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Illusions and Reality of the Special Relativity

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It is shown that the Lorentz transformations change the scale of the units of space and time as a result of the application of the relativistic factor, the use of which ensures the preservation of proportionality when they change. The conclusion is made about the constancy of the course of time in moving systems. It was found that light propagates in space without any connection with the movement of reference frames and radiation sources.These statements are supported by reference to the experiments of Sagnac with a ring interferometer, in which the dependence of the speed of light on the direction of its propagation was demonstrated.It is shown that A.Einstein's formula $E = mc^2$ is an independent law of nature, which is not related to the Lorentz transformations.It is concluded that the slowing down of time, the constancy of the speed of light and the reduction in the size of spatial objects in moving frames of reference are illusions caused by the Lorentz transformations that distort reality.

Key words: *Inertial reference frames, Lorentz transformations, theory of relativity, principle of relativity, speed of light.*

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I. INTRODUCTION

By extending the Galilean principle of relativity to all physical processes, including the speed of propagation of light in inertial systems and determining it to be maximum for the propagation of information, signal and interaction, Albert Einstein became the creator of the special theory of relativity. In his fundamental work [1], he found expressions for the transformation of spatial coordinates and time between inertial systems, performed transformations of the components of the electromagnetic field and used them to describe various physical processes. Investigating the motion of an electron in an electric field, A. Einstein obtained an expression for the kinetic energy of a moving material body, from which his famous formula $E=mc^2$follows. The body mass in this formula is represented by the relativistic expression:

$$m = \mu/\sqrt{1-u^2/c^2}, \qquad (1)$$

where$u$ is the speed of a body in a stationary coordinate system, μ is its rest mass.

As a result, the basis of the theory of relativity was formed by an expression for the relationship between the energy and mass of a body and the transformation of coordinates, which, on the initiative of A. Poincare, began to be called the Lorentz transformations. The Lorentz transformations, as well as the expression for the mass of a moving body, contain the relativistic factor$\beta = 1/\sqrt{1-V^2/c^2}$,in which the symbol V is the speed of the moving frame of reference.

These transformations are a consequence of A. Einstein's assumption that light in a vacuum always propagates with a certain speed relative to a moving radiating body [1]. If we believe the Lorentz transformations, then the presence of the factor β leads to a reduction in the size of spatial objects and a slowdown in the course of time in a moving frame of reference. At the same time, time and space coordinates are not independent components of the world around us, but are mutually dependent and constitute a single four-dimensional physical entity - space-time.

Initially, Einstein's new theory met with rejection even among those scientists who made a certain contribution to its emergence. Poincare did not acknowledgmentit and Lorenz treated her with distrust. Due to the smallness of the speed of material objects in comparison with the speed of light, experimental verification of the slowing down of time and the reduction in the size of objects in moving systems is very difficult. Therefore, the Lorentz transformations have to be taken on faith.It turned out to be easier with the formula $E=mc^2$. The validity of this formula has been confirmed in many studies and its result is widely used in many fields of science and technology. Einstein's formula works in particle accelerators and nuclear power plants.

It was obtained by A. Einstein using the Lorentz transformations. This circumstance is a definite argument in favor of the correctness of the transformations. Nevertheless, there are many skeptics who consider the Lorentz transformations and the theory of relativity in general to be inappropriate to reality.

There are many publications that soundly criticize the theory of relativity. Among the recent are the publications of Jean Slovak [2,3], who wrote a whole book on this problem [4], in the title of which he called the theory of relativity stupidity. However, not everything in the theory of relativity is stupid. Einstein's fundamental formula $E = mc^2$ is not stupid. The purpose of this publication is to show that the validity of this formula is satisfied regardless of the assumption of the constancy of the speed of light and, therefore, is not associated with the Lorentz transformations, which result in the illusion of slowing down the course of time and reducing the size of objects in moving frames of reference.

II. $E=mc^2$isthe law of nature in motionless space

The theory of relativity does not give an exact definition of time. Time is represented in it as a part of four-dimensional space-time, in which spatial coordinates and time are linked by the speeds of moving objects and frames of reference. This relationship is also subject to the postulate of the constancy of the speed of light in frames of reference moving together with the light source. The dependence of the course of time on the movement of the system is demonstrated by illustrative examples in moving systems in which the speed of light is considered constant. Under such assumptions, the concept of the simultaneity of events at spatially distant points loses its meaning.

Further, it will be shown that the idea of the dependence of the course of time on the speed of the system's movement does not correspond to reality. The course of time turns out to be the same in all moving systems. In this case, the assumption made by Einstein about the constancy of the speed of light in inertial systems turns out to be unfounded, and the problem of simultaneity of events in spatially distant places is removed.

In the paper [4] the definition of time as an all-embracing physical process in which movement occurs. The course of the time process is usually normalized by the stationary periodic motion of one of the moving objects, in particular, by the rotation of the Earth around its axis which is a stationary periodic process and does not depend on the motion of other inertial systems.

Next, we will show that Einstein's formula $E=mc^2$is an independent law that is not related to the postulate of the constancy of the speed of light. For this, we will use R. Feynman's method, which he applied in his lectures when deriving a relativistic formula for the dependence of mass on the velocity of an object [5]. He uses only one (fixed) coordinate system and proceeds from the formula $E=mc^2$, considering it valid. It assumes that the mass depends on the speed of the body.

He uses the fact that the energy of the body's movement is the result of the impact on it of force and the path traveled:

$$E=FS$$

He uses the fact that the energy of the body's movement is the result of the impact on it of force and the path traveled:

$$dE/dt = Fu$$

He further uses the fact that force is the time derivative of momentum

$$F=d(mu)/dt$$

After that some transformations are done

$$dmc^2/dt = Fu = ud(mu)/dt$$

$$2mc^2dm/dt = 2mudmu/dt$$

$$c^2dm^2/dt = d(mu)^2/dt$$

And as a result of integration it gets

$$m^2c^2 = m^2u^2+C$$

For $u = 0$, it is natural to assume that the mass is equal to the rest mass $m=\mu$

$$C=\mu^2c^2$$

$$m^2(c^2-u^2) = \mu^2 c^2$$

As a result, he received

$$m=\mu/\sqrt{1-u^2/c^2}$$

Without making any actions to switch to another frame of reference, without using the assumption of the constancy of the speed of light in the IS, being constantly in one stationary frame of reference, R. Feynman from the formula $E=mc^2$received the same expression for the mass that was obtained by A. Einstein using the Lorentz transformations. Note that Einstein's formula also describes energy in motionless space.

We will leave the problem of why different methods of obtaining the formula for the mass led to the same result for the reader.
In addition to the expression for mass, as an intermediate result, Feynman obtained the well-known expression connecting the energy and momentum of a moving body

$$E^2-P^2c^2=\mu^2c^4 \quad (2)$$

Thus, the formula $E=mc^2$ is an independent law of nature, which is not associated with the assumption of the constancy of the speed of light in inertial systems. The relativistic form of the dependence of mass on speed in this formula is the result of the formula itself and the impossibility of an object with mass m having a speed greater than the speed of light in a stationary coordinate system.
Now let's return to the expression for force through the derivative of momentum, in which we use the obtained dependence of mass on the velocity of the body.

$$F=d(mu)/dt = m\cdot du/dt+u\cdot dm/dt$$

After taking the derivative of the mass we obtain

$$F=\mu/(1-u^2/c^2)^{3/2}\, du/dt \quad (3)$$

So, if we use Newton's law of the relationship between force and acceleration $F=m\cdot du/dt = ma$, then the expression for the "longitudinal" mass will look like Einstein's

$$m_{//}= \mu/(1-u^2/c^2)^{3/2} \quad (4)$$

If the force is directed across the direction of the body and its velocity changes only in the direction, then the formula for the relation of force to acceleration takes the form:

$$F=\mu/\sqrt{1-u^2/c^2}\, du/dt \quad (5)$$

In this case, the role of the "transverse mass" is played by the expression:

$$m_{\perp}= \mu/\sqrt{1-u^2/c^2}, \quad (6)$$

which was also obtained by A. Einstein .[1]
Thus, in relativistic mechanics, the expression for mass, as the coefficient of proportionality between force and acceleration, differs not only from mass in classical mechanics, but also from mass, which determines the energy of a body in A. Einstein's formula $E = mc^2$. In fact, we can speak of the mass of a body as its defining characteristic only in view of the mass of a body at rest in motionless space. For the case of a moving system, the interaction between force and acceleration will be determined by formulas (3) and (5). In this regard, there are proposals to refer the concept of mass only to a body at rest [6]. In this case, all other combinations connecting the energy and momentum of moving bodies with the mass of a body at rest, as well as expressions for the relationship between force and acceleration will not contain the dependence of mass on velocity.
The question of the energy of a moving body in a stationary coordinate system is solved by the formula of A. Einstein, in which the mass has a relativistic dependence. According to Einstein's formula, the total energy of a body consists of its kinetic energy and the energy associated with its rest mass. In a moving system, the kinetic energy of a resting body is zero. As a result, of the energy determined by Einstein's formula, only the energy of a body at rest in motionless space remains. Thus, in spite of the increasing inertness of the body, determined by formulas (4) and (6), the energy of the body at rest in the moving frame will remain the same as the energy of the stationary body in the non-moving frame of reference.

III. Lorentz transformations are the source of the illusion about the change in the scale of space and time in moving systems

In this case, the question arises about the information that the Lorentz transformations carry. A. Poincare and H. Lorentz in their papers used them without derivation as a number to simplify the expressions for the transformation of Maxwell's equations from a stationary to a moving frame of reference [7,8]. At the same time, the form of these transformations in the paper of H. Lorentz was noticeably different from the transformations that were derived by A. Einstein. In the works of Poincare and Lorentz, they carried an auxiliary function, although Lorentz called the time obtained as a result of the transformation in the moving frame local time.

To derive transformations, A. Einstein uses a rod moving with a speed u in the direction of its length L, in which a light pulse propagates from one end of it to the other and back. In this case, from the point of view of an observer who is in a stationary frame of reference, the light moving in pursuit will have a velocity $c-u$ relative to the rod, and $c+u$ in the opposite direction. As a result, the light takes time to move in both directions.

$$T'=L/(c-u)+L/(c+u)=2L/(1-u^2/c^2)$$

As you can see, the relativistic factor in the estimation of time arises without any assumptions about the speed of light in a moving frame. If the rod were at rest in a stationary frame, then it would take $T = 2L/c$

[1] In the publication [1] a mistake was made in the writing of the expression for mass $m_{\perp}$- instead of $\sqrt{1-u^2/c^2}$ it was written $1-u^2/c^2$.

time to move the light pulse in both directions. The movement of the rod leads to the fact that the time required for the movement of the light pulse between its ends increases. Note that the resulting increase in the time *T* 'spent on the passage of a light pulse between the ends of a moving rod in comparison with the case of a stationary rod is not associated with the assumption of the constancy of the speed of light in a moving system and is a consequence of the process of motion of a material object in a stationary system. Taking into account the assumption made by A. Einstein about the constancy of the speed of light led to somewhat different dependences in the transformations of spatial coordinates and time.

Despite the differences in the transit times of light in the rods at rest and moving in a stationary frame of reference, there are no reasons to talk about any slowing down or acceleration of the course of time.The conditions for the propagation of light at the same speed in objects at rest of the stationary and moving systems are equivalent. Therefore, the above expressions for the expenditure of time and the change in length during the propagation of light in a moving rod do not indicate a change in its spatial size and a slowdown in the course of time.

Putting the speed of light in a moving frame the same as in a stationary frame, using the differences in the times of propagation of light and assuming that the origin of coordinates of the moving frame satisfy the coordinate transformation of classical mechanics

$$x' = x - Vt,$$

A. Einstein obtained coordinate transformations between systems.

The formulas, obtained by Einstein for transforming the spatial coordinate and time of a stationary system into the coordinates of a moving system has the form:

$$x' = (x - Vt) / \sqrt{(1 - V^2/c^2)} \quad (7)$$

$$t' = (t - Vx/c^2) / \sqrt{(1 - V^2/c^2)} \quad (8)$$

Inverse transformations are obtained by replacing the "minus" sign with "plus" in the numerator of expressions (7) and (8).

There are ideas that in a moving system the dimensions of spatial objects are reduced in the direction of their movement in relation to the dimensions of the same objects in a stationary system. Indeed, from formula (7) it follows that the transformation of a rod with length L′ in the coordinates of the moving system leads to a reduction of its length L in the coordinates of the stationary system

$$L = L' \cdot (1 - V^2/c^2)^{1/2}.$$

The change in the length of the rod as a result of the transformation is a consequence of the presence of the relativistic factor in the transformation formula (7). In this case, the length of the rod in the coordinates of the moving system is maintained unchanged.Only its representation in the coordinates of a stationary system changes, the size of which decreases as the speed of the system approaches the speed of light.

If we transform the coordinates of the rod L in the stationary system into the coordinates of the moving system using the same formula (7), then the length of this rod in the coordinates of the moving system will be

$$L' = L/(1 - V^2/c^2)^{1/2}.$$

Whence it follows that in the coordinates of a moving system, a rod at rest in a stationary system has a larger size than in a stationary system. The size of this rod in the coordinates of the moving system grows indefinitely as the speed of the system approaches the speed of light. If we take the moving system as stationary, then as a result of the transformation, the size of the same rod in the coordinates of the same system, only having a different semantic meaning, will decrease with increasing speed between the systems.Thus, we have obtained a mutual inconsistency of the results of transformations of the spatial coordinate in the same pair of inertial systems. Transformations give an increase or decrease in the size of an object, depending on the semantic value of the frame of reference.

If we combine the origin of coordinates of a stationary and a moving system, setting $t = 0$ in formula (7), then we can estimate the ratio between the sizes of units of measurement of spatial dimensions in the coordinate grids of both systems. It is easy to see that one meter in the coordinates of a stationary system turns into β meters in a moving system and, conversely, one meter of a moving system is converted into 1 / β meters in a stationary system. Thus, one meter of a stationary frame is not equal to one meter of a moving frame of reference and vice versa.Lorentz transformations create a coordinate transformation between two reference systems that have different scales of units of measurement of space.Moreover, the length of a meter in a moving frame is always less than the length of a meter in a stationary frame of reference. Material objects retain their size regardless of the coordinate system in which they are located. Only the scale of their measurement changes, as a result of which the illusion of a change in their size is created. Therefore, it is more correct to speak not about reducing the size of spatial objects, but about changing the units of measurement of space in a moving system in relation to units of measurement in a stationary system.

Likewise, the pace of time and the transformed values of time intervals depend on the subjective choice of the role of the frame of reference in the relative motion of the two systems. If we put $x = 0$ in formula (8), then the time interval Δt in a stationary frame is transformed into a time interval in a moving frame as $\Delta t' = \Delta t \cdot \beta$. Here, similarly to the case with spatial coordinates, one second of a stationary frame is not equal to one second of a moving frame. Thus, the illusion of time dilation and reduction of the spatial dimensions of objects in a moving system arises as a result of the use of units of measurement with other scales.Note that the scales of units of measurement of space and time in frames of reference change proportionally with a coefficient of proportionality equal to β. Due to this proportionality, the constancy of the speed of light in moving systems is maintained.

There are several obvious contradictions between the Lorentz transformations and reality. Thus, the results of the transformations contradict the principle of relativity, according to which all laws and associated physical processes do not depend on coordinate systems moving relative to each other. This, for example, means that the same springs of two watches must move their hands along the dial with the same speed, regardless of the coordinate system in which the watch is located. The deceleration of time in a moving frame in relation to the passage of time in a stationary frame is in clear contradiction with the principle of relativity.

In the publication [4], an insoluble paradox from the point of view of Lorentz transformations is given, when there are three inertial reference frames, one of which is stationary, and the other two move from it in opposite directions with equal speeds.If you look from the position of a stationary system, then in moving systems time should go the same way. However, from the point of view of each of the moving systems, the passage of time in the system moving in the opposite direction should slow down. It follows from this that transformations do not describe the real state of processes in moving systems.

Using this paradox, it is easy to prove that time in all three systems will go the same. To do this, we will use the principle of relativity and place another inertial system, making it motionless, between the former stationary and one of the moving frames of reference so that their velocities are equal and opposite in direction. As a result, we get a situation equivalent to the first case. From this it follows that the clock in a new pair of moving systems should run the same way.

At the same time, in the initially stationary frame, not knowing about our manipulations with the frames of reference, the clock will run in the same way as it went before the second fixed frame was placed. In this case, the only consistent result of such a situation is the statement that time in all inertial systems should go the same way. So easily one of the fundamental stones on which the theory of relativity is based - the slowing down of time in moving systems, collapses.

Despite the assumption made by Einstein that the speed of light in a moving frame of reference remains constant and does not depend on the speed of the frame, it follows directly from the Lorentz transformations that the propagation of light is not associated with the movement of the frame of reference or the source of radiation. Let us show this with the following example.

Let two sources of radiation, one of which is stationary in a stationary coordinate system, and the other moves at a certain speed, simultaneously emit light signals from point **A** of stationary space in the direction of a remote stationary point **B**.Based on the fact that the speed of light relative to a moving source of radiation remains the same as relative to a stationary source, and the distance to point **B** in the moving system decreases, in accordance with the Lorentz transformation, it can be assumed that the signal emitted by the moving source will arrive at point **B** earlier stationary source signal. However, a signal emitted by a moving source in a stationary space propagates in the same way as a signal from a stationary source. This means that both signals will arrive at their destination at the same time.

The same signal, moving in the space constructed by the Lorentz transformations with the same speed, spends less own time on the flight to point **B**, nevertheless, it arrives at the destination at the same time "with itself". This suggests that the propagation of light is not associated with the movement of the frame of reference and the movement of the radiation source.

Note that the result obtained is a consequence of the assumption of the constancy of the speed of light, as a result of which the Lorentz transformations were obtained. The constancy of the speed of light in them is maintained due to the preservation of proportional communication when the scales of space and time change. In fact, the Lorentz transformations, without making any changes in the properties of space and time, change the scales of their units of measurement while maintaining a proportional relationship between them.In fact, the meters and seconds of a stationary system in a moving system are increased by multiplying by a factor β, keeping the previous semantic value of the units of measurement.The illusion of changing the scales of space and time in SRT is similar to the action of an optical lens, which, without changing the actual dimensions of the observed objects, converts their visible image.

The existence of the dependence of the speed of light on the speed of a moving frame of reference was shown in the experiments of Sagnac with a ring interferometer [9,10]. In his experiments, the light source moved with the rotating ring. From a moving source, light was emitted in opposite directions and, with the help of mirrors located along the perimeter of the ring, propagated along the ring. In the frame of reference associated with the movement of the ring, beams of light propagating in opposite directions travel the same path until they meet. Under conditions of the same speed of light, independent of the direction of propagation, the phase displacement at the moment of their meeting should not be observed. However, contrary to A. Einstein's assumption about the constancy of the speed of lightin the experiments of Sagnac, interference was observed, indicating a difference in the speed of propagation of light signals moving in opposite directionsfrom the radiation source. In this case, the interference pattern changed with a change in the rotation speed of the interferometer.

IV. CONCLUSION

The short result of this paper is the conclusion that the special theory of relativity is correct in terms of the expression for the relationship between energy and mass and is incorrect in terms of the assumption that the speed of light is constant in inertial systems. Therefore, the conclusions of the theory of relativity about slowing down the pace of time and reducing the size of spatial objects in the direction of their motion are false.The supporters of the theory of relativity can recall the experiments with the Michelson interferometer, in which they failed to detect the movement of the Earth relative to the luminiferous ether.

In publication [4], I explained the reason for the failure of these experiments by the influence of the atmospheric air in which the experiments were carried out. Unequal to unity, the refractive index of light could determine the magnitude of the speed of light, regardless of the direction of its propagation. The speed of light in optical media is equal to the quotient of dividing the speed of light by the refractive index and does not depend on the direction of its propagation.

The statement that Maxwell's equations turn out to be invariant with respect to the Lorentz transformations cannot be an argument in favor of the validity of SRT. There is one constant in Maxwell's equations - the speed of light and it remains unchanged during transformations, and the scales of space and time are proportionally changed by using one factor. The invariance of Maxwell's equations is a consequence of such circumstances.

The results of this study allow us to assume that in the Universe there is "absolutely resting space", in the stationary frame of which the formula $E = mc^2$ is fulfilled and the speed of light does not depend on the direction of propagation. In all moving systems, the speed of light will depend on the direction of propagation and the speed of the system. With respect to a moving frame of reference, depending on the direction of propagation, it can be either greater or less than the speed of light in motionless space.

REFERENCES

[1]. Einstein.A.//Ann. d. Phys. 1905. Bd 17. S. 891.

[2]. SlowakJ. Lorentz Transformations And Time Dilation Do Not Verify Reality, *SCIREA Journal of Physics*. Vol. 5 , No. 3 , 2020 , pp. 49 - 60 .

[3]. SlowakJ. Special Relativity is Nonsense. 2nd ed. (Books on Demand, Stockholm, 2020).

[4]. RudakovV.A., About the failure of the A. Einstein's relativity principle, *SCIREA Journal of Physics*. Vol. 6 , No. 3 , 2021 , pp. 34 - 50 .

[5]. FeynmanR., LeightonR., SandsM.The Feynman Lectures on Physics. Issue 2, Space-time-motion. Ed. "Mir", Moscow, 1977. (in rus)

[6]. Okun L.B. *Mass, energy, relativity*. UFN, vol. 158, no. 3, 1989, pp. 511-530, (in rus).

[7]. Poincaré H.“Sur la dynamique de l’electron”, RendicontidelCircoloMatematico di Palermo, XXI, 129, 1906.

[8]. LorentzH.A. Electromagnetic phenomena in a system moving with any velocity smaller than that oflight, in:KNAW, Proceedings, 6, 1903-1904, Amsterdam, 1904, pp. 809-831

[9]. Sagnac M G *C.R. Acad. Sci* **157** 708 (1913); *engl.* - Sagnac G., *The Luminiferous Ether is Detected as a Wind Effect Relative to the Ether Using a Uniformly Rotating Interferometer*, THE ABRAHAM ZELMANOV JOURNAL, p.74,Vol.1, ISSN 1654-9163, (2008).

[10]. Sagnac M G *C.R. Acad. Sci* **157** 1410 (1913); *engl.* - Sagnac G., *Regarding the Proof for the Existence of a Luminiferous Ether Using a Rotating Interferometer Experiment*, THEABRAHAM ZELMANOV JOURNAL, p.77,Vol.1, ISSN 1654-9163, (2008).

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