore, the second hypothesis of relativity of Einstein is uncertain.
8) The rest mass of photon can be written as Eq. (16) in the absence of light wave.

$$m_0 = m_u\sqrt{1-\frac{u^2}{V_2}} \tag{16}$$

where u is the movement velocity of photon in the absence of light wave; is the mass of photon with a movement velocity of u; V is the wave velocity of photon chosen for detection, and obviously that V is great than u.

B. When the Relativity Wave Velocity (V) Less than Light Velocity(C)

According to the relativistic transformation of relativistic wave velocity, when the relativity wave velocity (V) is less than light velocity(C), the following conclusions can be drawn as below:

1) The rest mass of photon is not being negative number, since the actual movement velocity of photon is not the propagation velocity of light wave (C), even though the relativistic wave velocity is less than light velocity C, and so long as is greater than or equal to actual movement velocity of photon.
2) For the problem of the Doppler effect of the sound wave, only need to set the Relativistic wave velocity as the sonic speed, then the Lorentz transformation was established. Sound wave doppler effect formula now used is consistent with the experiments, which might because in the experiments, the speed of light is applied for the measurement of distance and time but not the velocity.

C. When the Relativity Wave Velocity (V) Equals to the Speed of Light (C)

When the relativistic wave velocity equals to the speed of light, it is the Einstein's special theory of relativity. However, if the assumption is dropped that the light can spread in the vacuum, the photons will be separated from the light waves. As a result, the trap of zero-quality of photon will not exist any more.

The explanation of potoelectric effect is also established, that is, the light wave from the light source is spread to the photons around the metal illuminated through the photons around the light source and then the photons collide with the surface of the metal after getting energy from the light wave. The energy is absorbed by the metal and electrons are released. Meanwhile, the photons having lost energy return to normality and existed around or in the metal. The verdict that the photons will be absolutely absorbed is not necessary.

The direction shear wave spreads is perpendicular to the direction that medium particles vibrate. Though the medium particles might have no displacement along the direction of the wave spread, the spread of wave can still be realized. The light wave is a form of shear wave and if the assumption is correct that the photons are real particles owning rest mass, then the light wave can spread along the perpendicular direction that light wave spreads, rather than kind of movement with the wave at the speed of light.

During the spread of light wave, if the the perpendicular direction movement speed of the photon is u and the movement coordinate is set on the photon, then according to Einstein's theory of relativity, the rest mass of the photon is calculated through the following formula:

$$m_0 = m_u\sqrt{1-\frac{u^2}{C^2}}$$

D. The Mass of Material in Universe Will Increase

In the Einstein's theory of relativity, the rest mass of photon is zero. Thus, the mass of the visible matterial in universe obviously does not contained the mass of photon. However, electromagnetic wave including the light wave can arbitrarily spread in space and even spread inside the matter that is euphotic. It was indicated that photons exist commonly in the areas that electromagnetic wave spreads in universe. If the rest mass of photons in universe is taken into account, the mass of universe visible material will increase.

V. Conclusions

1) The Lorentz transformation was established if the light wave is replaced by any other kind of wave and the mechanical parameters yielded is consistent with the special theory of relativity, the only differences are the symbol and the speed of wave.

2) After the light wave is replaced by any other kind of wave, the formula of the theory of relativity resulted by the Lorentz transformation applies only to the materials whose movement speed is less than the wave speed selected.
3) If the selected wave speed exceeds the speed of light in Lorentz transformation, then the rest mass of the photon is not zero and the assumption that the light speed never changes can not be established. As a result, photons separate from the light wave and the photons which move according to their own movement rules exist in universe.
4) According to the Lorentz transformation inference of hyper light speed, strong gravity alters the density distribution of the photons in space and the light wave changes the spread direction based on the density distribution of the photons thus changes the spread route. The infinite gravity if black holes absorbed the photons inside continually. Because light wave spread through photons, the light is not able to get rid of the infinite gravity of black holes.
5) If the rest mass of photons in universe is taken into account, the mass of the visible material relative to the dark material will increase.

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