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Three Serious Mistakes in Einstein's Original Paper of Special Relativity in 1905

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Abstract

It is revealed in this paper that there were three serious mistakes in the Einstein's original paper in 1905. Einstein did not prove that the motion equation of classical electromagnetic field could satisfy the invariance of the Lorentz coordinate transformation. The Einstein's derivations on the formulas of transverse and longitudinal masses, as well as the calculation on the mass-energy relation are wrong. 1. In order to prove that the classical Maxwell electromagnetic field equation satisfied the invariance of Lorentz transformation in free space without charged and current, Einstein introduced the transformations of electromagnetic fields themselves, called the Einstein's transformations of electromagnetic fields. However, these transformations are completely different from the Lorentz transformations of electromagnetic fields themself, which leads to contradiction and does not hold. 2. For the electromagnetic field equations in non-free space with charge and current, the Einstein's transformations can not make the electromagnetic fields unchanged under the Lorentz transformation. 3. The constitutive equations of electromagnetic theory in the medium do not satisfy the invariance of the Lorentz transformation too. Therefore, the classical electromagnetic field equations have no the invariance of the Lorentz transformation actually, and the most important theoretical and experimental basis of special relativity do not exist. 4. The Einstein's derivations on the formulas of transverse and longitudinal masses have a series of elementary mistakes in mathematics and physics. Einstein took the relative speed between two reference frames as the arbitrary moving velocity of a particle, and the obtained formulas were completely different from the existing mass-velocity of special relativity. 3. When Einstein derived the mass-energy relationship, he only calculated the work done by the force in the x-axis direction of particle's motion, ignoring the work done by the force at the y- and z-axes directions. Meanwhile, the constant relative motion velocity between two reference frames was misused as the variable arbitrary velocity of a particle. Therefore, Einstein had not derived the mass-velocity formula and mass-energy relationship used in the present special relativity.

Keywords: Lorentz coordinate transformation, Galilean velocity transformation, special relativity, mass-velocity formula, mass-energy relation, classical electromagnetic field equation, transverse mass, longitudinal mass

1. Introduction

Einstein put forward the principle of special relativity and the invariance principle of light's speed, derived the Lorentz coordinate transformation formula in his original paper "On the Electrodynamics of Moving Bodies" in 1905. According to Einstein, the Lorentz transformation formula indicated that space and time were relative and variable, and absolute motion did not exist. Einstein also proved that the motion equations of classical electromagnetic fields satisfied the invariance of the Lorentz coordinate transformation, which has been the most important theoretical basis for special relativity and modern physics.

It is well known that Lorentz coordinate transformation was proposed by Lorentz 1895 in order to explain the zero result of the Michelson-Morley experiment (M-M experiment). However, Mei Xiaochun and Yuan Canlun published a paper titled "A re-understanding of the zero result of the Mchelson-Morley experiment" in Applied Physics Research in March, 2023 (Mei Xiaochun, Yuan Canlun, 2023). It is pointed out in this paper that there are serious several problems in the calculation of the M-M experiment, which lead to the wrong understanding of the experiment. Michelson assumed that the light source was fixed on the absolutely stationary reference frame of the universe (or the ether reference frame), which was completely inconsistent with the actual experiment. In the actual experiment, the light source was fixed on the earth motion reference frame and moves and rotates with the Michelson interferometer.

Considering the fact that the light source is fixed on the Earth's reference frame, it is proved that the M-M experiment does not produce the change of interference fringes observed either in the Earth reference frame or in the absolutely stationary reference frame of the universe according to the Galilean rule of addition of velocities. Therefore, the zero result of the M-M experiment is natural, and the M-M experiment is an invalid one for measuring the absolute motion velocity of the Earth.

Since the M-M experiment can be explained by the Galilean velocity transformation, the Lorentz coordinate transformation becomes redundant. The further question is that is the Lorentz velocity transformation formula correct? If it's true, the Galilean formula of velocity addition is incorrect. For the high-speed motion of objectors, the Lorentz transformation is still required.

On the other hand, the mass-velocity formula is the most important formula in Einstein's special relativity, and the famous mass-energy relationship is derived on the basis of the mass-velocity formula. In special relativity, the mass-velocity formula is derived based on the Lorentz velocity transformation. Mei Xiaochun and Yuan Canlun reanalyzed the various derivations of the mass-velocity formula in special relativity (Mei Xiaochun, Yuan Canlun, 2023), including the elastic collision process of two particles, the inelastic collision process, the particle's splitting process of a particle, and the moment balance method.

The results show that there are serious problems in these derivations and all of them are not valid in fact. Meanwhile, the mass-velocity formula derived by the method of Hamiltonian action has nothing to do with Lorentz transformation, does not belong to the category of special relativity, and also has some problems.

Therefore, it is concluded that it is impossible to derive the mass-velocity formula and the mass-energy relation of special relativity according to the Lorentz coordinate transformation formula. The mass-velocity formula and the mass-energy relationship in modern physics actually has nothing to do with special relativity. If the mass-velocity formula and the mass-energy relationship are correct, it just means that Einstein's special relativity is not true. The mass-velocity formula can only be regarded as an empirical formula, which cannot be strictly derived theoretically, and its correctness can only be tested by experiment. Whether its current form needs to be modified is also a problem that future physics experiments need to pay attention to.

This paper re-examines the Einstein's original paper of special relativity in 1905 and finds three serious errors. It reveals that the principle of special relativity was uneatable, and Einstein did not prove that the motion equations of classical electromagnetic fields satisfied the invariance of the Lorentz transformation. Meanwhile, Einstein's calculations on transverse mass and longitudinal mass, as well as the derivation of the famous mass-energy relationship were wrong.

In addition to the principle of invariable speed of light and the principle of special relativity, Einstein's paper actually implied another hypothesis. In order to prove that the free classical Maxwell electromagnetic field equation without charge and current satisfied the invariance of Lorentz transformation, Einstein introduced a space-time coordinate transformation for the electromagnetic fields themselves, called the Einstein's transformations of electromagnetic fields (A. Einstein, 1905). However, these hypothesized transformations are completely different from the Lorentz transformations of electromagnetic fields themselves, resulting in serious contradiction (Mei Xiaochun, 2014).

For the classical electromagnetic field equations in non-free space with charge and current, it is proved in this paper that it is impossible to maintain the invariance of Lorentz transformation even if the Einstein transformations of electromagnetic fields are adopted. An additional current term is increased to change the motion equation of the electromagnetic field after the Lorentz coordinate transformation. Moreover, when the relative velocity of the reference frames $V \to c$, the additional term of current becomes infinite so that it's effect is great.

In addition, it is well known that the constitutive equations of electromagnetic fields in the medium obviously violates the invariance of the Lorentz transformation. Therefore, the classical theory of electromagnetic fields has no relativity, and the most important theoretical and experimental basis for special relativity does not exist.

In 1905's paper, Einstein used the Lorentz coordinate transformation to derive the longitudinal mass m_L (in the x axial direction of the electromagnetic fields) and obtained (A. Einstein, 1905).

$$m_L = \frac{m_0}{(1 - V^2 / c^2)^{3/2}} \tag{1}$$

As well as the transverse mass m_T (in the y axis and z axis directions of the electromagnetic fields)

$$m_T = \frac{m_0}{1 - V^2 / c^2} \tag{2}$$

Where V was the relative motion velocity between two reference frames, not the arbitrary velocity of a moving particle.

In the Einstein's derivations, the Lorentz factor β was miscalculated as $1/\beta$. Meanwhile, it did not take into account that the velocity of a charged particle could not be equal to zero under the action of electromagnetic force. The relative speed V between two reference frames was wrongly regarded as the arbitrary moving velocity u of a particle. Therefore, Einstein's derivation of longitudinal mass m_L and transverse mass m_T were invalid.

The accepted formula for the mass-velocity formula in special relativity at present is

$$m = \frac{m_0}{\sqrt{1 - u^2 / c^2}} \tag{3}$$

Where u is the arbitrary velocity of a particle in any reference frame, not the relative velocity V between two reference frames. Obviously, Eqs.(1), (2) and (3) are not only different in the forms, but also completely different in physical meaning.

When deriving the mass-energy relation from the longitudinal mass of Eq.(1), Einstein also regarded the relative velocity V (a constant) of two reference frames as the arbitrary velocity (variable) of a particle, and only calculated the work done by the force at the x axis direction of particle's motion, ignoring the work done by the force at the y and z axes directions of particle's motion. Einstein had not obtained and impossible to obtain the mass-energy relationship $E = m_0 c^2$ actually.

Therefore, the conclusion of this paper is that Einstein neither proved the equations of motion of the classical electromagnetic field satisfying the invariance of the Lorentz transformation, nor derived the mass-velocity formula which was the dynamics basis of special relativity as well as the famous mass-energy relationship.

This paper proves once again that the mass-velocity formula and the mass-energy relation have nothing to do with Einstein's special relativity. If these two formulas are correct, it just indicates that special relativity is invalid.

2. The Proof That the Motion Equations of Classical Electromagnetic Fields Have no the Invariance of Lorentz Transformation

2.1 The Einstein's Transformation of Free Electromagnetic Fields Themselves

In order to make the Maxwell equations of classical electromagnetic fields satisfying the invariance of Lorentz transformation, Einstein introduced the space-time coordinate transformations of electromagnetic fields themselves in his original paper in 1905, which can be called the Einstein's transformations of electromagnetic fields. These transformations are actually Einstein's hypothesis, which forms the basis of Einstein's proof but not belongs to the classical electromagnetic field theory.

Let $\vec{E}(\vec{x}, t)$ and $\vec{B}(\vec{x}, t)$ be the intensities of electromagnetic fields in the inertial reference frame K, $\vec{E}'(\vec{x}', t')$ and $\vec{B}'(\vec{x}', t')$ be the intensities of electromagnetic fields in the inertial reference frame K'. The reference frame K' moves at a uniform velocity V along the x axis direction relative to the reference frame K.

In Einstein's original paper, the intensity of electric field was expressed in terms of components X, Y, Z and the intensity of magnetic field was expressed in terms of components L, M, N. The intensity of electric field in reference frame K' was expressed in terms of components X', Y', Z' and the intensity of magnetic field was expressed in terms of components L', M', N'. The relative velocity between two reference frames was expressed in lowercase v, and the speed of light was expressed in uppercase V.

Einstein's proof on this part was rather brief, here we admit the proof in Zhang Yongli's book "Introduction to Relativity" (Zhang Yunli, 1980). The Maxwell's electromagnetic field equations in the initial reference frame K in vacuum without charge and current are

$$\nabla\cdot\vec{E}=0 \qquad \nabla\cdot\vec{B}=0 \tag{4}$$

$$\frac{1}{c}\frac{\partial}{\partial t}\vec{E}=\nabla\times\vec{B} \qquad -\frac{1}{c}\frac{\partial}{\partial t}\vec{B}=\nabla\times\vec{E} \tag{5}$$

Written them in the forms of components, we have

$$\frac{\partial E_x}{\partial x}+\frac{\partial E_y}{\partial y}+\frac{\partial E_z}{\partial z}=0 \qquad \frac{\partial B_x}{\partial x}+\frac{\partial B_y}{\partial y}+\frac{\partial B_z}{\partial z}=0 \tag{6}$$

$$\frac{1}{c}\frac{\partial E_x}{\partial t}=\frac{\partial B_z}{\partial y}-\frac{\partial B_y}{\partial z} \qquad \frac{1}{c}\frac{\partial E_y}{\partial t}=\frac{\partial B_x}{\partial z}-\frac{\partial B_z}{\partial x} \qquad \frac{1}{c}\frac{\partial E_z}{\partial t}=\frac{\partial B_y}{\partial x}-\frac{\partial B_x}{\partial y}$$

$$-\frac{1}{c}\frac{\partial B_x}{\partial t}=\frac{\partial E_z}{\partial y}-\frac{\partial E_y}{\partial z} \qquad -\frac{1}{c}\frac{\partial B_y}{\partial t}=\frac{\partial E_x}{\partial z}-\frac{\partial E_z}{\partial x} \qquad -\frac{1}{c}\frac{\partial B_z}{\partial t}=\frac{\partial E_y}{\partial x}-\frac{\partial E_x}{\partial y} \tag{7}$$

Introducing the Lorentz factor and adopting Einstein's sign β to let

$$\beta=\frac{1}{\sqrt{1-V^2/c^2}} \tag{8}$$

The Lorentz coordinate transformation can be written as

$$x'=\beta(x-Vt) \qquad y'=y \qquad z'=z \qquad t'=\beta\left(t-\frac{Vx}{c^2}\right) \tag{9}$$

The Lorentz transformations of operators are (Zhang Yunli, 1980)

$$\frac{\partial}{\partial x}=\frac{\partial x'}{\partial x}\frac{\partial}{\partial x'}+\frac{\partial t'}{\partial x}\frac{\partial}{\partial t'}=\beta\left(\frac{\partial}{\partial x'}-\frac{V}{c^2}\frac{\partial}{\partial t'}\right) \qquad \frac{\partial}{\partial y}=\frac{\partial}{\partial y'}$$

$$\frac{\partial}{\partial z}=\frac{\partial}{\partial z'} \qquad \frac{\partial}{\partial t}=\frac{\partial t'}{\partial t}\frac{\partial}{\partial t'}+\frac{\partial x'}{\partial t}\frac{\partial}{\partial x'}=\beta\left(\frac{\partial}{\partial t'}-V\frac{\partial}{\partial x'}\right) \tag{10}$$

Substituting Eq.(10) in Eqs.(6) and (7), we can get

$$\beta\frac{\partial E_x}{\partial x'}-\frac{\beta V}{c^2}\frac{\partial E_x}{\partial t'}+\frac{\partial E_y}{\partial y'}+\frac{\partial E_z}{\partial z'}=0 \tag{11}$$

$$\beta\frac{\partial B_x}{\partial x'}-\frac{\beta V}{c^2}\frac{\partial B_x}{\partial t'}+\frac{\partial B_y}{\partial y'}+\frac{\partial B_z}{\partial z'}=0 \tag{12}$$

$$\frac{\beta}{c}\frac{\partial E_x}{\partial t'}-\frac{\beta V}{c}\frac{\partial E_x}{\partial x'}=\frac{\partial B_z}{\partial y'}-\frac{\partial B_y}{\partial z'} \tag{13}$$

$$\frac{\beta}{c}\frac{\partial E_y}{\partial t'}-\frac{\beta V}{c}\frac{\partial E_y}{\partial x'}=\frac{\partial B_x}{\partial z'}-\beta\frac{\partial B_z}{\partial x'}+\frac{\beta V}{c^2}\frac{\partial B_z}{\partial x} \tag{14}$$

$$\frac{\beta}{c}\frac{\partial E_z}{\partial t'}-\frac{\beta V}{c}\frac{\partial E_z}{\partial x'}=\beta\frac{\partial B_y}{\partial x'}-\frac{\beta V}{c^2}\frac{\partial B_y}{\partial t'}-\frac{\partial B_x}{\partial y'} \tag{15}$$

$$-\frac{\beta}{c}\frac{\partial B_x}{\partial t'}+\frac{\beta V}{c}\frac{\partial B_x}{\partial x'}=\frac{\partial E_z}{\partial y'}-\frac{\partial E_y}{\partial z'} \tag{16}$$

$$-\frac{\beta}{c}\frac{\partial B_y}{\partial t'}+\frac{\beta V}{c}\frac{\partial B_y}{\partial x'}=\frac{\partial E_x}{\partial z'}-\beta\frac{\partial E_z}{\partial x'}+\frac{\beta V}{c^2}\frac{\partial E_z}{\partial x} \tag{17}$$

$$-\frac{\beta}{c}\frac{\partial B_z}{\partial t'}-\frac{\beta V}{c}\frac{\partial B_z}{\partial x'}=\beta\frac{\partial E_y}{\partial x'}-\frac{\beta V}{c^2}\frac{\partial E_y}{\partial t'}-\frac{\partial E_x}{\partial y'} \tag{18}$$

Writing Eqs.(11) and (12) as

$$\frac{\partial E_x}{\partial x'}=\frac{V}{c^2}\frac{\partial E_x}{\partial t'}-\frac{1}{\beta}\frac{\partial E_y}{\partial y'}-\frac{1}{\beta}\frac{\partial E_z}{\partial z'} \tag{19}$$

$$\frac{\partial B_x}{\partial x'}=\frac{V}{c^2}\frac{\partial B_x}{\partial t'}-\frac{1}{\beta}\frac{\partial B_y}{\partial y'}-\frac{1}{\beta}\frac{\partial B_z}{\partial z'} \tag{20}$$

Substituting Eq.(19) in Eq.(13) and considering Eq.(18), the result are

$$\frac{1}{c}\frac{\partial E_x}{\partial t'}=\frac{\partial}{\partial y'}\left[\beta\left(B_z-\frac{V}{c}E_y\right)\right]-\frac{\partial}{\partial z'}\left[\beta\left(B_y+\frac{V}{c}E_z\right)\right] \tag{21}$$

Substituting Eq.(20) in Eq.(16) and arrangement the formula, the result is

$$-\frac{1}{c}\frac{\partial B_x}{\partial t'}=\frac{\partial}{\partial y'}\left[\beta\left(E_z+\frac{V}{c}B_y\right)\right]-\frac{\partial}{\partial z'}\left[\beta\left(E_y-\frac{V}{c}B_z\right)\right] \tag{22}$$

Eqs.(14), (15), (17) and (18) can be written as

$$\frac{1}{c}\frac{\partial}{\partial t'}\left[\beta\left(E_y-\frac{V}{c}B_z\right)\right]=\frac{\partial B_x}{\partial z'}-\frac{\partial}{\partial x'}\left[\beta\left(B_z-\frac{V}{c}E_y\right)\right] \tag{23}$$

$$\frac{1}{c}\frac{\partial}{\partial t'}\left[\beta\left(E_z+\frac{V}{c}B_y\right)\right]=\frac{\partial}{\partial x'}\left[\beta\left(B_y+\frac{V}{c}E_z\right)\right]-\frac{\partial B_x}{\partial y'} \tag{24}$$

$$-\frac{1}{c}\frac{\partial}{\partial t'}\left[\beta\left(B_y+\frac{V}{c}E_z\right)\right]=\frac{\partial E_x}{\partial z'}-\frac{\partial}{\partial x'}\left[\beta\left(E_z+\frac{V}{c}E_y\right)\right] \tag{25}$$

$$-\frac{1}{c}\frac{\partial}{\partial t'}\left[\beta\left(B_z-\frac{V}{c}E_y\right)\right]=\frac{\partial}{\partial x'}\left[\beta\left(E_y-\frac{V}{c}B_z\right)\right]-\frac{\partial E_x}{\partial y'} \tag{26}$$

On the other hand, according the principle of relativity, Einstein thought that the forms of the motion equations of electromagnetic fields should be the same at another initial reference frame K' with [3]

$$\frac{\partial E'_x}{\partial x'}+\frac{\partial E'_y}{\partial y'}+\frac{\partial E'_z}{\partial z'}=0 \qquad \frac{\partial B'_x}{\partial x'}+\frac{\partial B'_y}{\partial y'}+\frac{\partial B'_z}{\partial z'}=0 \tag{27}$$

$$\frac{1}{c}\frac{\partial E'_x}{\partial t'}=\frac{\partial B'_z}{\partial y'}-\frac{\partial B'_y}{\partial z'} \qquad \frac{1}{c}\frac{\partial E'_y}{\partial t'}=\frac{\partial B'_x}{\partial z'}-\frac{\partial B'_z}{\partial x'} \qquad \frac{1}{c}\frac{\partial E'_z}{\partial t'}=\frac{\partial B'_y}{\partial x'}-\frac{\partial B'_x}{\partial y'}$$

$$-\frac{1}{c}\frac{\partial B'_x}{\partial t'}=\frac{\partial E'_z}{\partial y'}-\frac{\partial E'_y}{\partial z'} \qquad -\frac{1}{c}\frac{\partial B'_y}{\partial t'}=\frac{\partial E'_x}{\partial z'}-\frac{\partial E'_z}{\partial x'} \qquad -\frac{1}{c}\frac{\partial B'_z}{\partial t'}=\frac{\partial E'_y}{\partial x'}-\frac{\partial E'_x}{\partial y'} \tag{28}$$

Comparing Eqs.(21) ~ (26) with Eq.(28), Einstein obtained (A. Einstein, 1905)

$$E'_x(x')=E_x(x) \qquad E'_y(x')=\beta\left(E_y(x)-\frac{V}{c}B_z(x)\right)$$

$$E'_z(x')=\beta\left(E_z(x)+\frac{V}{c}B_y(x)\right) \qquad B'_x(x')=B_x(x)$$

$$B'_y(x')=\beta\left(B_y(x)+\frac{V}{c}E_z(x)\right) \qquad B'_z(x')=\beta\left(B_z(x)-\frac{V}{c}E_y(x)\right) \tag{29}$$

Eq.(29) can be called the Einstein's transformations of electromagnetic fields, which did not come from the original Maxwell's electromagnetic theory, but artificially introduced by Einstein in order to make the classical electromagnetic field equations unchanged under the Lorentz coordinate transformation.

2.2 The Proof That the Einstein's Transformations of Electromagnetic Fields Do Not Hold

The transformation formulas (29) are often used in modern electromagnetic theory, but they are not true. Because they are different from both the Galilean transformations and the Lorentz transformations of electromagnetic fields themself. There is no any experiment to support them. Let's take the electromagnetic fields generated by the linear motion of a charged particle as an example (Mei Xiaochun, 2015).

As shown in Fig.1, suppose that a particle with a charge q moves in vacuum at a uniform speed $u>V$ along the positive direction of the x axis in the reference frame K. Relative to the reference frame K', the particle moves with speed u' along the x' axis. Suppose that the origins of two reference frames coincide at the initial moment $t=t'=0$, and the particle arrives at the point $x_0=b=ut$ and $y_0=z_0=0$ in the reference frame K at moment t, we have $r=\sqrt{(x-ut)^2+y^2+z^2}$.

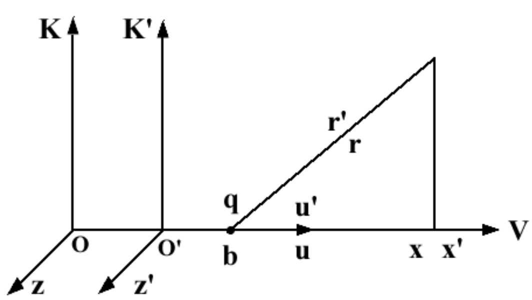

Figure 1. The Einstein's transformations of electromagnetic fields for a changed particle moving at a uniform speed along the x axis in vacuum

Using the Gaussian system, the electromagnetic field intensities generated by the moving particle at the point r in the reference frame K are

$$E_x = \frac{q(x-ut)}{r^3} \qquad E_y = \frac{qy}{r^3} \qquad E_z = \frac{qz}{r^3}$$

$$B_x = 0 \qquad B_y = -\frac{quz}{cr^3} \qquad B_z = \frac{quy}{cr^3} \tag{30}$$

According to the Einstein's transformation formula (29), the intensities of electromagnetic fields in the reference frame K' are

$$E'_x = \frac{q(x-ut)}{r^3} \qquad E'_y = \frac{q\beta(1-uV/c^2)}{r^3} \qquad E'_z = \frac{q\beta(1-uV/c^2)}{r^3}$$

$$B'_x = 0 \qquad B'_y = -\frac{q\beta(u-V)z}{cr^3} \qquad B'_z = \frac{q\beta(u-V)y}{cr^3} \tag{31}$$

The right side of Eq.(31) is still represented by the coordinates of reference frame K. If representing it by the coordinates of reference frame K', we need to take into account the transformations of coordinates and velocities. The Lorentz velocity transformation formula is

$$u = \frac{u'+V}{1+u'V/c^2} \tag{32}$$

We have

$$1-\frac{uV}{c^2} = \frac{1-V^2/c^2}{1+u'V/c^2} \qquad x-ut = \frac{(x'-u't')}{\beta(1+u'V/c^2)} \tag{33}$$

The Lorentz transformation of coordinate r can be written as

$$r \to R' = \sqrt{\beta^2(x'-u't')^2 + y'^2 + z'^2} \tag{34}$$

Substituting Eqs.(33) and (34) in Eq.(31) we get

$$E'_x = \frac{q(x'-u't')}{\beta(1+u'V/c^2)R'^3} \qquad E'_y = \frac{qy'}{\beta(1+u'V/c^2)R'^3}$$

$$E'_z = \frac{qz'}{\beta(1+u'V/c^2)^2 R'^3} \qquad B'_x = 0$$

$$B'_y = -\frac{qu'z'}{c\beta(1+u'V/c^2)R'^3} \qquad B'_z = \frac{qu'y'}{c\beta(1+u'V/c^2)R'^3} \tag{35}$$

On the other hand, considering that the electromagnetic fields are also the functions of space-time coordinates, and by considering the Lorentz transformation of electromagnetic fields intensities (expressed by subscript L), the quantities on the right of Eq.(30) are transformed to that in the reference frame K', the result are

$$E'_{Lx} = \frac{q(x'-u't')}{\beta(1+u'V/c^2)R'^3} \qquad E'_{Ly} = \frac{qy'}{R'^3} \qquad E'_{Lz} = \frac{qz'}{R'^3}$$

$$B'_{Lx} = 0 \qquad B'_{Ly} = -\frac{q(u'+V)z'}{c(1+u'V/c^2)R'^3} \qquad B'_{Lz} = \frac{q(u'+V)y'}{c(1+u'V/c^2)R'^3} \tag{36}$$

The components of electromagnetic fields along the x axis are the same in Eqs.(36) and (35), but the components along the y and z axes are obviously different, which leads to contradiction.

If the Galilean transformation of space-time coordinates are considered, Ee.(30) becomes

$$E'_{Gx} = \frac{q(x'-u't')}{r'^3} \qquad E'_{Gy} = \frac{qy'}{r'^3} \qquad E'_{Gz} = \frac{qz'}{r'^3}$$
$$B'_{Gx} = 0 \qquad B'_{Gy} = -\frac{q(u'+V)z'}{cr'^3} \qquad B_{Gz} = \frac{q(u'+V)y'}{cr'^3} \tag{37}$$

The result is also different from Eq.(35). So Einstein's relativistic transformation of electromagnetic field must be wrong.

2.3 The Lorentz Transformation of Non-free Electromagnetic Fields

The Einstein transform expressed by Eq.(29) only describers the free electromagnetic field in a vacuum without charge and current. If there are charge and current distribution in space, the Maxwell's equations of electromagnetic fields are written as

$$\nabla\cdot\vec{E} = 4\pi\rho \qquad \nabla\cdot\vec{B} = 0$$
$$\frac{1}{c}\frac{\partial}{\partial t}\vec{E} = \nabla\times\vec{B} - \frac{4\pi}{c}\vec{j} \qquad -\frac{1}{c}\frac{\partial}{\partial t}\vec{B} = \nabla\times\vec{E} \tag{38}$$

By considering the transformation formulas of operators, Eq.(19) becomes

$$\frac{\partial E_x}{\partial x'} = \frac{V}{c^2}\frac{\partial E_x}{\partial t'} - \frac{1}{\beta}\frac{\partial E_y}{\partial y'} - \frac{1}{\beta}\frac{\partial E_z}{\partial z'} + 4\pi\rho \tag{39}$$

Substituting Eq.(39) in Eq.(13), we get

$$\frac{1}{c}\frac{\partial E_x}{\partial t'} = \frac{\partial}{\partial y'}\left[\beta\left(B_z - \frac{V}{c}E_y\right)\right] - \frac{\partial}{\partial z'}\left[\beta\left(B_y + \frac{V}{c}E_z\right)\right] - \frac{4\pi j_x}{c} - \frac{4\pi\rho V\beta^2}{c} \tag{40}$$

According to the relativity principle, the form of electromagnetic field equation is unchanged under the Lorentz transformation. So according to Eq.(38), the x component of motion equation in the K' reference frame should be

$$\frac{1}{c}\frac{\partial E'_x}{\partial t'} = \frac{\partial B'_z}{\partial y'} - \frac{\partial B'_y}{\partial z'} - \frac{4\pi j'_x}{c} \tag{41}$$

Where the Lorentz transformation of current $j_x = \rho u_x$ is

$$j'_x = \rho' u'_x = \frac{\rho'(u_x - V)}{1 - u_x V / c^2} \tag{42}$$

Charge ρ' is the Lorentz transformation of ρ. According to the Einstein's transformation of Eq.(29), Eq.(40) should be written as

$$\frac{1}{c}\frac{\partial E'_x}{\partial t'} = \frac{\partial B'_z}{\partial y'} - \frac{\partial B'_y}{\partial z'} - \frac{4\pi j'_x}{c} - \frac{4\pi J'_x}{c} \tag{43}$$

Compared with Eq.(41), there is an additional current density on the right side of formula (43)

$$J'_x = \rho' V\beta^2 = \frac{\rho' V}{(1 - V^2/c^2)} \tag{44}$$

It is caused by the Einstein's transformation of electromagnetic fields. When the speed of reference frame $V \to c$, it leads $J'_x \to \infty$, seriously deviates from the original equation of motion. So the equations of non-free classical electromagnetic field cannot remain unchanged under the Lorentz transformation if the Einstein transformations of electromagnetic fields are considered.

2.4 The Lorentz Transformation of Four-dimensional Magnetic Potentials

The motion equations of electromagnetic fields can be expressed by the forms of four-dimensional electromagnetic potentials $A_\mu = (\vec{A}, i\varphi)$, the obtained formulas are (Cao Canqi, 1961)

$$\nabla^2 \vec{A} - \frac{1}{c^2}\frac{\partial^2}{\partial t^2}\vec{A} - \nabla\left(\nabla \cdot \vec{A} + \frac{1}{c}\frac{\partial \varphi}{\partial t}\right) = -\frac{4\pi}{c}\vec{j}$$

$$\nabla^2 \varphi - \frac{1}{c^2}\frac{\partial^2}{\partial t^2}\varphi + \frac{1}{c}\frac{\partial}{\partial t}\left(\nabla \cdot \vec{A} + \frac{\partial}{\partial t}\varphi\right) = -\frac{4\pi}{c}\rho \tag{45}$$

Bu introducing the Lorentz condition of electromagnetic potentials

$$\nabla \cdot \vec{A} + \frac{1}{c}\frac{\partial}{\partial t}\varphi = 0 \tag{46}$$

Eq.(45) can be briefly written as

$$\partial^2 A_\mu = -\frac{4\pi}{c} j_\mu \tag{47}$$

According to Eq.(10), it can easy be proved

$$\partial^2 = \partial_\nu \partial_\nu = \beta^2\left(\frac{\partial}{\partial x'} - \frac{V}{c^2}\frac{\partial}{\partial t'}\right)^2 + \frac{\partial^2}{\partial y'^2} + \frac{\partial^2}{\partial z'^2} - \frac{\beta^2}{c^2}\left(\frac{\partial}{\partial t'} - V\frac{\partial}{\partial x'}\right)^2$$

$$= \frac{\partial^2}{\partial x'^2} + \frac{\partial^2}{\partial y'^2} + \frac{\partial^2}{\partial z'^2} - \frac{1}{c^2}\frac{\partial^2}{\partial^2 t'^2} = \partial'_\nu \partial'_\nu = \partial'^2 \tag{48}$$

Therefore, let $A'_\mu(\vec{x}', t') = A_\mu(\vec{x}, t)$ and $j'_\mu(\vec{x}', t') = j_\mu(\vec{x}, t)$, Eq.(47) is invariable under the Lorentz coordinate transformation. The problem is that, according to Eq.(48), the Lorentz transformation of Eq.(46) is

$$\beta\left[\frac{\partial}{\partial x'} - \frac{V}{c^2}\frac{\partial}{\partial t'}\right]A'_x(\vec{x}', t') + \frac{\partial}{\partial y'}A'_y(\vec{x}', t')$$

$$+\frac{\partial}{\partial z'}A'_x(\vec{x}', t') + \frac{\beta}{c}\left[\frac{\partial}{\partial t'} - V\frac{\partial}{\partial x'}\right]\varphi'(\vec{x}', t) = 0 \tag{49}$$

The form of Eq.(49) is different from Eq.(46), so the Lorentz condition of electromagnetic potential has no the invariance of Lorentz transformation, and the Maxwell electromagnetic field equations (45) expressed by the four-dimensional electromagnetic potentials still do not satisfy the invariance of Lorentz transformation.

This problem is never discussed in the existing literature and textbooks of special relativity. In fact, electromagnetic potentials are physical quantities that cannot be directly measured. In practical application, it needs to be converted into electromagnetic field intensity. Therefore, the theory of electromagnetism, expressed in terms of four-dimensional magnetic potential, has no relativity too.

2.5 Electromagnetic Theory in Medium Has no the Invariance of Lorentz Transformation

For the electromagnetic theory in medium, the constitutive equations need to be considered with (Cao Canqi, 1961).

$$\vec{D}' = \varepsilon\vec{E} = \varepsilon_0\vec{E} + \vec{P} \qquad \vec{B} = \mu\vec{H} = \mu_0(\vec{H} + \vec{M}) \tag{50}$$

However, physicists all know that the constitutive equations do not satisfy the invariance of Lorentz transformation, that is to say, the electromagnetic field equations in medium naturally violate the principle of special relativity.

2.6 Micro-physical Processes Have no Relativity

Since the classical macro-electromagnetic field motion equations have no relativity, the most important foundation for Einstein's special relativity do not exist. Unfortunately, physicists after Einstein did not pay attention to this problem, and had always regarded the invariance of Lorentz transformation of classical electromagnetic field motion equation as the most important theoretical basis to show the validity of Einstein's special relativity.

It is well known that there are four kinds of interactions in current physics, and the macro-physical processes are mainly dominated by electromagnetic interactions and gravitational interactions. In fact, the process of gravitational interaction cannot satisfy the invariance of Lorentz transformation too. Because the principle of special relativity is not valid, the principle general relativity is also impossible. Macroscopic physical processes have no relativity.

In practical physics processes, relativity leads to an infinite number of space-time paradoxes. Relativity has caused great controversy for a hundred years, and there have been too many papers discussing these issues. The author will analyze them in another paper.

2.7 Micro-physical Processes Have the Invariance of Lorentz Transformation

In addition, Mei Xiaochun published a paper in Journal of Modern Physics in 2015 to prove that the interaction processes of micro-physics also violate the principle of relativity (Mei Xiaochun, 2014).

For example, the Schrodinger equation of quantum mechanics used to describe the bound state microscopic particles, the Dirac equation to describe the non-free state microscopic particles, the formula used to calculate the decay probability and collision cross section of particle in quantum field theory, the propagation function used to describe the spinor field of Compton scattering, and the higher-order perturbation re-normalization process of quantum field theory, all of them have no the invariance of Lorentz transformation.

As for the so-called relativistic Dirac equation of quantum mechanics, it is actually the equation constructed by combining the mass-velocity formula and the mass-energy relation into a formula, then using the momentum operator and energy operator of quantum mechanics to represent momentum and energy. By considering the mass-velocity formula, the momentum and energy of a particle can be written as (Zhang Yongli, 1961)

$$p_x = \frac{m_0 u_x}{\sqrt{1-u^2/c^2}} \qquad p_y = \frac{m_0 u_y}{\sqrt{1-u^2/c^2}} \qquad p_z = \frac{m_0 u_z}{\sqrt{1-u^2/c^2}} \qquad E = \frac{m_0 c^2}{\sqrt{1-u^2/c^2}} \tag{51}$$

It can be obtained from Eq.(51)

$$E^2 = p^2c^2 + m_0^2c^4 \qquad E = \sqrt{p^2c^2 + m_0^2c^4} \tag{52}$$

By introducing the four-dimensional matrix $\vec{\alpha}$ and β, Dirac assumed (Zhou Shixun, 1961)

$$E = \sqrt{p^2c^2 + m_0^2c^4} \sim c\vec{\alpha}\cdot\vec{p} + \beta m_0 c^2 \tag{53}$$

According to the corresponding relation of quantum mechanics, the Dirac equations of a free particle are

$$(E - c\vec{\alpha}\cdot\vec{p} - \beta m_0 c^2)\psi = 0 \tag{54}$$

$$(i\hbar\frac{\partial}{\partial t} + i\hbar c\vec{\alpha}\cdot\nabla - \beta m_0 c^2)\psi = 0 \tag{55}$$

If electromagnetic interaction is considered, the Dirac equation of non-free particle is written as

$$\left[E+e\varphi-\vec{\alpha}\cdot(c\vec{p}+e\vec{A})-\beta m_0c^2\right]\psi=0 \tag{56}$$

In the quantum theory of field, Eq.(56) is used to calculate the hyperfine structure of hydrogen atom energy level with the accuracy of 10^{-12} in agreement with the experiments. This result is considered the most successful and important application of special relativity in micro-physics.

However, the truth is that since the mass-velocity formula and the mass-energy relation have no relation to relativity, the Dirac equation of free particle has virtually no relation to special relativity. Considering the existence of electromagnetic potential $(\vec{A},i\varphi)$, Eq.(56) does not actually satisfy the invariance of the Lorentz transformation. Therefore, the hyperfine structure's calculation of hydrogen atom can only be considered as a success of quantum field theory, and has virtually nothing to do with special relativity.

In macro-physics, relativity leads to infinite numbers of space-time paradoxes. Special relativity has caused great controversy for a hundred years about these problems, there are too many documents on these issues. The author will discuss this issue in another paper. So, the principle of special relativity does not work in either macro-world and micro-world.

Einstein falsified the Einstein's transformation of electromagnetic fields themselves to prove that the motion equation of electromagnetic field satisfied the relativity principle. This led physics and the thinking way of human into a completely wrong model, causing great confusions. The trend of relativism became popular in the world for more than a hundred years. Now it is time for a reckoning

3. Mistakes in the Derivations of Transverse Mass and Longitudinal Mass

3.1 Einstein's Derivations on Transverse Mass and Longitudinal Mass

Einstein assumed that there was a particle with charge q (using ε in original paper) and static mass m_0 (using μ in original paper). In the reference frame K', the particle was at the origin $x'=y'=z'=0$ (using τ, ξ, η, ζ in original paper) at initial time $t'=0$. Under the action of electric field, the motion equations of particle in K' were (A. Einstein, 1905)

$$m_0\frac{d^2x'}{dt'^2}=qE'_x \qquad m_0\frac{d^2y'}{dt'^2}=qE'_y \qquad m_0\frac{d^2z'}{dt'^2}=qE'_z \tag{57}$$

Assume that the relative velocity was V for two reference frames K' and K, and the particle was at the origin $x=y=z=0$ of reference frame K at initial time $t=0$. According to the Lorentz transformation formula (9) and substituting Eq.(29) in Eq.(57), the motion equation of charged particle in the reference frame K was

$$m_0\frac{d^2x}{dt^2}=\frac{q}{\beta^3}E_x \tag{58}$$

$$m_0\frac{d^2y}{dt^2}=\frac{q}{\beta}\left(E_y-\frac{V}{c}B_z\right) \tag{59}$$

$$m_0\frac{d^2z}{dt^2}=\frac{q}{\beta}\left(E_z+\frac{V}{c}B_y\right) \tag{60}$$

Einstein re-wrote Eqs.(58), (59) and (60) as

$$m_0\beta^3\frac{d^2x}{dt^2}=qE_x=qE'_x \tag{61}$$

$$m_0\beta^2\frac{d^2y}{dt^2}=q\beta\left(E_y-\frac{V}{c}B_z\right)=qE'_y \tag{62}$$

$$m_0\beta^2\frac{d^2z}{dt^2}=q\beta\left(E_z+\frac{V}{c}B_y\right)=qE'_y \tag{63}$$

Then Einstein said that the first thing to notice was that there was a force component $qE'_x,\ qE'_y,\ qE'_z$ acting on the electron looking from a coordinate system that was moving at the same speed with the electron. If you simply called this value as force on the electron, and you kept the equation like following

$$mass \times acceleration = force$$

And it was specified that acceleration must be measured in a stationary reference frame K. From the right sides of Eqs.(61), (62) and (63), longitudinal mass and transverse mass were derived (A. Einstein,1905)

$$m_L = m_0\beta^3 = \frac{m_0}{(1-V^2/c^2)^{3/2}} \qquad m_T = m_0\beta^2 = \frac{m_0}{1-V^2/c^2} \tag{64}$$

We will prove below that the Einstein's calculations of formulas (58) ~ (64) are wrong.

3.2 The Mistakes of Einstein's Calculations

There are five mistakes in the Einstein's calculations.

1) Eq.(57) is the basic formula of Einstein's calculations. However, this is the formula of Newtonian mechanics. It assumes that the stationary mass of a charged particle is m_0 when it is at rest. However, due to the existence of electromagnetic force, Eq.(57) is the formula in general case which does not only describe the initial state, but also for whole process, for the charged particle will be accelerated by the force and begin to move. Even if the particle is at rest at the initial moment, it will obtain velocity later. Therefore, the mass of particle in Eq.(57), should be written as $m(u)$, instead of m_0.

2) Eq.(57) describes the motion equations in the reference frame K'. Considering that the electric field is not equal to zero in the three directions of space, the particle is accelerated under the action of electric field force with the velocities $u_x = dx/dt$, $u_y = dy/dt$ and $u_z = dz/dt$. According to the Lorentz coordinate transformation formula, they can be written:

$$dx' = \beta(dx - Vdt) = \beta(u_x - V)dt \qquad dy' = d \qquad dz' = d$$

$$dt' = \beta\left(dt - \frac{V}{c^2}dx\right) = \beta\left(1 - \frac{u_xV}{c^2}\right)dt \tag{65}$$

The Lorentz velocity transformation are obtained based on Eq.(65)

$$u'_x = \frac{dx'}{dt'} = \frac{u_x - V}{1 - u_xV/c^2} \qquad u'_y = \frac{dy'}{dt'} = \frac{u_y}{\beta(1 - u_xV/c^2)}$$

$$u'_z = \frac{dz'}{dt'} = \frac{u_z}{\beta(1 - u_xV/c^2)} \tag{66}$$

Using the formulas above, we get

$$\frac{d^2x'}{dt'^2} = \frac{du'_x}{dt'} = \frac{1}{\beta(1-u_xV/c^2)}\frac{d}{dt}\frac{u_x - V}{1-u_xV/c^2}$$

$$= \frac{(1-V^2/c^2)}{\beta(1-u_xV/c^2)^3}\frac{du_x}{dt} = \frac{1}{\beta^3(1-u_xV/c^2)^3}\frac{d^2x}{dt^2} \tag{67}$$

$$\frac{d^2y'}{dt'^2}=\frac{du'_y}{dt'}=\frac{1}{\beta^2(1-u_xV/c^2)}\frac{d}{dt}\frac{u_y}{1-u_xV/c^2}$$

$$=\frac{1}{\beta^2(1-u_xV/c^2)^3}\left[\left(1-\frac{u_xV}{c^2}\right)\frac{d^2y}{dt^2}+\frac{u_yV}{c^2}\frac{d^2x}{dt^2}\right] \tag{68}$$

$$\frac{d^2z'}{dt'^2}=\frac{du'_z}{dt'}=\frac{1}{\beta^2(1-u_xV/c^2)}\frac{d}{dt}\frac{u_z}{1-u_xV/c^2}$$

$$=\frac{1}{\beta^2(1-u_xV/c^2)^3}\left[\left(1-\frac{u_xV}{c^2}\right)\frac{d^2z}{dt^2}+\frac{u_zV}{c^2}\frac{d^2x}{dt^2}\right] \tag{69}$$

Substituting Eqs.(29), (67), (68) and (69) in the two sides of Eq.(57), we obtain

$$\frac{m_0}{\beta^3(1-u_xV/c^2)^3}\frac{d^2x}{dt^2}=qE_x \tag{70}$$

$$\frac{m_0}{\beta^2(1-u_xV/c^2)^3}\left[\left(1-\frac{u_xV}{c^2}\right)\frac{d^2y}{dt^2}+\frac{u_yV}{c^2}\frac{d^2x}{dt^2}\right]=q\beta\left(E_y-\frac{V}{c}B_z\right) \tag{71}$$

$$\frac{m_0}{\beta^2(1-u_xV/c^2)^3}\left[\left(1-\frac{u_xV}{c^2}\right)\frac{d^2z}{dt^2}+\frac{u_zV}{c^2}\frac{d^2x}{dt^2}\right]=q\beta\left(E_z+\frac{V}{c}B_y\right) \tag{72}$$

From Eqs.(70), (71) and (72), it can be seen that even let $u_x=u_y=u_z=0$, we still have

$$\frac{m_0}{\beta^3}\frac{d^2x}{dt^2}=qE_x \tag{73}$$

$$\frac{m_0}{\beta^2}\frac{d^2y}{dt^2}=q\beta\left(E_y-\frac{V}{c}B_z\right) \tag{74}$$

$$\frac{m_0}{\beta^2}\frac{d^2z}{dt^2}=q\beta\left(E_z+\frac{V}{c}B_y\right) \tag{75}$$

Comparing Eq.(73), (74) and (75) with Eqs.(61), (62) and (63), we see that Einstein used the wrong factors $1/\beta$ to replace the correct factor β. The effect of this mistake on the velocity-mass formula is great.

Besides, due to $u_x\neq 0, u_y\neq 0$ and $u_z\neq 0$ in general, Eqs.(58), (59) and (60) cannot be correct. Not only was Einstein's calculation a primary mathematical mistake, but was also a principal mistake in physics. He treated the relative velocity V of two reference frames as the velocity $\vec{u}$ of a particle. In fact, if $u_x=u_y=u_z=0$, we have $d\vec{u}/dt=d^2\vec{x}/dt^2=0$, all Eqs.(67) ~ (75) become meaningless.

3) Because electron moves in an electromagnetic field, it is impossible to have $u_x=u_y=u_z=0$. In this case, Eq.(43) should be written as

$$\frac{m_0}{\beta^2(1-u_xV/c^2)^3}\frac{d^2x}{dt^2}=q\beta E_x \tag{76}$$

Substituting Eq.(76) in Eqs.(71) and (72), we get

$$\frac{m_0}{\beta^2(1-u_xV/c^2)^2}\frac{d^2y}{dt^2}=q\beta\left[E_y-\frac{V}{c}\left(B_z+\frac{u_y}{c}E_x\right)\right] \tag{77}$$

$$\frac{m_0}{\beta^2(1-u_xV/c^2)^2}\frac{d^2z}{dt^2}=q\beta\left[E_z+\frac{V}{c}\left(B_y-\frac{u_z}{c}E_x\right)\right] \tag{78}$$

The right sides of Eqs.(77) and (78) are not what defined by Einstein in Eq.(29) to describe the transformation of electromagnetic fields.

4) Even let $u_x=u_y=u_z=0$, based on Eqs.(73), (74) and (75), and according to Einstein's understanding on longitudinal mass and transversal mass, we also have

$$m_L=\frac{m_0}{\beta^3}=m_0\left(1-\frac{V^2}{c^2}\right)^{3/2} \tag{79}$$

$$m_T=\frac{m_0}{\beta^2}=m_0\left(1-\frac{V^2}{c^2}\right) \tag{80}$$

Eqs.(79) and (80) are completely different from Einstein's formulas (1) and (2).

5) If considering Eqs.(76), (77) and (78), but does consider the definition of Eq. (29), the transverse and longitudinal mass should be

$$m_L=\frac{m_0}{\beta^3(1-u_xV/c^2)^3}=\frac{m_0(1-V^2/c^2)^{3/2}}{(1-u_xV/c^2)^3} \tag{81}$$

$$m_T=\frac{m_0}{\beta^2(1-u_xV/c^2)^3}=\frac{m_0(1-V^2/c^2)}{(1-u_xV/c^2)^3} \tag{82}$$

The formulas (81) and (82) have greater differences comparing with the formulas (1) and (2), so the transverse mass and the longitudinal mass derived in Einstein's original paper in 1905 were completely wrong.

4. The Mistakes in the Derivation of Mass-energy Relation

4.1 Einstein's Derivation on Mass-energy Relation

Einstein derived the mass-energy relation based on Eq.(58) in his original paper in 1905. The derivation was very simple. The right side of formula (58) is the force acted on the charged particle in the electric field. Under the action of this force, the work W was done, resulting in the increase of the kinetic energy ΔT of particle. Einstein deduced the famous formula of mass-energy for a particle with static mass m_0

$$W=\Delta T=\int qE_xdx=m_0\int_0^V\beta^3VdV=m_0c^2\left(\frac{1}{\sqrt{1-V^2/c^2}}-1\right) \tag{83}$$

In order to see Einstein's calculation error, we need to go back to the details and write out the derivation explicitly. Let $u=dx/dt$ be the velocity of particle along the x axis, according to Eq.(58), the work done by electric field is

$$W=\Delta T=\int qE_xdx=m_0\int\beta^3\frac{d^2x}{dt^2}dx=m_0\int\beta^3\frac{du}{dt}dx$$

$$=m_0\int\beta^3\frac{du}{dt}dx=m_0\int\beta^3\frac{du}{dx}\frac{dx}{dt}dx$$

$$= m_0 \int \beta^3 u \frac{du}{dx} dx = m_0 \int_0^V \frac{1}{(1-u^2/c^2)^{3/2}} u du$$

$$= m_0 c^2 \left(\frac{1}{\sqrt{1-V^2/c^2}} - 1 \right) \tag{84}$$

4.2 The Mistakes in Einstein's Derivation

There are following mistakes in the Einstein's derivation of mass-energy relation.

1) Treat relative velocity V (an invariable) as arbitrary velocity u (a variable)

According to the definition of Eq.(7), V in β is the uniform relative velocity between two reference frames which does not change with time. In Eq.(84), the particle's velocity $u = dx/dt$ is a variable, so we have $u \neq V$. However, Einstein let $u = V$ so that Eq.(84) cannot hold. According to the correct calculation, the result should be

$$W = \Delta T = \int qE_x dx = m_0 \beta^3 \int \frac{du_x}{dt} dx = m_0 \beta^3 \int u_x \frac{du_x}{dx} dx$$

$$= \frac{m_0}{(1-V^2/c^2)^{3/2}} \int_0^u u_x du_x = \frac{m_0 u^2}{2(1-V^2/c^2)^{3/2}} \tag{85}$$

Eq.(85) is completely different from Eq.(64) and is not the mass-energy relation of special relativity.

2) The mistake to take β as $1/\beta$

As mentioned before, the term β in Einstein's original formula (58) is actually $1/\beta$. According to Eq. (84), even we do not consider the problem $u \neq V$, the result should be

$$W = \Delta T = \int_0^V qE_x dx = m_0 \int_0^V \beta^{-3} \frac{du}{dt} dx$$

$$= m_0 \int_0^V \left(1 - \frac{u^2}{c^2}\right)^{3/2} u du = \frac{m_0 c^2}{5} \left[1 - \left(1 - \frac{V^2}{c^2}\right)^{5/2} \right] \tag{86}$$

Eq.(86) is not the mass-energy relation of special relativity.

3) Ignoring the forces acted on the direction of the y and z axis

In the calculation of Eq.(84), Einstein ignored the work done by the forces acted on the direction of the y and z axis, the result cannot be correct. In order to calculate the work done by a force along the y and z axes, it is necessary to repeat the standard derivation of the mass-energy relationship of special relativity. According to the mass-velocity formula (3), by considering $d\vec{l} = \vec{u} dt$, the work done should be written as

$$dT = \vec{F} \cdot d\vec{l} = \left(\frac{d}{dt} \frac{m_0 \vec{u}}{\sqrt{1-u^2/c^2}} \right) \cdot \vec{u} dt \tag{87}$$

Due to

$$\vec{u} \cdot \left(\frac{d}{dt} \frac{\vec{u}}{\sqrt{1-u^2/c^2}} \right) = \vec{u} \cdot \vec{u} \left(\frac{d}{dt} \frac{1}{\sqrt{1-u^2/c^2}} \right) + \frac{1}{\sqrt{1-u^2/c^2}} \vec{u} \cdot d\vec{u}$$

$$= \frac{u^2/c^2}{(1-u^2/c^2)^{3/2}} u \frac{du}{dt} + \frac{1}{\sqrt{1-u^2/c^2}} \vec{u} \cdot d\vec{u}$$

$$=\left[\frac{u^2/c^2}{(1-u^2/c^2)^{3/2}}+\frac{1}{\sqrt{1-u^2/c^2}}\right]\vec{u}\cdot d\vec{u}$$

$$=\frac{1}{(1-u^2/c^2)^{3/2}}\vec{u}\cdot d\vec{u}=\frac{d}{dt}\frac{1}{\sqrt{1-u^2/c^2}} \tag{88}$$

Eq.(87) can be written as

$$dT=\frac{d}{dt}\frac{m_0c^2}{\sqrt{1-u^2/c^2}} \tag{89}$$

Taking the integral of Eq.(69), we have

$$\Delta T=\int_0^u\frac{d}{dt}\frac{m_0c^2}{\sqrt{1-u'^2/c^2}}dt=\int_0^u d\frac{m_0c^2}{\sqrt{1-u'^2/c^2}}=m_0c^2\left[\frac{1}{\sqrt{1-u^2/c^2}}-1\right] \tag{90}$$

Therefore, even in accordance with Einstein's original calculation method, taking into account the forces on the directions of y and z axes, Eq.(84) should be changed to

$$W=\int_0^V\vec{F}\cdot d\vec{l}=m_0\int_0^V\left[\beta^3\frac{d^2x}{dt^2}dx+\beta^2\frac{d^2y}{dt^2}dy+\beta^2\frac{d^2z}{dt^2}dz\right]$$

$$=m_0\int_0^V(\beta^3u_xdu_x+\beta^2u_ydu_y+\beta^2u_zdu_z)$$

$$=m_0\int_0^V\left[\frac{u_xdu_x}{(1-u^2/c^2)^{3/2}}+\frac{u_ydu_y}{(1-u^2/c^2)}+\frac{u_zdu_z}{(1-u^2/c^2)}\right] \tag{91}$$

The integral of Eq.(91) is hard, we cannot obtain Eq.(84) from it.

4) The calculation results in general cases

Considering general situations and calculating the mass-energy relation according to Einstein's method, Eqs.(70), (72) and (57) should be used simultaneously, the result is

$$W=\int_0^V\vec{F}\cdot d\vec{l}=m_0\int_0^V\left[\frac{1}{\beta^3(1-u_xV/c^2)^3}\frac{d^2x}{dt^2}dx\right.$$

$$\left.+\frac{1}{\beta^2(1-u_xV/c^2)^3}\frac{d^2y}{dt^2}dy+\frac{1}{\beta^2(1-u_xV/c^2)^3}\frac{d^2z}{dt^2}dz\right]$$

$$=m_0\int_0^u\left[\frac{u_xdu_x}{\beta^3(1-u_xV/c^2)^3}+\frac{u_ydu_y}{\beta^2(1-u_xV/c^2)^3}+\frac{u_ydu_y}{\beta^2(1-u_xV/c^2)^3}\right] \tag{92}$$

This is a more difficult integral, and we cannot obtain the mass-energy relation of Eq.(84) based on it.

5. Conclusions

Einstein published his famous paper “On the Electrodynamics of Moving Bodies” in 1905, putting forward the principle of special relativity and the invariance principle of light’s speed, deducing the Lorentz coordinate transformation formula, the formula of mass-velocity formula and the mass-energy relation, which were considered to be the foundations of modern physics.

Einstein made the relativity explanation for the Lorentz coordinate transformation, so that time, space and motion become the concepts of relativity. These concepts caused an endless series of logical paradoxes and all sorts of bizarre physical fantasies that physicists have debated for more than a century. A great number of physicists, including Michelson, Lorentz, Poincare and Maher, who were considered the pioneers of relativity, were reluctant to accept the Einstein's theory of relativity.

On the other hand, Einstein's special relativity had become the mainstream theory of physics, and deep into gravity theory, quantum theory, astrophysics and cosmology. Its influence even extends beyond physics into the realm of human mental thinking and philosophy. It was regarded as the greatest monument in the abstract scientific world that mankind has built.

It is well known, however, a theory that can be regarded as a scientific truth must not contain internal contradictions. Einstein's special relativity has sharp inherent contradictions, and new contradictions are constantly founded. For a hundred years, although many people have tried to cover up and deny the problems existing in the Einstein's theory of relativity, these contradictions are like a mountain that physicists cannot cross over.

When Michelson designed the Michelson-Morley experiment, he fixed the light source on the absolutely stationary reference frame of the universe, which was inconsistent with the actual experiment and led to the wrong experimental calculation. It was this unremarkable mistake that led to the strange behemoth of special relativity, which like the flap of a butterfly's wings in South America, caused a global and cosmological storm.

In fact, without Michelson's miscalculation, there would be no the Lorentz's coordinate transformation formula, no Einstein's special relativity and general relativity, and no modern cosmology based on general relativity.

Since the Michelson-Morley experiment can be explained by the Galilean velocity transformation, the most important experimental basis for special relativity does not exist, and neither the Lorentz coordinate transformation nor the invariance principle of light's speed are necessary.

Einstein's special relativity is divided into two parts, kinematics and dynamics. The kinematics part mainly discusses the relativity of time, space and motion. The contradictions of special relativity mainly appear in this section. The dynamics section deals with the action of forces, which are not relative and have therefore rarely been doubted in past hundred years. Einstein's theory of relativity is considered a success mainly because of the existence of its kinetic component.

The kinetic part of special relativity is based on the mass-velocity formula. On this basis, the Newton's kinetic equation is modified, and the famous mass-energy relation is deduced, which has been widely used in the field of atomic energy, and thus Einstein has gained the worldwide reputation.

In a dramatic twist, however, Mei Xiaochun and Yuan Canlun proved that it is impossible to derive the mass-velocity formula of special relativity from the Lorentz velocity transformation formula. All the derivations of the mass-velocity formula in special relativity are wrong, artificial, far-fetched products. The formula of mass-velocity can only be regarded as the product of physical experiment and cannot be derived theoretically. Since the mass-energy relation is derived from the mass-velocity formula, this means that the mass-energy relation also has nothing to do with special relativity.

This paper makes a further analysis on the original paper of Einstein in 1905, and points out that there are three serious mistakes, which lead to the invalidity of the principle of special relativity. Einstein's derivations of transverse mass and longitudinal mass as well as the mass-energy relation are all wrong.

In order to prove that the free classical Maxwell electromagnetic field equation satisfied the invariance of Lorentz transformation, Einstein introduced the transformations of electromagnetic fields themselves, called the Einstein's transformation of electromagnetic fields. However, these transformations were completely different from the Lorentz transformation, resulting in contradiction. So, Einstein did not prove that the classical electromagnetic field motion equations had the invariance of Lorentz transformation.

For the classical electromagnetic field equations in non-free space with charge and current, it is proved impossible to have the invariance of Lorentz transformation even if Einstein's electromagnetic field transformations are adopted. An additional current term would be produced to change the motion equations of electromagnetic fields. Besides, it is well known that the constitutive equations of electromagnetic fields in the medium obviously also violates the invariance of the Lorentz transformation.

Therefore, Einstein's 1905 paper did not prove that the classical equations of electromagnetic fields had the invariance of the Lorentz transformation, the most important theoretical and experimental basis for special relativity does not actually exist.

The transverse mass and longitudinal mass which Einstein deduced in his original paper in 1905 are different from the existing mass-velocity formula of special relativity. Einstein's calculations were wrong. When Einstein derived the mass-energy relation, he only calculated the work done by the force in the x axis direction of particle motion, ignoring the work done by the force in the direction of y and z axis. He also misused the constant relative velocities between two reference frames as a variable velocity of particle. It is practically impossible for Einstein to get the mass-velocity formula and mass-energy relation.

Therefore, this paper concludes that Einstein's 1905 paper contained too many fundamental mistakes that made Einstein's special relativity impossible. Einstein did not prove that the classical electromagnetic field equations satisfied the invariance of the Lorentz transformation, nor did he derive the mass-velocity formula, which was regarded as the basis of the dynamics of special relativity, nor did he prove the famous mass-energy relation which was regarded as the basis of modern atomic energy industry. These two formulas have nothing to do with special relativity actually.

So, what about so many experimental verification of special relativity? We had to think that these experiments are either wrong or have other explanations. There are many complicated factors involved in this problem. The author will discuss them in separated papers.

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