Special theory of Ether

EXCERPTS FROM THE BOOK

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Symbols and Labels

U_i – inertial frame of reference U_i otherwise inertial system (e.g. U_1, U_2, U_3)

c_p – velocity of light in vacuum measured in the ether (c_p=c)

c_s – velocity of light in a transparent material

$c'_{p\alpha}$ – velocity of light in vacuum, flowing at an angle α to the velocity of the inertial system, measured in the system

$c'_{s\alpha}$ – velocity of light in a transparent material, flowing at an angle α to the velocity of the inertial system, measured in the system

$v_{i/j}$ – velocity of the inertial system U_i relative to the inertial system U_j, measured in the system U_j (e.g. $v_{1/2}$, $v_{2/1}$, $v_{1/3}$) – the relative velocity

v_i – velocity of the inertial system U_i measured in the ether, other designation $v_{i/E}$ (e.g. v_1, v_2, v_3) – absolute velocity

${}_xv_{i/j}$ – velocity component of the inertial system U_i relative to the inertial system U_j, parallel to the X axis of coordinate system associated with the inertial system U_j (e.g. ${}_xv_{1/2}$, ${}_xv_{2/1}$, ${}_xv_{1/3}$)

${}_yv_{i/j}$ – velocity component of the inertial system U_i relative to the inertial system U_j, parallel to the Y axis of the coordinate system associated with the inertial system U_j (e.g. ${}_yv_{1/2}$, ${}_yv_{2/1}$, ${}_yv_{1/3}$)

${}_xv_i$ – velocity v_i component of the inertial system U_i relative to the ether, parallel to the X axis of the coordinate system associated with the ether, other designation ${}_xv_{i/E}$ (e.g. ${}_xv_1$, ${}_xv_2$, ${}_xv_3$)

${}_yv_i$ – velocity v_i component of the inertial system U_i relative to the ether, parallel to the Y axis of the coordinate system associated with the ether, other designation ${}_yv_{i/E}$ (e.g. ${}_yv_1$, ${}_yv_2$, ${}_yv_3$)

$p_{i/j}$ – the momentum of a mass that is located in the inertial system U_i measured in the inertial system U_j (e.g. $p_{1/2}$, $p_{2/1}$, $p_{1/3}$)

p_i – the momentum of a mass that is located in the inertial system U_i measured in the ether, other designation $p_{i/E}$ (e.g. p_1, p_2, p_3)

$\Delta p_{i/j}$ – change in the momentum of a mass located in the inertial system U_i measured in the inertial system U_j (e.g. $\Delta p_{1/2}$, $\Delta p_{2/1}$, $\Delta p_{1/3}$)

p^x – the momentum of a mass described in the dynamics model x (e.g. x=Δp, F, ΔE, m)

$E_{i/j}$ – kinetic energy of a mass in the inertial system U_i measured in the inertial system U_j

E_i – kinetic energy of a mass in the inertial system U_i measured in the ether, other designation $E_{i/E}$ (e.g. E_1, E_2, E_3)

E^x – kinetic energy of a mass described in a dynamics model x (e.g. x=Δp, F, ΔE, m)

$F_{i/j}$ – force acting in the inertial system U_i measured in the inertial system U_j

F_i – force acting in the inertial system U_i measured in the ether, other designation

$L_{i/j}$ – distance connected with the inertial system U_i measured in the inertial system U_j

L_0 – distance connected with the inertial system U_i measured in the same system (L_0=$L_{1/1}$=$L_{2/2}$=$L_{i/i}$)

$m_{i/j}$ – mass inertia connected with the inertial system U_i measured in the inertial system U_j (e.g. $m_{1/2}$, $m_{2/1}$, $m_{1/3}$) - relativistic mass

m_0 – mass inertia connected with the inertial system U_i measured in the same system – the rest mass

t_i – time that is measured on the clocks connected with the inertial system U_i (e.g. t_1, t_2, t_3)

Δt_i – the time interval between two events measured in the inertial system U_i (e.g. Δt_1, Δt_2, Δt_3)

t – time measured on a clocks connected with the inertial system U

t' – time measured on a clocks connected with the inertial system U'

$\gamma(v)$ – gamma function of the form $\gamma(v)$=γ=$1-(v/c)^2$

1. Introduction

In the book, we present the new physical theory, introduced by us, which we called the Special Theory of Ether (STE).

The task of physics is to study and describe reality. The most important sources of information about reality are experiments. The physics deals with creating theories that describe the results of experiments and explain them. Over time, with the development of technology and knowledge are available the results of new, more complex experiments. Sometimes, it turns out that they reveal new properties of reality that have not been described nor explained with available theories so far. This was the case when phenomena of the electromagnetic interaction and radioactivity were revealed experimentally. Then, to describe this reality completely, it was necessary to redevelop the earlier theory, or create entirely new ones. It is a normal process that we call the development of science.

In the nineteenth century, have been conducted experiments very important for future of physics. In 1849, Armand Fizeau (by the method of a toothed wheel), and in 1850, Jean Foucault (by the method of a rotating mirror) have conducted an measurements of the velocity of light. Then and later, was measured only average velocity of light that covers the way there and back, after reflection from the mirror. Nobody has ever been able to measure the velocity of light in one direction with high accuracy.

In 1887, Albert Michelson and Edward Morley conducted an experiment with light, the aim of which was to find a universal frame of reference, called the ether, and to measure the velocity at which the Earth moves in the ether. The ether by assumption was supposed to be the medium where light propagates. Based on the available traffic theory, which was developed by Galileo and Isaac Newton, the outcome of this experiment was predicted. The result of the experiment, however, was inconsistent with expectations. It turned out that it cannot be explained by the theory available then.

The answer to this problem was the new physical theory published in 1905 by Albert Einstein and called the Special Theory of Relativity (STR). The theory's aim was to explain the results of the Michelson-Morley experiment. STR has become the only one available theory describing kinematics and dynamics of mass. For over 110 years, it has been considered to be one of the most important achievements of physics in the history of mankind. On the basis of STR, interpretations of very expensive scientific projects, which billions of dollars are being spent on, such as particle accelerators, are conducted. STR is lectured at universities and is contained in almost every textbook on physics. STR is considered today as an unquestionable science, which is why its criticism is facing great resistance from many physicists.

It turns out, however, that the Theory of Relativity is a self-contradictory and unbelievably complicated theory. Physicists analyzing it are not able to understand its real significance, and that the assumptions underlying the theory are wrong. Because of the absence of another theory, physicists ignore the contradictions found in STR and do not enter the dispute over it. It is therefore justified to derive a new theory that can replace the special theory of relativity. That is the theory presented in this book.

The book presents the theory of movement in space (kinematics of STE) and the motion theory of mass (dynamics of STE). The analysis shows that there is a universal reference frame, called the ether. It stands out from all the other inertial reference frames, that in it the velocity of light is constant in all directions, and all chemical processes proceed the fastest. The acknowledgement of existence of the ether is necessary if we want to properly explain the results of the Michelson-Morley experiment.

In the work, four ways to derive the most important model in the theory, namely the transformation of time and position between the ether and a inertial reference frame, are presented. The first two methods are based on geometric analysis, based on the conclusions from the Michelson-Morley experiment. The third one bases on generalization of the Galilean transformation. The fourth one is based on the correct interpretation and modification of the Lorentz transformation.

In the work, we presented theory of dynamics of mass and present four descriptions based on different assumptions that concern respectively the law of conservation of: change in momentum (STE/Δp), force (STE/F), force to change of time (STE/$F/\Delta t$) and mass (STE/m).

We show what properties the velocity of light has, and why numerous experiments aimed at detecting the ether could not have been successful. We have shown the method of determining the velocity of the Solar System in the ether. We present the correct formula for the Doppler effect. We also present the description of an experiment that will help to determine the velocity of light in any direction in our inertial frame of reference.

We have shown why the special relativity theory is incorrect (Chapter 4), namely:

1. The main assumption of STR that the velocity of light is the same in every inertial reference frame is incorrect. Such an assumption leads to a contradiction in the theory. The assumption that light has the same velocity in any direction, in any inertial system is the result of a misinterpretation of the results of the Michelson-Morley experiment. In fact, this is not true. It is worth mentioning that there is no such an experiment, which shows that the velocity of light is the same in every direction, and much less that it is the same in different inertial reference frames.
2. It has wrongly been considered that the Michelson-Morley experiment entails that the ether does not exist. This has been assumed despite the fact that no formal proof of non-existence of the ether was conducted.
3. The second assumption of STR of equivalence of all inertial reference frames is also incorrect. By assuming the wrong assumption, the meaning of the Lorentz transformation, on which the Special Theory of Relativity is based, has been wrongly interpreted.
4. The Lorentz transformation, which in fact is only the transformation between the ether and inertial reference frame and not, as it is believed to be the transformation between any inertial reference frames, has been wrongly interpreted. The Lorentz transformation can be derived from the main transformation of our theory by moving in space and time coordinates bound together by the correct transformation of STE. The Lorentz transformation can be created by the deterioration of the correct transformation of STE.
5. The Lorentz transformation has been wrongly interpreted in STR, because of the assumption that the spatial coordinates related to this transformation are, at any given time, side by side, which means that the transformation converts time of clocks which are side by side. In fact, this transformation converts a position coordinate from the inertial reference frame to a coordinate from the ether, next to which it will be in the future, or has been in the past.
6. In the (STR), it has been mistakenly considered that the constant c occurring in the Lorentz transformation, is the velocity of light in any inertial reference frame. In fact, it is the velocity of light in the ether. The constant c is also the average velocity of light in vacuum in any inertial reference frame, when light goes to the mirror and then back.
7. In STR, it has been wrongly concluded that the simultaneity of events is relative. In fact, the concept of simultaneity of events is absolute. In STR, the events simultaneous in one inertial reference frame do not have to be simultaneous in another inertial reference frame. This effect is due to the false assumption that the velocity of light is constant. It results also from a misinterpretation of the Lorentz transformation, which actually calculates the coordinates of position and time from one inertial reference frame to future or past coordinates in another reference frame. The transformation does not calculate the coordinates of events that are seen in various systems in the present.

8. In STR, there is a misinterpretation of the formula for kinetic energy, because in reality it expresses the kinetic energy relative to the ether, and not relative to any inertial reference frame. This formula concerns only one of the many possible descriptions of the body dynamics, in which it has been assumed that the force is the same for an observer from every inertial reference frame (Section 3.3.6).
9. In STR, a wrong conclusion on the equivalence of mass and energy has been made. The formula $E=mc^2$ is only an amendment that occurs in the law of kinetic energy and has no connection with the internal energy of matter. Therefore, in the subject literature there are unjustified views that lead to conclusion that a heated body or tensioned spring is heavier. We show that the amendment to the kinetic energy present in the law of the kinetic energy in the Special Theory of Relativity is not a property of the matter and only depends on the assumed model of dynamics of mass. This dependence is related to the kinetic energy which is proven in this elaboration.
10. In STR, it has been mistakenly concluded that the time multiplied by the velocity of light is the fourth dimension of space (in this way the concept of space-time has been introduced). This erroneous conclusion has been drawn from the invariant of the Lorentz transformation, which in reality is only a mathematical formula linking time with distances and not proof of the equivalence of these values.
11. A consequence of the misinterpretation the Lorentz transformation is the wrong derivation of the formula for adding velocity and the wrong formula for the Doppler effect. Relative velocities of inertial reference frames related to the Lorentz transformation have also been mistakenly read from this transformation.

The Special Theory of Ether presented below is our design. The results of the calculation are our results (only Chapter 10 include our interpretation of known results). Most formulas derived in this book was calculated with use of different methods to verify it. Therefore, if it seemed interesting, we included more than one derivation of the same dependence.

2. Kinematics in the Special Theory of Ether (STE)

2.1. The geometrical derivation of the STE transformation – I

In this chapter, a derivation of main transformations of STE, with use of geometric method, has been introduced. An explanation of the results of the Michelson-Morley experiment is presented, on the assumption that there is the ether, wherein the velocity of light is constant. In the inertial frames of reference that are moving in the ether, the velocity of light may be different. With these considerations, main transformations of STE, that transform coordinates from the inertial frame of reference (the inertial system or briefly called the system) into the ether and from the ether into the system, were derived. Knowledge of this transformation allows us to understand why STR is wrong and what the Lorentz transformation really describes. The Special Theory of Ether is based on the main transformation described in this section. This theory is internally coherent.

< OUT OF ELECTRONIC VERSION >

As a result of the sub-chapter analysis of the Michelson-Morley experiment, derivation was the transformation between any inertial system and the ether

$$\begin{cases} t = \dfrac{1}{\sqrt{1-(v/c)^2}}t' \\ x = \dfrac{1}{\sqrt{1-(v/c)^2}}vt' + \sqrt{1-(v/c)^2}\cdot x' \end{cases} \tag{1}$$

and the inverse transformation from the ether to any inertial system

$$\begin{cases} t' = \sqrt{1-(v/c)^2}\cdot t \\ x' = \dfrac{1}{\sqrt{1-(v/c)^2}}(-vt + x) \end{cases} \tag{27}$$

2.2. Derivation of the transformation between systems

< OUT OF ELECTRONIC VERSION >

The transformation from the inertial system U_2 to the system U_1, associated with the ether, can be written on the basis of (26), and (27) as

$$\begin{cases} t_1 = \dfrac{\sqrt{1-(v_1/c)^2}}{\sqrt{1-(v_2/c)^2}}t_2 \\ x_1 = \dfrac{v_2 - v_1}{\sqrt{1-(v_1/c)^2}\cdot\sqrt{1-(v_2/c)^2}}t_2 + \dfrac{\sqrt{1-(v_2/c)^2}}{\sqrt{1-(v_1/c)^2}}x_2 \end{cases} \tag{29}$$

< OUT OF ELECTRONIC VERSION >

2.3. The analytical derivation of the STE transformation

2.3.1. The generalization of the Galilean transformation

The objective is to determine the transformation of positions and the time between inertial systems U_1 and U_2, Figure 2. The systems move relative to each other, in parallel to the axis x. We assume that the system U_1 moves relative to U_2 at the velocity $v_{1/2}$, and the system U_2 moves relative to the U_1 at the velocity $v_{2/1}$ and ($-v_{1/2}=v_{2/1}$).

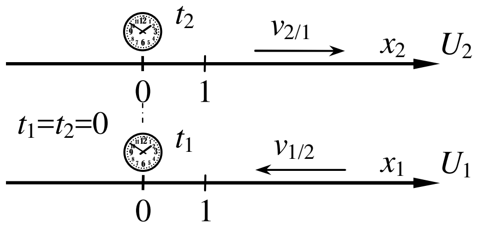

Fig. 2. Two inertial systems U_1 and U_2 move relative to each other at velocities $v_{1/2}$ and $v_{2/1}$

The generalization of the Galilean transformation consists in allowing the possibility that the absolute values of velocities $v_{1/2}$ and $v_{2/1}$ may be different.

We assume that in any inertial system the first principle of Newton is true. So if a body moves uniformly in one inertial reference system, its movement observed in another inertial reference system will also be uniform. It follows that the coordinate transformation of time and position, between two systems must be linear and can be written in the form

$$\begin{aligned} t_1 &= at_2 + b'x_2 \\ x_1 &= et_2 + dx_2 \end{aligned} \tag{31}$$

The coefficient a>0 as in any inertial reference frame because time may not elapse back.

Now we write the inverse transformation. It is assumed that if in the system U_2 time runs faster, so in the system U_1 it runs slower. Hence, in the inverse transformation, the coefficient a must be replaced by $1/a$. Similarly, if in one system the length contraction takes place, in the second the length elongation should take place. From this inverse transformation, the coefficient d must be replaced by $1/d$. If the velocity of the system U_2 relative to U_1 is positive, the velocity of U_1 relative to U_2 is negative. Therefore, the coefficient e should be changed to $-e$. For the coefficient b' we do not accept any assumptions, so in the inverse transformation we have taken the coefficient b''. The inverse transformation is in the form

$$\begin{aligned} t_2 &= \frac{1}{a}t_1 - b''x_1 \\ x_2 &= -et_1 + \frac{1}{d}x_1 \end{aligned} \tag{32}$$

< OUT OF ELECTRONIC VERSION >

Finally, transformations (31) and (32) can be expressed relative to the speed and saved as

$$\begin{cases} t_1 = \sqrt{-\dfrac{v_{1/2}}{v_{2/1}}}\cdot t_2 \\ x_1 = v_{2/1}\sqrt{-\dfrac{v_{1/2}}{v_{2/1}}}\cdot t_2 + \sqrt{-\dfrac{v_{2/1}}{v_{1/2}}}\cdot x_2 \end{cases} \tag{51}$$

$$\begin{cases} t_2 = \sqrt{-\dfrac{v_{2/1}}{v_{1/2}}}\cdot t_1 \\ x_2 = v_{1/2}\sqrt{-\dfrac{v_{2/1}}{v_{1/2}}}\cdot t_1 + \sqrt{-\dfrac{v_{1/2}}{v_{2/1}}}\cdot x_1 \end{cases} \tag{52}$$

We have obtained transformations that are completely symmetrical. If we substitute in transformation (51) indices 1 with 2 and 2 with 1, we obtain transformation (52). This symmetry is despite the fact that in the derivation of the transformation seemingly the asymmetry was introduced (formulas (31) and (32)).

Transformations (51) and (52) are the most general transformations of STE presented in this book, because to derive them it was not necessary to refer to the results of the Michelson-Morley experiment nor to assume the existence of the universal reference system, i.e. the ether.

Transformations (51) and (52) are generalized Galilean transformations. If for the relative velocities of systems U_2 and U_1 $v_{2/1}=-v_{1/2}=v$ is true, then these transformations come down to the Galilean transformation.

2.3.2. The assumption that a universal reference system exists

< OUT OF ELECTRONIC VERSION >

2.3.3. Determining of function γ by Michelson-Morley experiment

< OUT OF ELECTRONIC VERSION >

2.4. Velocity in STE

2.4.1. Adding velocity and the relative velocity

< OUT OF ELECTRONIC VERSION >

On the basis of the transformation has been introduced model for combining speed

$$\begin{aligned} v_1 &= v_2 + v_{1/2}\cdot(1-(v_2/c)^2) \\ v_2 &= v_1 + v_{2/1}\cdot(1-(v_1/c)^2) \end{aligned} \tag{88}$$

and for the relative velocity in the form

$$v_{2/1} = \frac{v_2 - v_1}{1-(v_1/c)^2}$$
$$v_{1/2} = \frac{v_1 - v_2}{1-(v_2/c)^2} \tag{89}$$

< OUT OF ELECTRONIC VERSION >

On the basis of the transformation we obtain the formula for adding relative velocities

$$v_{3/1} = -v_{3/2}\frac{v_{2/1}}{v_{1/2}} + v_{2/1} \tag{101}$$

On the basis of (61) and (78) we have

$$-\frac{v_{2/1}}{v_{1/2}} = \frac{\gamma(v_2)}{\gamma(v_1)} = \frac{1-(v_2/c)^2}{1-(v_1/c)^2} = \frac{c^2 - v_2^2}{c^2 - v_1^2} \tag{102}$$

The formula for adding up relative velocities takes the form

$$v_{3/1} = v_{3/2}\frac{1-(v_2/c)^2}{1-(v_1/c)^2} + v_{2/1} = v_{3/2}\frac{c^2 - v_2^2}{c^2 - v_1^2} + v_{2/1} \tag{103}$$

2.4.2. The maximum velocity in the ether

< OUT OF ELECTRONIC VERSION >

2.4.3. The ether velocity relative to the system

< OUT OF ELECTRONIC VERSION >

In this connection, for the observer of the system U' the ether has velocity relative to him

$$v' = \frac{x'_2 - x'_1}{t'_2 - t'_1} = \frac{-v}{1-(v/c)^2} \tag{115}$$

< OUT OF ELECTRONIC VERSION >

This equation has two solutions

$$v_g^{1,2} = \frac{-c \pm \sqrt{c^2 + 4c^2}}{2} = \frac{-c \pm c\sqrt{5}}{2} = c\frac{\pm\sqrt{5}-1}{2} \tag{119}$$

The negative value of the velocity exceeds the velocity of light and is unacceptable. Therefore, there is another solution

$$v' = -c \quad \Leftrightarrow \quad v_g = \frac{\sqrt{5}-1}{2}c \approx 0.61803399 \cdot c = 1.85281929 \cdot 10^8 \quad \text{m/s} \tag{120}$$

It is interesting that the resulting velocity v_g divides the light velocity c into two parts at a ratio that is known as the Golden Section.

2.4.4. The velocity of light in the inertial system

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2.4.5. Increases of velocity in inertial systems

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2.4.6. Two useful formulas

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2.4.7. Other ways of determining formulas for velocities

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2.5. Equivalent forms of the transformation in STE

Transformations between systems can be written in various forms. One of them is the form expressed by the relative velocities (51)-(52). If (48) and (50) are taken into account, then transformation (51) and (52) can be written as

$$\begin{matrix} v_{2/1} > 0 \\ v_{1/2} < 0 \end{matrix} \quad \begin{cases} t_1 = \sqrt{-\dfrac{v_{1/2}}{v_{2/1}}} \cdot t_2 \\ x_1 = \sqrt{-v_{1/2} \cdot v_{2/1}} \cdot t_2 + \sqrt{-\dfrac{v_{2/1}}{v_{1/2}}} \cdot x_2 \end{cases} \tag{158}$$

$$\begin{matrix} v_{2/1} > 0 \\ v_{1/2} < 0 \end{matrix} \quad \begin{cases} t_2 = \sqrt{-\dfrac{v_{2/1}}{v_{1/2}}} \cdot t_1 \\ x_2 = -\sqrt{-v_{1/2} \cdot v_{2/1}} \cdot t_1 + \sqrt{-\dfrac{v_{1/2}}{v_{2/1}}} \cdot x_1 \end{cases} \tag{159}$$

Transformation (158)-(159) is valid only when velocity $v_{2/1}>0$ (at the same time $v_{1/2}<0$).
Having taken (78) and (62)-(63) into account, we can write transformations as

$$\begin{cases} t_1 = \sqrt{\dfrac{1-(v_1/c)^2}{1-(v_2/c)^2}} \cdot t_2 \\ x_1 = v_{2/1}\sqrt{\dfrac{1-(v_1/c)^2}{1-(v_2/c)^2}} \cdot t_2 + \sqrt{\dfrac{1-(v_2/c)^2}{1-(v_1/c)^2}} \cdot x_2 \end{cases} \tag{160}$$

$$\begin{cases} t_2 = \sqrt{\dfrac{1-(v_2/c)^2}{1-(v_1/c)^2}} \cdot t_1 \\ x_2 = v_{1/2}\sqrt{\dfrac{1-(v_2/c)^2}{1-(v_1/c)^2}} \cdot t_1 + \sqrt{\dfrac{1-(v_1/c)^2}{1-(v_2/c)^2}} \cdot x_1 \end{cases} \tag{161}$$

Having taken (89) into account, we can write the above transformations as expressions of the absolute velocities (transformations are identical to (29)-(30) derived using the geometric method)

$$\begin{cases} t_1 = \sqrt{\dfrac{1-(v_1/c)^2}{1-(v_2/c)^2}} \cdot t_2 \\ x_1 = \dfrac{v_2 - v_1}{\sqrt{1-(v_1/c)^2} \cdot \sqrt{1-(v_2/c)^2}} \cdot t_2 + \sqrt{\dfrac{1-(v_2/c)^2}{1-(v_1/c)^2}} \cdot x_2 \end{cases} \tag{162}$$

$$\begin{cases} t_2 = \sqrt{\dfrac{1-(v_2/c)^2}{1-(v_1/c)^2}} \cdot t_1 \\ x_2 = \dfrac{v_1 - v_2}{\sqrt{1-(v_1/c)^2} \cdot \sqrt{1-(v_2/c)^2}} \cdot t_1 + \sqrt{\dfrac{1-(v_1/c)^2}{1-(v_2/c)^2}} \cdot x_1 \end{cases} \tag{163}$$

Interesting forms of the transformation can be obtained when in the transformation of position we replace time of another system with the use of the transformation of time. Then, we obtain the transformation, in which the position is expressed by the system own time.

The transformation of (51)-(52) can be written in the form

$$\begin{cases} t_1 = \sqrt{-\dfrac{v_{1/2}}{v_{2/1}}} \cdot t_2 \\ x_1 = v_{2/1} \cdot t_1 + \sqrt{-\dfrac{v_{2/1}}{v_{1/2}}} \cdot x_2 \end{cases} \tag{164}$$

$$\begin{cases} t_2 = \sqrt{-\dfrac{v_{2/1}}{v_{1/2}}} \cdot t_1 \\ x_2 = v_{1/2} \cdot t_2 + \sqrt{-\dfrac{v_{1/2}}{v_{2/1}}} \cdot x_1 \end{cases} \tag{165}$$

The transformation (162) and (163) we can written in the form

$$\begin{cases} t_1 = \sqrt{\dfrac{1-(v_1/c)^2}{1-(v_2/c)^2}} \cdot t_2 \\ x_1 = \dfrac{v_2 - v_1}{1-(v_1/c)^2} \cdot t_1 + \sqrt{\dfrac{1-(v_2/c)^2}{1-(v_1/c)^2}} \cdot x_2 \end{cases} \tag{166}$$

$$\begin{cases} t_2 = \sqrt{\dfrac{1-(v_2/c)^2}{1-(v_1/c)^2}} \cdot t_1 \\ x_2 = \dfrac{v_1 - v_2}{1-(v_2/c)^2} \cdot t_2 + \sqrt{\dfrac{1-(v_1/c)^2}{1-(v_2/c)^2}} \cdot x_1 \end{cases} \tag{167}$$

If the system U_2 is the ether and U and $U_1 \equiv U'$, then any of the above transformations comes down to the transformation between the inertial reference system and the ether (26) and (27). It is enough to substitute $v_2=0$, $v_{2/1}=-v/(1-(v/c)^2)$, $v_{1/2}=v_1=v$, $x_2=x$ and $x_1=x'$.

On the basis of (115) the transformation system-ether (26) and (27) can be written as

$$\begin{cases} t = \dfrac{1}{\sqrt{1-(v/c)^2}} t' \\ x = vt + \sqrt{1-(v/c)^2} \cdot x' \end{cases} \tag{168}$$

$$\begin{cases} t' = \sqrt{1-(v/c)^2} \cdot t \\ x' = v't' + \dfrac{1}{\sqrt{1-(v/c)^2}} x \end{cases} \tag{169}$$

2.6. Contractions in STE

2.6.1. The length contraction

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we calculated the formula for reducing the length expressed by the absolute velocity

$$\frac{L_{2/1}}{L_0} = \frac{\sqrt{1-(v_2/c)^2}}{\sqrt{1-(v_1/c)^2}} = \frac{\sqrt{c^2-v_2^2}}{\sqrt{c^2-v_1^2}} \tag{175}$$

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Figure 12 presents the length contraction (175), where the system U_1 has constant velocity v_1, in the function of variable velocity v_2.

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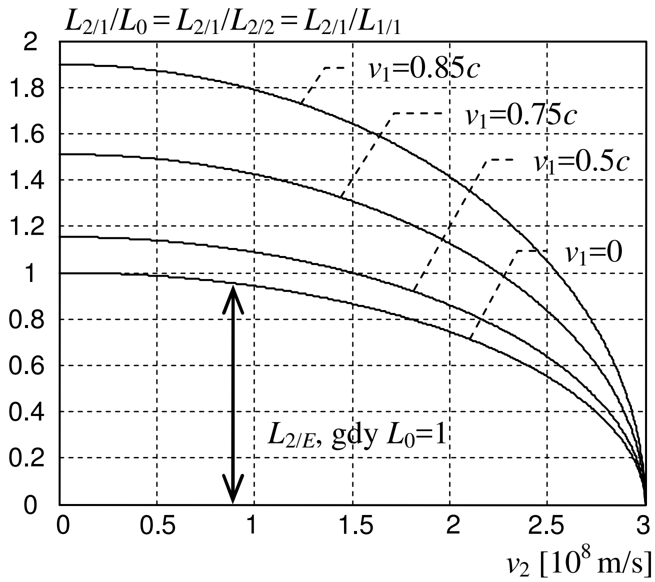

Fig. 12. The length contraction in the system U_2, seen in the system U_1, at set constant velocity v_1

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2.6.2. The time contraction

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we obtain the formula for the time contraction expressed by the absolute velocity in the form of

$$\frac{\Delta t_1}{\Delta t_2} = \frac{\sqrt{1-(v_1/c)^2}}{\sqrt{1-(v_2/c)^2}} = \frac{\sqrt{c^2-v_1^2}}{\sqrt{c^2-v_2^2}} \tag{187}$$

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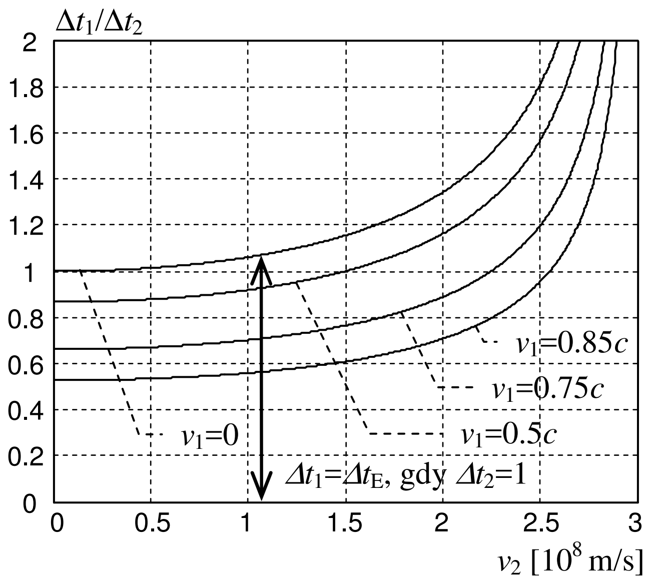

Fig. 14. The time contraction in the system U_2, seen in the system U_1 at constant velocity v_1

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2.7. Geometrical derivation of the transformation STE – II

In this section, the main transformation of STE between system and the ether is derived by using other geometrical method than in Section 2.1. In this case, instead of assuming the form of the transformation, the light flow parallel to the direction of movement of the system U' will be further examined.

The considerations presented in the Chapter initiated the creation of the entire Special Theory of Ether. It all began with an explanation of the results of the Michelson-Morley experiment by means of the geometric method, but in a different way than it was done previously [a sketch of geometric methods is shown in 2]. In the known for over 100 years approach that led to the creation of the Special Theory of Relativity, the Michelson-Morley experiment was explained rejecting the existence of the ether (Section 0). Then, the equivalence of all inertial reference systems and the stability of the velocity of light in all inertial frames were assumed. With these assumptions, internally contradictory STR was created. Of course, the contradictions are proof that assumptions adopted in STR were unacceptable.

We assume that there is an absolute reference system (the ether), in which light travels at constant velocity c. Figure 16 shows two systems. The system U rests in the ether while the system U' moves in relation to the ether at velocity v. In the system U', an experiment measuring the velocity of light in vacuum perpendicular and parallel to the direction of movement of the system U' in relation to the ether was conducted. In each of these directions, light travels to the mirror and back. According to the conclusions of the Michelson-Morley experiment, it was assumed that the average velocity of light in the system U' is the same in both directions, i.e. along the axis x' and y'.

Figure 16 presents in part a) the flow path of light seen by the observer from the system U', while in part *b*) the path seen by the observer from the system U. 6 characteristic events are marked in the Figure. For each of them position and time (given in parentheses) are defined. The same events seen from the system U and U' are designated by the same subscripts.

In the Figure, the following designations (t, x, y), where t is the moment of event, and x and y are the coordinates of position, were assumed for events.

Event $(0,0,0)_1$ corresponds to sending two streams of light. One is sent parallel to the axis x', the second parallel to the axis y'. Event $(\cdot,\cdot,\cdot)_2$ corresponds to light reaching the mirror on the axis y'. Event $(\cdot,\cdot,\cdot)_3$ corresponds to the return of both streams of light to the source point. Event $(\cdot,\cdot,\cdot)_4$ corresponds to light reaching the mirror on the axis x'. Event $(\cdot,\cdot,\cdot)_5$ corresponds to the light stream reaching point A, when the light stream parallel to the axis y' reached the mirror. Event $(\cdot,\cdot,\cdot)_6$ is the additional event and is needed as a reference and occurs at time $t=t'=0$, when the origins of the coordinate systems overlap. Event $(\cdot,\cdot,\cdot)_6$ takes place in the system U' at distance K' from the origin of the system. The event $(\cdot,\cdot,\cdot)_6$ in the system U, i.e. the ether, takes place at distance K from the origin.

The mirrors are associated with the system U' and placed at distance D' from the origin. One mirror is located on the axis x', the second one on the axis y'. It is assumed that distance D' perpendicular to the direction of movement is the same for observers from both systems.

The flow time of light in the system U, along the axis x, in the direction to the mirror is marked as t_{p1}. The flow time back is marked as t_{p2}.

The flow time of light in the system U', along the axis x', in the direction to the mirror is marked as t_{p1}'. The flow time back to the source is marked t_{p2}'. Total time is marked respectively as t_p and t_p'.

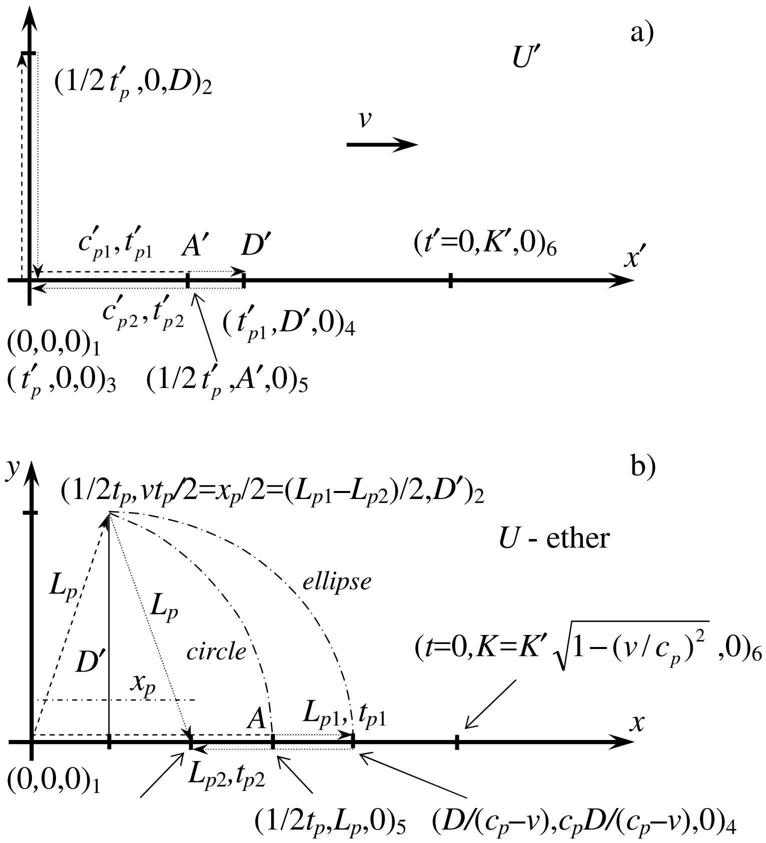

Fig. 16. Paths of two streams of light
a) seen by an observer from the system U',
b) seen by an observer from the system U – the ether.

The light stream, moving parallel to the axis y', from the point of view of the system U moves along the arms of an isosceles triangle of side length L_p. Since the velocity of light is constant in the system U, therefore, the time of movement along both arms is the same and is equal to $1/2t_p$.

In the system U, the light stream parallel to the axis x, in the direction of the mirror overcomes distance L_{p1} during time t_{p1}. On the way back, it travels distance L_{p2} during time t_{p2}. These distances are different due to the movement of the mirror and the source point of light in the ether.

In the experiment, both light streams come back to the source point at the same time.

The velocity of light in the system U i.e. the ether is constant in any direction and is equal to c. The Michelson-Morley experiment shows that in the system U', the average velocity of light c_p is the same in every direction.

If we allow that the average velocity of light c_p in the system U' is a function of the velocity of light c in the system U, i.e. the ether dependent on the velocity v, we can write

$$c_p = f(v)c \tag{191}$$

From measurement, we know that the average velocity of light is the same for different velocities of the Earth relative to the ether, so $f(v_1)=f(v_2)$. Since $f(0)=1$, therefore $f(v)=1$ for every velocity v. It follows that $c=c_p$.

For an observer of U' and U, the velocity of light can be written as

$$c_p = \frac{2D'}{t'_{p1}+t'_{p2}} = \frac{2D'}{t'_p} = \frac{2L_p}{t_p} = \frac{L_{p1}+L_{p2}}{t_{p1}+t_{p2}} \tag{192}$$

From equation (192) light paths L_p and D' as a function of the velocity of light c_p and the light flow times t_p, t_p' respectively in the systems U and U' can be determined

$$L_p = \frac{c_p t_p}{2}; \quad D' = \frac{c_p t'_p}{2} \tag{193}$$

The velocity of the system U' relative to the absolute frame of reference U, i.e. the ether is marked by v. Since x_p is the path that the system U' traveled in time t_p, of the light flow, we have

$$v = \frac{x_p}{t_p}; \quad x_p = vt_p \tag{194}$$

Using the geometry of Figure 16, the length L_p can be expressed as

$$L_p = \sqrt{(1/2x_p)^2 + D'^2} = \sqrt{(1/2vt_p)^2 + D'^2} \tag{195}$$

Having squared equation (195) and taken (193) into account, we obtain

$$(1/2c_p t_p)^2 = (1/2vt_p)^2 + (1/2c_p t'_p)^2 \tag{196}$$

After arranging we obtain

$$t_p^2(c_p^2 - v^2)^2 = (c_p t'_p)^2 \tag{197}$$

$$t_p = t'_p \frac{1}{\sqrt{1-(v/c_p)^2}} \tag{198}$$

Having introduced (198) to (194), we have

$$x_p = vt'_p \frac{1}{\sqrt{1-(v/c_p)^2}}, \quad dla\ x' = 0 \tag{199}$$

Length D' associated with the system U' that is parallel to the axis x, and is seen from the system U as D. If light flows in the absolute frame of reference U to the mirror, is chasing the mirror, which is away from it at length D. After reflection, light travelling distance D returns to the source point, which runs against him. Using equations (217), we obtain the equations for times and light flow paths in both directions along the axis x' in the system U

$$\begin{gathered} t_{p1} = \frac{D}{c_p - v}; \quad t_{p2} = \frac{D}{c_p + v} \\ L_{p1} = c_p \frac{D}{c_p - v}; \quad L_{p2} = c_p \frac{D}{c_p + v} \end{gathered} \tag{200}$$

From equations (200) the sum and difference in length the L_{p1} and L_{p2}, which light travelled in the ether, can be determined

$$\begin{gathered} L_{p1} + L_{p2} = 2D \frac{1}{1-(v/c_p)^2}, \\ L_{p1} - L_{p2} = 2D \frac{v}{c_p} \cdot \frac{1}{1-(v/c_p)^2} \end{gathered} \tag{201}$$

From the second equation, the distance that the system U' travelled in half of the light flow time $1/2t_p$ can be determined, so we have

$$1/2x_p = 1/2vt_p = \frac{L_{p1} - L_{p2}}{2} = D\frac{v}{c_p}\frac{1}{1-(v/c_p)^2} \tag{202}$$

Since it was assumed that in the system U i.e. the ether, the velocity of light c_p is constant, therefore both distances, which are travelled by light $2L_p$ and $L_{p1}+L_{p2}$ are the same

$$2L_p = L_{p1} + L_{p2} \tag{203}$$

After substituting (195) and the first equation (201) we obtain

$$2\sqrt{(1/2vt_p)^2 + D'^2} = 2D\frac{1}{1-(v/c_p)^2} \tag{204}$$

After reducing by two, raising to the square and taking (202) into account we can write

$$\left(D\frac{v}{c_p}\frac{1}{1-(v/c_p)^2}\right)^2 + D'^2 = D^2\left(\frac{1}{1-(v/c_p)^2}\right)^2 \tag{205}$$

From equation (205) a dependence for the length contraction can be determined

$$\begin{gathered} D'^2 = D^2\left(\frac{1}{1-(v/c_p)^2}\right)^2 (1-(v/c_p)^2) \\ D' = D\left(\frac{1}{1-(v/c_p)^2}\right)\sqrt{1-(v/c_p)^2} = D\frac{1}{\sqrt{1-(v/c_p)^2}} \end{gathered} \tag{206}$$

$$D = D'\sqrt{1-(v/c_p)^2} \tag{207}$$

If linear factors dependent on x' are added to the transformation of time and position (198), (199), transformations with unknown coefficients a, b can be obtained

$$\begin{gathered} t_p = t'_p\frac{1}{\sqrt{1-(v/c_p)^2}} + ax' \\ x_p = vt'_p\frac{1}{\sqrt{1-(v/c_p)^2}} + bx' \end{gathered} \tag{208}$$

To determine the unknown coefficients a, b the reference event $(0, K', 0)_6$ was used (Figure 16). For the coordinate K', the analogous length contraction as for the coordinate D' will occur. Event 6, which in the system U' has position K', in the system U i.e. the ether, has position K. Therefore, having substituted coordinates of Event 6 into (208), we have

$$\begin{gathered} 0 = aK' \\ \sqrt{1-(v/c_p)^2}\,K' = bK' \end{gathered} \tag{209}$$

We obtain coefficients a and b

$$\begin{gathered} a = 0 \\ b = \sqrt{1-(v/c_p)^2} \end{gathered} \tag{210}$$

Finally, the transformation from any inertial system U' to the system U, associated with the ether takes the form

$$t = \frac{1}{\sqrt{1-(v/c)^2}} t' \tag{211}$$

$$x = \frac{1}{\sqrt{1-(v/c)^2}} vt' + \sqrt{1-(v/c)^2} \cdot x' \tag{212}$$

After transformations of the above equations, we obtain the inverse transformation, that is the transformation from the system U i.e from the ether, to the inertial system U'

$$t' = \sqrt{1-(v/c)^2} \cdot t \tag{213}$$

$$x' = \frac{1}{\sqrt{1-(v/c)^2}} \left(-vt + x\right) \tag{214}$$

The determined coordinate transformations (211)-(212) and (213)-(214) are consistent with the experience of Michelson-Morley. We will later prove that above transformations show that the measurement of the velocity of light in vacuum, by means of previously applied methods, will always give the average value equal to c. This is despite the fact that the velocity of light has a different value in different directions. In previous measurements of the velocity of light, only the average velocity of light, which travelled back and forth, was determined. This average velocity is always constant and independent of the inertial reference system (the sum of times t_{p1} and t_{p2} is always constant). The measurement of the velocity of light in one direction has never been carried out.

In deriving the transformation of STE have been applied two points K and K'. These points are at $t = 0$ next to each other. With those points known to be derived transformation STE associated with each location coordinates that are next to each other. Such property does not have a Lorentz transformation, which has been demonstrated in this book.

2.8. The geometrical derivation of the velocity of light

The premise of STE is the existence of the ether, in which light in vacuum moves at constant velocity c_p in each direction. The result of this assumption is that in inertial systems moving in the ether, the velocity of light is not constant and depends on the direction of the light flow and the velocity of the system in relation to the ether. In this section, we derived the model of light flow in vacuum and in the material medium such as glass. Formulas for time and velocity of light flow in any direction relative to the inertial reference frame were derived.

In the first part, formulas for light flow in parallel and perpendicularly to the direction of movement of the system are derived. In the second part, formulas for light flow in any direction.

The derived light flow model is based on the results of the Michelson-Morley experiment and many other similar experiments. In the conducted experiments, instruments in which light from the source travels a certain distance, is reflected in mirrors, and always comes back to the source point have been used. From this experiments, we know that the measured average velocity of light over the entire distance is the same regardless of the orientation of the device. The measured average velocity of light does not depend on the orientation of the instruments, even when light flows along various path sections, through different media.

We will also demonstrate that it is possible to construct model of the light flow, for which the results of the Michelson-Morley experiment are met, despite the fact that the ether exists and the velocity of light in the inertial reference system has different values depending on the direction of flow.

2.8.1. Time and path of the light flow in the ether

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2.8.2. Parallel velocity in vacuum

In this section, formulas for the flow time and the velocity of light in vacuum are derived, when the direction of the velocity of light is parallel to the direction of the velocity v of the inertial system in the ether.

We considered two cases, when the light has velocity consistent with velocity v of the system and opposite to v.

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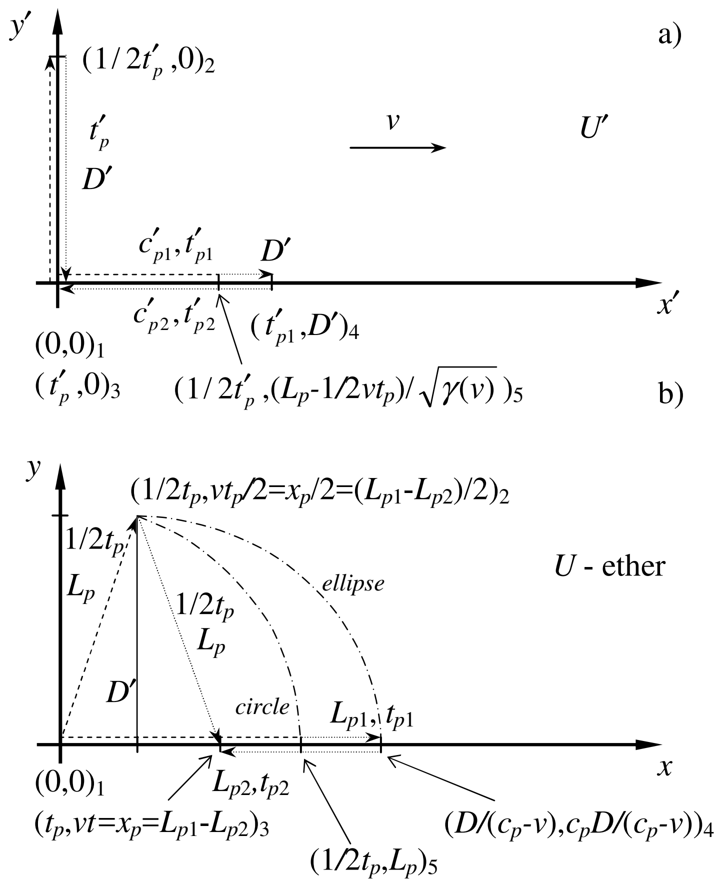

Fig. 18. The flow path of light, seen from the point of view of the system a) and the ether b)

The following designations have been adopted:

t_{p1}' - the flow time in the system U', when the velocity of light is consistent with v,
t_{p2}' - the flow time in the system U', when the velocity of light is opposite to v,
t_{p1} - the flow time in the ether, when the velocity of light is consistent with v,
t_{p2} - the flow time in the ether, when the velocity of light is opposite to v,
t_p' - total flow time of light seen from the system U' ($t_p'=t_{p1}'+t_{p2}'$),

t_p - total flow time of light seen from the ether ($t_p=t_{p1}+t_{p2}$),
L_{p1} - light path in the ether when the velocity of light is consistent with v,
L_{p2} - light path in the ether when the velocity of light is opposite to v,
D' - light path in the system U', in one direction,
D - light path parallel to v seen from the ether,
c_{p1}' - the velocity of light in the system U', when the velocity of light is consistent with v,
c_{p2}' - the velocity of light in the system U', when the velocity of light is opposed to v,
c_p - the velocity of light in the ether,
v - the velocity of the system U' in the ether.

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$$t'_{p1} = t_{p1}\sqrt{1-(v/c_p)^2} = t_{p1}\sqrt{\frac{c_p^2-v^2}{c_p^2}} = \frac{D'}{c_p^2}(c_p+v) \tag{229}$$

$$t'_{p2} = t_{p2}\sqrt{1-(v/c_p)^2} = t_{p2}\sqrt{\frac{c_p^2-v^2}{c_p^2}} = \frac{D'}{c_p^2}(c_p-v) \tag{230}$$

The measured velocity of light in the system U' is equal

$$c_p = \frac{2D'}{t'_p} \tag{231}$$

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$$t'_{p1} = \frac{D'}{c_p} + \frac{vD'}{c_p^2} = \frac{D'}{c_p} + \left(\frac{D'}{c_p}\right)^2 \frac{v}{D'} = \frac{1}{2}t'_p + \frac{1}{4}t'^2_p\frac{v}{D'} \tag{233}$$

$$t'_{p2} = \frac{D'}{c_p} - \frac{vD'}{c_p{}^2} = \frac{D'}{c_p} - \left(\frac{D'}{c_p}\right)^2 \frac{v}{D'} = \frac{1}{2}t'_p - \frac{1}{4}t'^2_p\frac{v}{D'} \tag{234}$$

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$$L_p = D'\sqrt{\frac{c_p^2}{c_p^2-v^2}} \tag{238}$$

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$$L_{p_2} = L_p - \frac{1}{2}vt_p \tag{242}$$

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$$L_{p1} = D'\sqrt{\frac{c_p + v}{c_p - v}} \tag{252}$$

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Having introduced t_{p1}', t_{p2}' from (229) and (230), we obtain

$$c'_{p1} = \frac{c_p^2}{c_p + v} \tag{255}$$

$$c'_{p2} = \frac{c_p^2}{c_p - v} \tag{256}$$

The resulting formulas are identical to (121) and (122). In dependence (256), there is no minus sign, because directions of velocity have not been taken into account here.

The average velocity of light flowing in the system U' in both directions is equal to the velocity of light in the ether c_p

$$c_{śr} = \frac{2D'}{\frac{D'}{c'_{p1}} + \frac{D'}{c'_{p2}}} = \frac{2D'}{\frac{(c_p + v)D'}{c_p^2} + \frac{(c_p - v)D'}{c_p^2}} = \frac{2D'c_p^2}{2D'c_p} = c_p \tag{257}$$

2.8.3. Parallel velocity in the material medium

In this section, the light flow in a material medium such as glass is considered. The light flow is analyzed in the same manner as in section 2.8.2 except that in this analysis, light flows in a different medium in one direction than the way back. A material medium is associated with the system U' and moves with it at velocity v.

Additional designations concerning the movement of light in the material medium are introduced:

- t_{s1}' - flow time in the medium as seen from system U', when the velocity of light is compatible with v,
- t_{s2}' - flow time in the medium as seen from system U', when the velocity of light is opposite to v,
- t_{s1} - flow time in the medium as seen from the ether, when the velocity of light is compatible with v,
- t_{s2} - flow time in the medium as seen from the ether, when the velocity of light is opposite to v,
- t_s' - the total time the light flow in the medium as seen from the system U',
- t_s - the total time the light flow in the medium as seen from the ether,
- L_{s1} - the light path in the medium as seen from the ether, while the velocity of light is compatible with v,
- L_{s2} - the light path in the medium as seen from the ether, when the velocity of light is opposite to v,
- c_{s1}' - the velocity of light in the medium as seen from the system U', when the velocity of light is compatible with v,
- c_{s2}' - the velocity of light in the medium as seen from the system U', when the velocity of light is opposite to v,
- c_s - the velocity of light in the medium that is resting in the ether.

The listed variables are shown in Figures 19 and 20.
We assume that for any direction of the light flow the following dependence is true

$$t'_{p1} + t'_{s2} = t'_{s1} + t'_{p2} = \frac{1}{2}(t'_p + t'_s) \tag{258}$$

< OUT OF ELECTRONIC VERSION >

$$L_{s1} = D'\sqrt{\frac{c_p^2}{c_p^2 - v^2}}\left[\frac{c_p c_s + c_p v}{c_p c_s}\right] \tag{265}$$

< OUT OF ELECTRONIC VERSION >

$$t_{s1} = D'\sqrt{\frac{c_p^2}{c_p^2 - v^2}}\,\frac{c_p^2 + c_s v}{c_p^2 c_s} \tag{270}$$

< OUT OF ELECTRONIC VERSION >

$$L_{s2} = D'\sqrt{\frac{c_p^2}{c_p^2 - v^2}}\left[\frac{c_p c_s - c_p v}{c_p c_s}\right] \tag{273}$$

< OUT OF ELECTRONIC VERSION >

$$t_{s2} = D'\sqrt{\frac{c_p^2}{c_p^2 - v^2}}\,\frac{c_p^2 - c_s v}{c_p^2 c_s} \tag{274}$$

Having introduced to the transformation of time from the ether to the system of equations (270), (274), we obtain

$$t'_{s1} = t_{s1}\sqrt{1 - (v/c_p)^2} = D'\left[\frac{c_p^2 + c_s v}{c_p^2 c_s}\right] \tag{275}$$

$$t'_{s2} = t_{s2}\sqrt{1 - (v/c_p)^2} = D'\left[\frac{c_p^2 - c_s v}{c_p^2 c_s}\right] \tag{276}$$

< OUT OF ELECTRONIC VERSION >

$$t'_{s1} = \frac{1}{2}t'_s + \frac{1}{4D'}vt'^2_p \tag{279}$$

$$t'_{s2} = \frac{1}{2}t'_s - \frac{1}{4D'}vt'^2_p \tag{280}$$

< OUT OF ELECTRONIC VERSION >

$$c'_{s1} = \frac{D'}{D'\left[\frac{c_p^2 + c_s v}{c_p^2 c_s}\right]} = \frac{c_p^2 c_s}{c_p^2 + c_s v} \tag{286}$$

$$c'_{s2} = \frac{D'}{D'\left[\frac{c_p^2 - c_s v}{c_p^2 c_s}\right]} = \frac{c_p^2 c_s}{c_p^2 - c_s v} \tag{287}$$

< OUT OF ELECTRONIC VERSION >

The average velocity of light in the system U' in both directions in the same medium is equal to the velocity of light in the medium associated with the ether

$$c_{śr/s} = \frac{2D'}{\frac{D'}{c'_{s1}} + \frac{D'}{c'_{s2}}} == \frac{2D'}{\frac{(c_p^2 + c_s v)D'}{c_p^2 c_s} + \frac{(c_p^2 - c_s v)D'}{c_p^2 c_s}} = \frac{2D'c_p^2 c_s}{2D'c_p^2} = c_s \tag{292}$$

2.8.4. The analysis of geometry for two media

< OUT OF ELECTRONIC VERSION >

2.8.5. The time of flow at any angle in vacuum

In this section, a model of the light flow in vacuum at any angle to the velocity v of the inertial system is derived. Times of the light flow back and forth are calculated. The angle between the direction of the light flow and velocity v is marked by $\alpha \in (0° \div 90°)$.

The following designations are adopted:

$t_{p1\alpha}$ - the flow time in the ether, when the velocity of light is consistent with v,
$t_{p2\alpha}$ - the flow time in the ether, when the velocity of light is opposite to v,
$L_{p1\alpha}$ - the light path in the ether when the velocity of light is consistent with v,
$L_{p2\alpha}$ - the light path in the ether when the velocity of light is opposite to v,
D' - the light path in the system U', in one direction,
D - the light path parallel to the v seen from the ether,
v - the velocity of system U' in the ether,
α - the angle between the direction of the light flow and velocity v,

These quantities are shown in Figure 21.

We assume that for all directions of the light flow, the flow time there and back is the same. So we have

$$t'_{p1\alpha} + t'_{p2\alpha} = t'_{p1} + t'_{p2} = t'_p \tag{311}$$

This assumption is included in Figure 21.

< OUT OF ELECTRONIC VERSION >

$$L_{p1\alpha} = D'\sqrt{\frac{c_p^2}{c_p^2 - v^2}}\sqrt{\left[\frac{v}{c_p} + \cos\alpha\right]^2 + \frac{c_p^2 - v^2}{c_p^2}\sin^2\alpha}, \quad \alpha \in (0^\circ \div 90^\circ) \tag{327}$$

< OUT OF ELECTRONIC VERSION >

$$L_{p2\alpha} = D'\sqrt{\frac{c_p^2}{c_p^2 - v^2}}\sqrt{\left[\frac{v}{c_p} - \cos\alpha\right]^2 + \frac{c_p^2 - v^2}{c_p^2}\sin^2\alpha}, \quad \alpha \in (0^\circ \div 90^\circ) \tag{329}$$

< OUT OF ELECTRONIC VERSION >

If we assume that angle α is the angle between the vector of velocity v and the vector of the light flow, then formulas (327) and (329) can be written as one formula for all angles

$$L_{p\alpha} = D'\sqrt{\frac{c_p^2}{c_p^2 - v^2}}\left[1 + \frac{v}{c_p}\cos\alpha\right], \quad \alpha \in (0^\circ \div 180^\circ) \tag{337}$$

The times of the light flow can be determined by dividing the path (327) and (329) by the velocity of light

$$t_{p1\alpha} = \frac{L_{p\alpha}}{c_p} = D'\sqrt{\frac{c_p^2}{c_p^2 - v^2}}\frac{1}{c_p}\left[1 + \frac{v}{c_p}\cos\alpha\right], \quad \alpha \in (0^\circ \div 90^\circ) \tag{338}$$

$$t_{p2\alpha} = \frac{L_{p\alpha}}{c_p} = D'\sqrt{\frac{c_p^2}{c_p^2 - v^2}}\frac{1}{c_p}\left[1 - \frac{v}{c_p}\cos\alpha\right], \quad \alpha \in (0^\circ \div 90^\circ) \tag{339}$$

If we assume that angle α is the angle between the vector of velocity v and the vector of the light flow, then the two above formulas can be written as one formula for all angles

$$t_{p\alpha} = \frac{L_{p\alpha}}{c_p} = D'\sqrt{\frac{c_p^2}{c_p^2 - v^2}}\frac{1}{c_p}\left[1 + \frac{v}{c_p}\cos\alpha\right], \quad \alpha \in (0^\circ \div 180^\circ) \tag{340}$$

2.8.6. The time of flow at any angle in the material medium

In this section, we consider the light flow in the material medium such as glass at any angle to velocity v of the inertial system. The light flow is analyzed in the same manner as in Section 2.8.5, except that in this analysis, light flows in one direction in a different medium than the way back. The material medium is associated with the system U' and moves with velocity v.

The angle between the direction of the light flow and velocity v is marked by $\alpha \in (0° \div 90°)$.

Additional markings concerning the movement of light in the material medium are introduced.

$t_{s1\alpha}'$ - the flow time in the inertial system U', when the velocity of light is consistent with v,
$t_{s2\alpha}'$ - the flow time in the inertial system U', when the velocity of light is opposite to v,

$t_{s1\alpha}$ - the flow time in the ether, when the velocity of light is consistent with v,
$t_{s2\alpha}$ - the flow time in the ether, when the velocity of light is opposite to v,
t_s' - the total flow time of light seen from the system U' ($t_p'=t_{p1\alpha}'+t_{p2\alpha}'$),
t_s - the total flow time of light seen from the ether ($t_p=t_{p1\alpha}+t_{p2\alpha}$),
$L_{s1\alpha}$ - the light path in the ether when the velocity of light is consistent with v,
$L_{s2\alpha}$ - the light path in the ether when the velocity of light is opposite to v,
D' - the light path in the system U', in one direction,
D - the light path parallel to the v seen from the ether,
$c_{s1\alpha}'$ - the velocity of light in the system U', when the velocity of light is consistent with v,
$c_{s2\alpha}'$ - the velocity of light in the system U', when the velocity of light is opposite to v,
c_s - the velocity of light in the ether.

These quantities are shown in Figures 22 and 23.
We assume that for any direction of the light flow the following occurs

$$t'_{p1\alpha}+t'_{s2\alpha}=t'_{s1\alpha}+t'_{p2\alpha}=t'_{p1}+t'_{s2}=t'_{s1}+t'_{p2}=\frac{1}{2}(t'_p+t'_s)c \tag{341}$$

Light flow paths in the system U' and in the system U, i.e. the ether are shown in Figures 22 and 23.

< OUT OF ELECTRONIC VERSION >

Having placed (348) and (321) to (344), we obtain

$$L_{s1\alpha}=D'\sqrt{\frac{c_p^2}{c_p^2-v^2}\left[\frac{v}{c_s}+\cos\alpha\right]^2+\sin^2\alpha},\quad \alpha\in(0^\circ\div 90^\circ) \tag{349}$$

Having placed (348) and (321) to (345), we obtain

$$L_{s2\alpha}=D'\sqrt{\frac{c_p^2}{c_p^2-v^2}\left[\frac{v}{c_s}-\cos\alpha\right]^2+\sin^2\alpha},\quad \alpha\in(0^\circ\div 90^\circ) \tag{350}$$

If we assume that angle α is the angle between the vector of velocity v and the vector of the light flow, then formulas (349) and (350) can be written as one formula for all angles

$$L_{s\alpha}=D'\sqrt{\frac{c_p^2}{c_p^2-v^2}}\sqrt{\left[\frac{v}{c_s}+\cos\alpha\right]^2+\frac{c_p^2-v^2}{c_p^2}\sin^2\alpha},\quad \alpha\in(0^\circ\div 180^\circ) \tag{351}$$

The velocity of light in the medium that moves in the ether is different than in the stationary medium. It depends on the direction of movement of the medium. Time of flow in the moving medium $t_{s1\alpha}$ is determined on the basis of the geometry of Figure 22 b)

< OUT OF ELECTRONIC VERSION >

$$t_{s1\alpha}=D'\sqrt{\frac{c_p^2}{c_p^2-v^2}}\left[\frac{c_p+c_s}{c_pc_s}-\frac{1}{c_p}\sqrt{\left[\frac{v}{c_p}-\cos\alpha\right]^2+\frac{c_p^2-v^2}{c_p^2}\sin^2\alpha}\right] \tag{361}$$

$$\alpha\in(0^\circ\div 90^\circ)$$

Having introduced dependence (359) and $t_{p1\alpha}$ to (352) on the basis of (339), we have

$$t_{s2\alpha} = D'\sqrt{\frac{c_p^2}{c_p^2 - v^2}}\left[\frac{c_p + c_s}{c_p c_s} - \frac{1}{c_p}\sqrt{\left[\frac{v}{c_p} + \cos\alpha\right]^2 + \frac{c_p^2 - v^2}{c_p^2}\sin^2\alpha}\right] \tag{363}$$

$$\alpha \in (0^\circ \div 90^\circ)$$

If we assume that angle α is the angle between the vector of velocity v and the vector of the light flow, then formulas (361) and (363) can be written as one formula for all angles

$$t_{s\alpha} = D'\sqrt{\frac{c_p^2}{c_p^2 - v^2}}\left[\frac{c_p + c_s}{c_p c_s} - \frac{1}{c_p}\sqrt{\left[\frac{v}{c_p} - \cos\alpha\right]^2 + \frac{c_p^2 - v^2}{c_p^2}\sin^2\alpha}\right] \tag{364}$$

$$\alpha \in (0^\circ \div 180^\circ)$$

Having applied (335), we obtain

< OUT OF ELECTRONIC VERSION >

$$t_{s\alpha} = D'\sqrt{\frac{c_p^2}{c_p^2 - v^2}}\left[\frac{1}{c_s} + \frac{v}{c_p^2}\cos\alpha\right] \tag{366}$$

$$\alpha \in (0^\circ \div 180^\circ)$$

2.8.7. The flow time in the inertial system

Having applied the transformation from the ether to the system to times (340) and (366), we obtain light flow times for an observer from the inertial reference system

$$t'_{p\alpha} = \frac{D'}{c_p}\left[1 + \frac{v}{c_p}\cos\alpha\right] \tag{367}$$

$$t'_{s\alpha} = \frac{D'}{c_p}\left[\frac{c_p}{c_s} + \frac{v}{c_p}\cos\alpha\right] \tag{368}$$

Light flow times in one direction can be expressed by total flow times in a homogeneous medium. Having placed $c_p=2D'/t_p'$, $c_s=2D'/t_s'$, we obtain

$$t'_{p\alpha} = D'\left[\frac{1}{2D'/t'_p} + \frac{v}{(2D'/t'_p)^2}\cos\alpha\right] = \frac{1}{2}t'_p + \frac{1}{4D'}vt'^2_p\cos\alpha \tag{369}$$

$$t'_{s\alpha} = D'\left[\frac{1}{2D'/t'_s} + \frac{v}{(2D'/t'_p)^2}\cos\alpha\right] = \frac{1}{2}t'_s + \frac{1}{4D'}vt'^2_p\cos\alpha \tag{370}$$

In the Michelson-Morley experiment, the total light flow times in two directions are compared. For the light flow in vacuum, the total time is equal to

$$t'_{p\alpha} + t'_{p(180-\alpha)} = \frac{1}{2}t'_p + \frac{1}{4D'}vt'^2_p\cos\alpha + \frac{1}{2}t'_p + \frac{1}{4D'}vt'^2_p\cos(180-\alpha) = t'_p \tag{371}$$

For the light flow in the material medium, the total flow time is equal to

$$t'_{s\alpha}+t'_{s(180-\alpha)}=\frac{1}{2}t'_s+\frac{1}{4D'}vt'^2_p\cos\alpha+\frac{1}{2}t'_s+\frac{1}{4D'}vt'^2_p\cos(180-\alpha)=t'_s \tag{372}$$

For the light flow in mixed media, medium-vacuum, the total flow time is equal to

$$\begin{aligned}&t'_{s\alpha}+t'_{p(180-\alpha)}=\\&=\frac{1}{2}t'_s+\frac{1}{4D'}vt'^2_p\cos\alpha+\frac{1}{2}t'_p+\frac{1}{4D'}vt'^2_p\cos(180-\alpha)=\frac{1}{2}(t'_s+t'_p)\end{aligned} \tag{373}$$

For the light flow in mixed media, vacuum-medium, the total flow time is equal to

$$\begin{aligned}&t'_{p\alpha}+t'_{s(180-\alpha)}=\\&=\frac{1}{2}t'_p+\frac{1}{4D'}vt'^2_p\cos\alpha+\frac{1}{2}t'_s+\frac{1}{4D'}vt'^2_p\cos(180-\alpha)=\frac{1}{2}(t'_p+t'_s)\end{aligned} \tag{374}$$

From the above dependencies, it follows that the presented light flow model is consistent with the results of the Michelson-Morley experiment. We have shown that the total light flow time in both directions does not depend on the angle α between the direction of the velocity of light and the direction of velocity v of the inertial system in ether. The total time does not also depend on the value of velocity v. For this reason, the rotation of the interferometer arms in the Michelson-Morley experiment does not result in any changes in interference fringes.

We explained the results of the Michelson-Morley experiment on the basis of the ether. The assertion repeated in STR that the result of the Michelson-Morley experiment denies the existence of the ether is not true.

2.8.8. The light flow velocity in the system

< OUT OF ELECTRONIC VERSION >

The velocity of light in the system U' at any angle in vacuum $c_{p\alpha}$ and medium $c_{s\alpha}$ on the basis of (367) and (368) can be written as

$$c'_{p\alpha}=\frac{c_p^2}{c_p+v\cos\alpha} \tag{377}$$

$$c'_{s\alpha}=\frac{c_p^2c_s}{c_p^2+c_sv\cos\alpha} \tag{378}$$

< OUT OF ELECTRONIC VERSION >

Figure 24 presents the velocity of light in vacuum, seen from the inertial system according to equation (477).

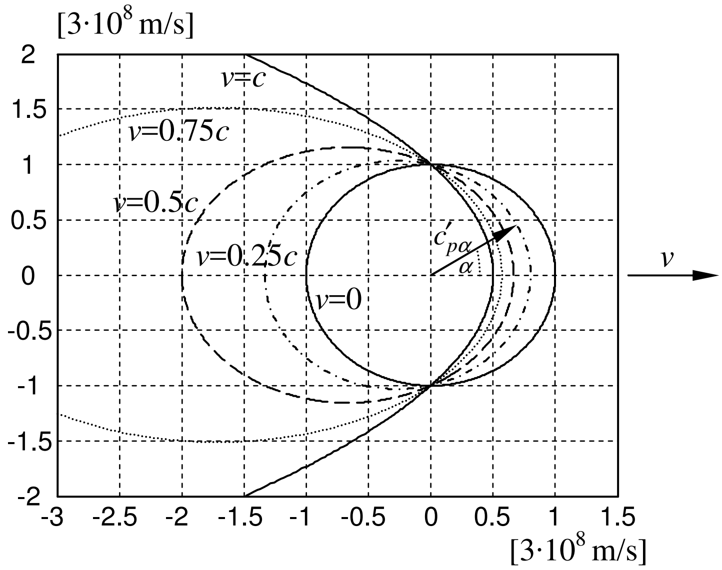

Fig. 24. The velocity of light $c_{p\alpha}$ for v=0, 0.25c, 0.5c, 0.75c, c

Figure 25 shows the path travelled by light in the Michelson-Morley experiment, and in some experiments measuring the velocity of light in the material medium. The velocity of light is measured from the system U' moving in the ether at velocity v.

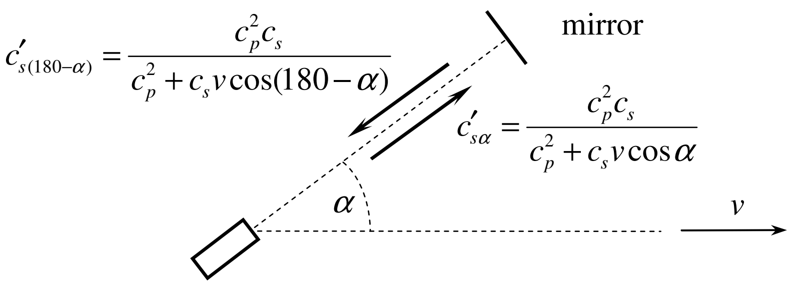

Fig. 25. The velocity of light in the Michelson-Morley experiment

Light travels the path with length L to the mirror, is reflected and returns to the source point travelling the same path. The average velocity of light in accordance with (378) is

$$c'_{sr} = \frac{2L}{t'_{s\alpha} + t'_{s(180-\alpha)}} = \frac{2L}{\dfrac{L}{\dfrac{c_p^2 c_s}{c_p^2 + c_s v\cos\alpha}} + \dfrac{L}{\dfrac{c_p^2 c_s}{c_p^2 + c_s v\cos(180-\alpha)}}} \tag{379}$$

$$c'_{sr} = \frac{2}{\dfrac{c_p^2 + c_s v\cos\alpha}{c_p^2 c_s} + \dfrac{c_p^2 - c_s v\cos\alpha}{c_p^2 c_s}} = \frac{2}{\dfrac{2c_p^2}{c_p^2 c_s}} = c_s \tag{380}$$

The average velocity of light is constant and equal to the velocity of light c_s in the stationary material medium related to the ether. It does not depend on the angle α nor velocity v. For this reason, the rotation of the interferometer arms in the Michelson-Morley experiment does no influence interference fringes.

2.8.9. The light flow velocity in the ether

< OUT OF ELECTRONIC VERSION >

2.8.10. The light flow simulation

The section presents the results of a simulation of the light flow on a closed path that is composed of six lines L_1 to L_6 as in figure 26.

< OUT OF ELECTRONIC VERSION >

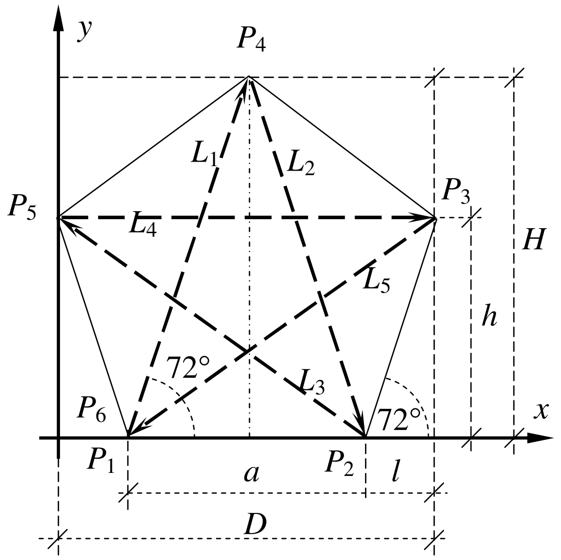

Fig. 26. A plan of the path along which light flows onto the plane x-y

< OUT OF ELECTRONIC VERSION >

2.9. Conclusions

Transformations of STE were derived in several ways. The geometric method and the analytical method lead to the same transformations, and to the same kinematics model in space.

An important property of STE transformations is that if in some inertial reference system U_1 clocks will be synchronized, they also become synchronized for an observer from other inertial system U_2. they indicate the same time. The system U_1 clocks go at a different pace than the system U_2 clocks, but show the same time for an observer from every frame of reference. Therefore, in STE events simultaneous for an observer from some inertial reference system, are simultaneous for observers from all other frames of reference. In STE simultaneity of events is absolute.

By the example of the performed simulation of the light flow we have shown that even when the light flows along a complicated closed trajectory, then the average flow velocity is always exactly the same as the velocity of light c in the ether. Along some path sections, light travels at higher velocities, and along other at smaller velocities. But always differences in velocity are compensated and the average velocity of light is constant. Because of this property of the velocity of light, it is not possible to detect the ether or demonstrate that light has different velocities in different directions and in different reference frames by means of experiments in which light travels along a closed trajectory.

3. Dynamics in the Special Theory of Ether

3.1. Initial Arrangements

In this section, four models of dynamics of bodies were deduced. Each of them is based on a different premise.

The first model assumes that the change in momentum of a body is the same for an observer from every inertial reference system (Section 3.2). The momentum in classical mechanics outlined in Section 0 has such property (formula (1023)).

The second model assumes that force causing the acceleration of a body is the same for an observer from every inertial reference system (Section 3.3). The same is true in classical mechanics.

In the third model, we assume that the change in the kinetic energy of a body is the same for an observer from every inertial reference system (Section 3.4). In classical mechanics, the kinetic energy has no such property as (1032)-(1033) occurs.

In the fourth model, we assume that body weight is the same for an observer from every inertial reference system (Section 3.5). The same is true in classical mechanics.

< OUT OF ELECTRONIC VERSION >

3.2. STE with the constant change in the momentum (STE/Δ*p*)

In this section, a model of dynamics of bodies based on the assumption that the change in momentum of the body is the same for an observer from every inertial system will be derived.

3.2.1. Relativistic mass in STE/Δ*p*

< OUT OF ELECTRONIC VERSION >

Hence, we obtain a formula for relativistic mass of the body that is located in the system U_2 and is seen from the system U_1, when the principle of conservation of the momentum changes is satisfied (404) as below

$$m_{2/1}^{\Delta p} = m_0 \frac{\gamma(v_1)}{\gamma(v_2)} = m_0 \frac{\gamma(v_1)}{\gamma(v_1 + v_{2/1}\gamma(v_1))} \tag{407}$$

< OUT OF ELECTRONIC VERSION >

3.2.2. The momentum relative to system STE/Δ*p*

< OUT OF ELECTRONIC VERSION >

Finally, we obtain the dependence for the momentum

$$p_{2/1}^{\Delta p} = \frac{m_0 c}{2} \ln\left(\frac{(c - v_1)(c + v_2)}{(c - v_2)(c + v_1)} \right) \tag{419}$$

In equation (419), the momentum is expressed by the absolute velocity v_1 and v_2. On the basis of (141) and (142), the momentum can be expressed by the absolute velocity v_1 and the relative velocity $v_{2/1}$

< OUT OF ELECTRONIC VERSION >

$$p_{2/1}^{\Delta p} = \frac{m_0 c}{2} \ln\left(\frac{c^2 + v_{2/1}(c - v_1)}{c^2 - v_{2/1}(c + v_1)} \right) \tag{421}$$

< OUT OF ELECTRONIC VERSION >

3.2.3. The momentum in the ether in STE/Δ*p*

< OUT OF ELECTRONIC VERSION >

3.2.4. The momentum for small velocity in STE/Δ*p*

< OUT OF ELECTRONIC VERSION >

3.2.5. The kinetic energy relative to system in STE/Δ*p*

< OUT OF ELECTRONIC VERSION >

Finally, the formula for kinetic energy takes the form of

$$E_{2/1}^{\Delta p} = \frac{m_0 c^2}{2} \ln\left[\left(\frac{c + v_1}{c + v_2} \right)^{\frac{c}{c - v_1}} \left(\frac{c - v_1}{c - v_2} \right)^{\frac{c}{c + v_1}} \right] \tag{2}$$

In equation (441), energy is expressed by the absolute velocities v_1 and v_2. On the basis of (141) and (142), the kinetic energy can be expressed by the absolute velocity v_1 and the relative velocity $v_{2/1}$

$$E_{2/1}^{\Delta p} = \frac{m_0 c^2}{2} \ln\left[\left(\frac{c^2}{c^2 + v_{2/1}(c - v_1)} \right)^{\frac{c}{c - v_1}} \left(\frac{c^2}{c^2 - v_{2/1}(c + v_1)} \right)^{\frac{c}{c + v_1}} \right] \tag{442}$$

< OUT OF ELECTRONIC VERSION >

3.2.6. The kinetic energy relative to the ether in STE/Δ*p*

< OUT OF ELECTRONIC VERSION >

3.2.7. The kinetic energy for small velocities in STE/Δ*p*

< OUT OF ELECTRONIC VERSION >

3.2.8. The law of the momentum in STE/Δ*p*

< OUT OF ELECTRONIC VERSION >

Finally, the dependence allowing to calculate the momentum between inertial systems (the law of the momentum)

$$p_{3/1}^{\Delta p} = p_{3/2}^{\Delta p} + p_{2/1}^{\Delta p} \tag{462}$$

This law is the same as in classical mechanics (1026).

* * *

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3.2.9. The law of the momentum change in STE/Δ*p*

< OUT OF ELECTRONIC VERSION >

3.2.10. Another property of the momentum in STE/Δ*p*

< OUT OF ELECTRONIC VERSION >

3.2.11. The law of the kinetic energy in STE/Δ*p*

< OUT OF ELECTRONIC VERSION >

Finally, we obtain a dependence that allows to calculate the kinetic energy between inertial systems (the law of the kinetic energy)

$$E_{3/1}^{\Delta p} - E_{2/1}^{\Delta p} = \frac{c^2 - v_2^2}{c^2 - v_1^2} E_{3/2}^{\Delta p} + v_{2/1} p_{3/2}^{\Delta p} \tag{494}$$

< OUT OF ELECTRONIC VERSION >

3.2.12. The law of the kinetic energy change in STE/Δp

< OUT OF ELECTRONIC VERSION >

3.3. STE with constant force (STE/F)

In this section, a model of dynamics of bodies based on the assumption that the force accelerating of the body is the same for an observer from every inertial system will be derived.

3.3.1. The relativistic mass in STE/F

< OUT OF ELECTRONIC VERSION >

Hence, we obtain the formula for the relativistic mass for the body that is located in the system U_2 and is seen from the system U_1, when the principle of conservation of force (499) is satisfied

$$m_{2/1}^{F} = m_0 \left[\frac{\gamma(v_1)}{\gamma(v_2)} \right]^{3/2} = m_0 \left[\frac{\gamma(v_1)}{\gamma(v_1 + v_{2/1}\gamma(v_1))} \right]^{3/2} \tag{502}$$

< OUT OF ELECTRONIC VERSION >

3.3.2. The momentum relative to system w STE/F

< OUT OF ELECTRONIC VERSION >

Finally, we obtain dependence for the momentum

$$p_{2/1}^{F} = m_0 \sqrt{\frac{c^2 - v_1^2}{c^2 - v_2^2}} \cdot v_2 - m_0 v_1 \tag{514}$$

3.3.3. The momentum in the ether in STE/F

For velocity v_1=0, (514) is the momentum that is seen from the ether

$$p_{2/E}^{F} = m_0 v_2 \frac{1}{\sqrt{1 - (v_2 / c)^2}} \tag{3}$$

The formula is identical as the formula for the momentum occurring in STR. The reason for this is that in the Special Theory of Relativity, the Lorentz transformations are misinterpreted, and all considerations are unconsciously conducted from the viewpoint of the ether. In STR, this formula expresses the momentum in relation to the ether, and not in relation to any inertial reference system. We explain this in Chapter 4.

3.3.4. The momentum for small velocities in STE/*F*

< OUT OF ELECTRONIC VERSION >

3.3.5. The kinetic energy relative to the system in STE/*F*

< OUT OF ELECTRONIC VERSION >

Finally, the formula for kinetic energy takes the form

$$E_{2/1}^{F} = m_0 c^2 \left[\frac{c^2 - v_1 v_2}{\sqrt{c^2 - v_1^2}\sqrt{c^2 - v_2^2}} - 1 \right] \tag{530}$$

3.3.6. The kinetic energy relative to the ether in STE/*F*

If we assume that the system U_1 rests in the ether, then it is true that v_1=0. Kinetic energy (530) takes the form

$$E_{2/E}^{F} = m_0 \frac{c^3}{\sqrt{c^2 - v_2^2}} - m_0 c^2 \tag{531}$$

$$E_{2/E}^{F} = m_0 c^2 \frac{1}{\sqrt{1 - (v_2 / c)^2}} - m_0 c^2 \tag{532}$$

This energy is the same as the kinetic energy in STR. This is because the kinetic energy in STR is derived under the assumption that a body is accelerated by a constant force from the point of view of its system [4]. Therefore, the reasoning conducted in STR is analogous to that in STE/*F*. In STR only formula (532) has been obtained instead of the general formula (530). The reason of this is that in STR, the Lorentz transformations are misinterpreted, and all considerations are unconsciously conducted from the viewpoint of the ether. In STR, the formula for the kinetic energy expresses the kinetic energy relative to the ether and not relative to any inertial reference system. We explain this in Chapter 4.

3.3.7. The kinetic energy for small velocities in the model STE/*F*

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3.3.8. The law of the momentum in STE/*F*

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On this basis, we obtain the law of the momentum

$$p_{3/1}^{F} = \frac{\sqrt{c^2 - v_1^2}}{\sqrt{c^2 - v_2^2}} p_{3/2}^{F} + p_{2/1}^{F} \tag{543}$$

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3.3.9. The law of the momentum change in STE/F

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3.4. STE with the constant force to change of time (STE/F/Δt)

In this section, a model of dynamics of bodies based on the assumption that the force divided by the increment of time of the body is the same for an observer from every inertial system will be derived.

3.4.1. Relativistic mass in STE/F/Δt

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Hence, we obtain the formula for the relativistic mass, for the body that is located in the system U_2 and is seen from the system U_1, when the principle of conservation change in the kinetic energy is satisfied (553)

$$m_{2/1}^{F/\Delta t} = m_0 \left[\frac{\gamma(v_1)}{\gamma(v_2)} \right]^2 = m_0 \left[\frac{\gamma(v_1)}{\gamma(v_{2/1}\gamma(v_1) + v_1)} \right]^2 \tag{556}$$

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3.4.2. The momentum relative to the system in STE/F/Δt

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Finally, we obtain dependence for the momentum

$$p_{2/1}^{F/\Delta t} = \frac{m_0 c}{2} \left[\frac{(v_2 - v_1)(c^2 + v_1 v_2)}{c(c^2 - v_2^2)} - \frac{c^2 - v_1^2}{2c^2} \ln \frac{(c+v_1)(c-v_2)}{(c-v_1)(c+v_2)} \right] \tag{568}$$

3.4.3. The momentum in the ether in STE/F/Δt

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3.4.4. The kinetic energy relative to system in STE/F/Δt

< OUT OF ELECTRONIC VERSION >

Finally, the formula for kinetic energy takes the form

$$E_{2/1}^{F/\Delta t}=\frac{m_0c^2}{2}\left[\frac{v_2(v_2-v_1)}{c^2-v_2^2}+\frac{v_1}{2c}\ln\frac{(c+v_1)(c-v_2)}{(c-v_1)(c+v_2)}\right] \tag{582}$$

3.4.5. The kinetic energy relative to the ether in STE/F/Δt

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3.4.6. The law of the momentum in STE/F/Δt

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Finally, the law of the momentum has the form

$$p_{3/1}^{F/\Delta t}=\frac{c^2-v_1^2}{c^2-v_2^2}\,p_{3/2}^{F/\Delta t}+p_{2/1}^{F/\Delta t} \tag{598}$$

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3.4.7. The law of the kinetic energy in STE/F/Δt

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Finally, the law of energy (610) has the form

$$E_{3/1}^{F/\Delta t}-E_{2/1}^{F/\Delta t}=E_{3/2}^{F/\Delta t}+v_{2/1}\frac{c^2-v_1^2}{c^2-v_2^2}\,p_{3/2}^{F/\Delta t} \tag{619}$$

3.4.8. The law of the kinetic energy change in STE/F/Δt

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3.5. STE with constant mass (STE/m)

In this section, a model of dynamics of bodies based on the assumption that body weight is the same for an observer from each inertial reference system will be derived. Therefore, for an observer from the inertial system U_1, the body mass located in the system U_2 is the same as the rest mass.

$$m^m_{2/1} = m_0 \tag{623}$$

3.5.1. The momentum relative to the system in STE/m

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Finally, we obtain a dependence for the momentum

$$p^m_{2/1} = m_0 \frac{v_2 - v_1}{\gamma(v_1)} = m_0 \frac{v_2 - v_1}{1-(v_1/c)^2} = m_0 v_{2/1} \tag{637}$$

The formula for the momentum, expressed by the relative velocity is identical to the formula in classical mechanics.

3.5.2. The momentum in the ether in STE/m

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3.5.3. The kinetic energy relative to the system in STE/m

< OUT OF ELECTRONIC VERSION >

Finally, we obtain the kinetic energy

$$E^m_{2/1} = \frac{m_0 v^2_{2/1}}{2} = \frac{m_0}{2}\left[\frac{v_2 - v_1}{\gamma(v_1)}\right]^2 = \frac{m_0}{2}\left[\frac{v_2 - v_1}{1-(v_1/c)^2}\right]^2 \tag{632}$$

The formula for the kinetic energy expressed by the relative velocity is identical to the formula in classical mechanics.

3.5.4. The kinetic energy relative to the ether in STE/m

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3.5.5. The right to the momentum in STE/m

< OUT OF ELECTRONIC VERSION >

Finally, the law of the momentum takes the form

$$p^m_{3/1} = \frac{c^2 - v_2^2}{c^2 - v_1^2} p^m_{3/2} + p^m_{2/1} \tag{642}$$

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3.5.6. The law of the momentum change in STE/m

< OUT OF ELECTRONIC VERSION >

3.5.7. Another property of the momentum in STE/m

< OUT OF ELECTRONIC VERSION >

3.5.8. The law of the kinetic energy in STE/m

< OUT OF ELECTRONIC VERSION >

3.6. Summary of the momentums and the kinetic energy

In general case, the relativistic mass of the body resting in the system U_2 that is seen from the system U_1 can be defined as

$$m_{2/1}^{(x)} = m_0 \left[\frac{\gamma(v_1)}{\gamma(v_2)} \right]^x, \qquad x \geq 0 \tag{678}$$

In Figure 33, vectors of the momentum, seen from the ether, are summarized.

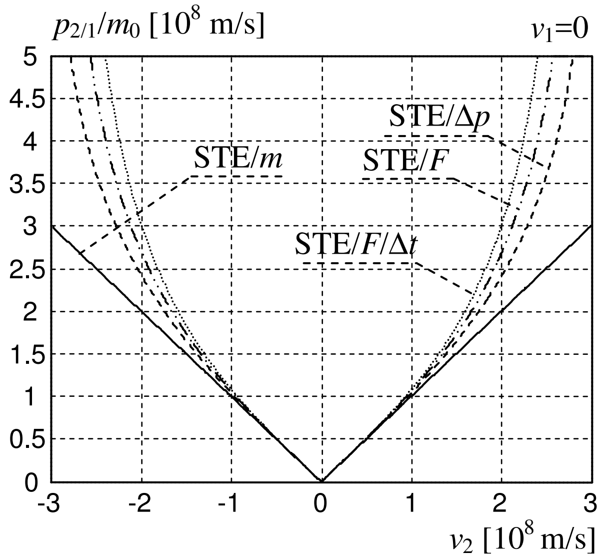

Fig. 33. The momentum in STE/Δp, STE/F, STE/ΔE and STE/m for v_1=0 (relative to the ether)

In Figure 34, vectors of the momentum that is seen from the system U_1 moving in the ether at velocity v_1=0.4c are summarized.

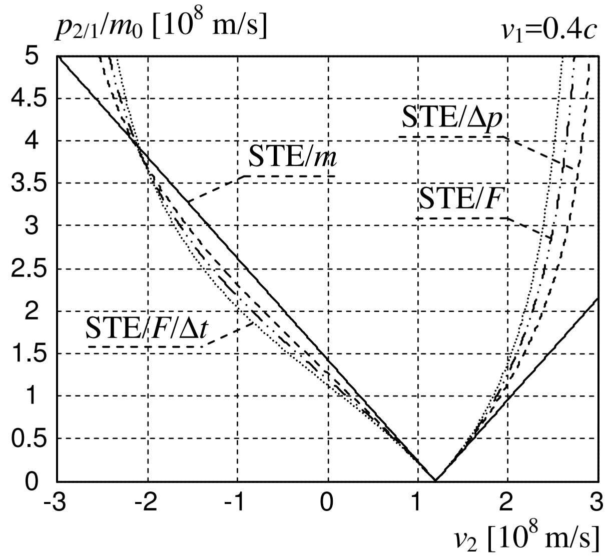

Fig. 34. The momentum in STE/Δp, STE/F, STE/ΔE and STE/m for v_1=0.4c

In Figure 35, kinetic energies, seen from the ether, are summarized.

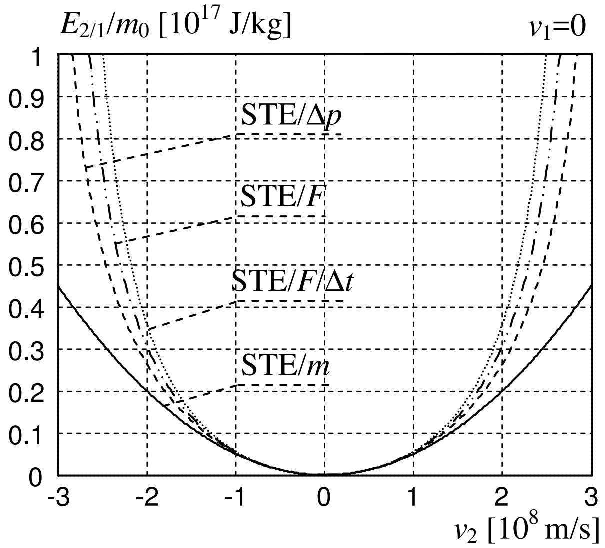

Fig. 35. Kinetic energies in STE/Δ*p*, STE/*F*, STE/Δ*E* and STE/*m* for v_1=0 (relative to the ether)

In Figure 36, vectors of the momentum that is seen from the system U_1 moving in the ether at velocity v_1=0.4*c* are summarized.

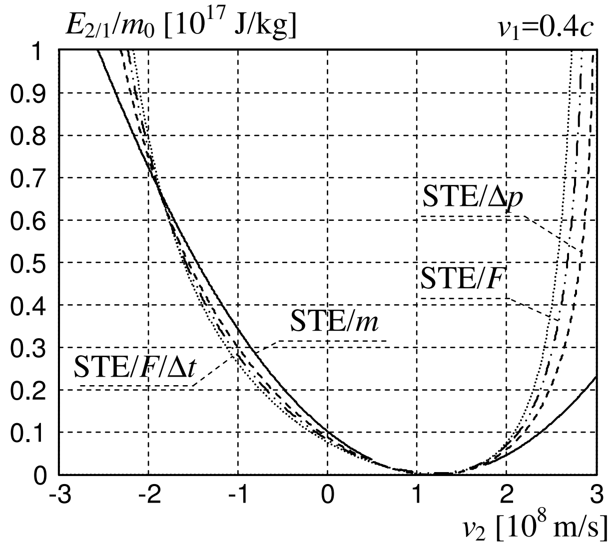

Fig. 36. Kinetic energies in STE/Δ*p*, STE/*F*, STE/Δ*E* and STE/*m* for v_1=0.4*c*

A summary made for derived formulas for the momentum and the kinetic energy:

x=1

$$p_{2/1}^{\Delta p}=\frac{m_0 c}{2}\ln\left(\frac{(c-v_1)(c+v_2)}{(c-v_2)(c+v_1)}\right) \tag{679}$$

$$E_{2/1}^{\Delta p}=\frac{m_0 c^2}{2}\ln\left[\left(\frac{c+v_1}{c+v_2}\right)^{\frac{c}{c-v_1}}\left(\frac{c-v_1}{c-v_2}\right)^{\frac{c}{c+v_1}}\right] \tag{680}$$

***x*=3/2**

$$p_{2/1}^{F} = m_0 \sqrt{\frac{c^2 - v_1^2}{c^2 - v_2^2}} \cdot v_2 - m_0 v_1 \tag{681}$$

$$E_{2/1}^{F} = m_0 c^2 \left[\frac{c^2 - v_1 v_2}{\sqrt{c^2 - v_1^2}\sqrt{c^2 - v_2^2}} - 1 \right] \tag{682}$$

***x*=2**

$$p_{2/1}^{F/\Delta t} = \frac{m_0 c}{2} \left[\frac{(v_2 - v_1)(c^2 + v_1 v_2)}{c(c^2 - v_2^2)} - \frac{c^2 - v_1^2}{2c^2} \ln \frac{(c + v_1)(c - v_2)}{(c - v_1)(c + v_2)} \right] \tag{683}$$

$$E_{2/1}^{F/\Delta t} = \frac{m_0 c^2}{2} \left[\frac{v_2 (v_2 - v_1)}{c^2 - v_2^2} + \frac{v_1}{2c} \ln \frac{(c + v_1)(c - v_2)}{(c - v_1)(c + v_2)} \right] \tag{684}$$

***x*=0**

$$p_{2/1}^{m} = m_0 \frac{v_2 - v_1}{1 - (v_1 / c)^2} = m_0 v_{2/1} \tag{685}$$

$$E_{2/1}^{m} = \frac{m_0}{2} \left[\frac{v_2 - v_1}{1 - (v_1 / c)^2} \right]^2 = \frac{m_0 v_{2/1}^2}{2} \tag{686}$$

3.7. Conclusions

In the chapter, four descriptions of dynamics of bodies in space have been derived. Each of them is based on a different assumption that comes down to the definition of the relativistic mass. In any case, we obtained other dependencies for the momentum and the kinetic energy.

Unresolved is whether the descriptions of dynamics of bodies in space are different models of the same reality or whether they are models of other realities.

It is possible that the solution to this problem is possible only through experimentation.

In Figure 36, it is shown that the values of the kinetic energy of the body at the set velocity are different for different descriptions of dynamics. However, the body has a specific kinetic energy. From this, it can be concluded that only one of the descriptions of dynamics can be a model of the real dynamics of bodies. Perhaps, however, it is possible to introduce the relativistic energy unit, which will compensate for differences in the kinetic energy of various descriptions of dynamics.

4. What is the Special Theory of Relativity (STR)

The basic dependence in STR is the Lorentz transformation. Its derivation is presented in Chapter 10 in two ways. Systems move relative to each other as shown in Figure 37.

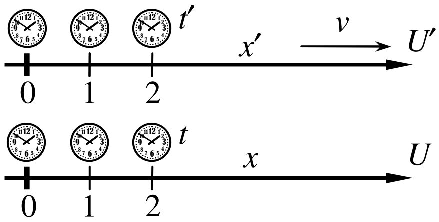

Fig. 37. The relative movement of inertial systems U and U' in STR

The transformation of STR from the inertial system U' to the system U, has the form (1064)–(1065)

$$t = \frac{1}{\sqrt{1-(v/c)^2}}(t' + \frac{v}{c^2}x') \tag{787}$$

$$x = \frac{1}{\sqrt{1-(v/c)^2}}(vt' + x') \tag{688}$$

The transformation of STR from the inertial system U to the system U', has the form (1066)-(1067)

$$t' = \frac{1}{\sqrt{1-(v/c)^2}}(t - \frac{v}{c^2}x) \tag{689}$$

$$x' = \frac{1}{\sqrt{1-(v/c)^2}}(-vt + x) \tag{690}$$

4.1. Deterioration of the Galilean transformation

In this section, it will be shown what the deterioration of the transformation on the example of the Galilean transformation is. Such a deteriorated transformation is the Lorenz transformation. In the next section, we will show that the transformation of STR (Lorentz) can be obtained by deteriorating the transformation of STE.

Let us consider systems U and U' moving relative to each other at velocity v two systems U and U' as shown in Figure 38. In classical mechanics, the relative velocity of systems is the same. Therefore, v is the velocity of the system U' relative to U, and at the same time, the velocity of the system U relative to U'. We assume that at $t=t'=0$ the origins of systems overlap. Then, the Galilean transformation of the system U' to the system U has the form

$$t = t' \tag{691}$$

$$x = vt' + x' \tag{693}$$

The reverse Galilean transformation has the form

$$t' = t \tag{693}$$

$$x' = -vt + x \tag{694}$$

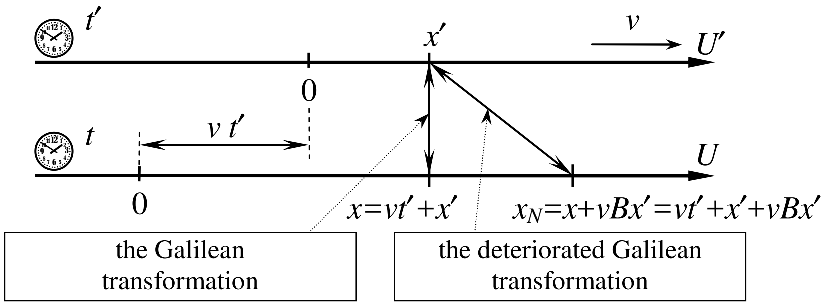

Fig. 38. The deterioration of the Galilean transformation

At the time $t=t'$, the point x' from the system U' is in the system U at position x. The Galilean transformation binds together coordinates x and x' which are next to each other. We introduce parameter $B>0$, that has a dimension opposite to velocity [s/m]. After some time $\Delta t=Bx'$ point x' is in the system U in position $x_N=x+\Delta x=x+vBx'$. We can deteriorate the Galilean transformation in such a way that we will bind point x' with the point x_N next to which it will be in the future (or in the past) by means of this transformation

$$t_N = t + \Delta t = t' + Bx' \tag{695}$$

$$x_N = x + \Delta x = vt' + x' + vBx' \tag{696}$$

Hence, we obtain the deteriorated Galilean transformation

$$t_N = t' + Bx' \tag{697}$$

$$x_N = vt' + (1+vB)x' \tag{698}$$

The deteriorated Galilean transformation determines which position point x' in the system U will have after some time, depending on the value x'. If $x'>0$, then it is transformed into its position in the future. If $x'<0$, then it is transformed into its position in the past. Only point $x'=0$ is transformed to the present position.

From the deteriorated transformation, the inverse transformation can be determined. It suffices to solve the system (697)-(698) relative to t' and x'. We obtain then

$$t' = (1+vB)t_N - Bx_N \tag{699}$$

$$x' = -vt_N + x_N \tag{700}$$

Equation (694) from the Galilean transformation and (700) from the deteriorated Galilean transformation are identical in form. This is despite the fact that x_N is the position of coordinate x' at time t_N, other than the position of x at different time t. In the next section, it will be shown that the same is true in the case of the Lorentz transformation.

We say that the system, for which the position and times have been modified in the transformation to x_N and t_N, is a system rescaled. In the example above the system U' is unchanged, while the system U is rescaled.

As it has already been written before, parameter B is expressed in units of the inverse velocity. You can, for example, assume $B_1=v/c^2$. Then, the deteriorated Galilean transformation has the form

$$t_{N_1} = t' + \frac{v}{c^2} x' \tag{701}$$

$$x_{N_1} = vt' + (1 + \frac{v^2}{c^2}) x' \tag{702}$$

and the deteriorated inverse Galilean transformation has the form

$$t' = (1 + \frac{v^2}{c^2}) t_{N_1} - \frac{v}{c^2} x_{N_1} \tag{703}$$

$$x' = -vt_{N_1} + x_{N_1} \tag{704}$$

On the basis of equations (701)-(704), it is difficult to notice that this is the Galilean transformation written in a different form. The Galilean transformation calculates coordinates from one system to another in a very simple way. The deteriorated Galilean transformation calculates the system coordinates in a way that is very complicated. Coordinates from the system U' are converted to the system U in the future or in the past. Time t_N, calculated from the transformation, depends not only on time t', but also on the position of x'.

Let us consider now the case when B_2=1/v. Then, the deteriorated Galilean transformation has the form

$$t_{N_2} = t' + \frac{1}{v} x' \tag{705}$$

$$x_{N_2} = vt' + (1 + v\frac{1}{v}) x' = vt' + 2x' \tag{706}$$

The deteriorated inverse Galilean transformation has the form

$$t' = 2t_{N_2} - \frac{1}{v} x_{N_2} \tag{707}$$

$$x' = -vt_{N_2} + x_{N_2} \tag{708}$$

Let us consider the case of transformation (707)-(708), when velocity v=1m/s. In this case, the deteriorated Galilean transformation takes the form (with an accuracy of units)

$$t_{N_2} = t' + x' \tag{709}$$

$$x_{N_2} = t' + 2x' \tag{710}$$

The deteriorated inverse Galilean transformation has the form (with an accuracy of units)

$$t' = 2t_{N_2} - x_{N_2} \tag{711}$$

$$x' = -t_{N_2} + x_{N_2} \tag{712}$$

The manner in which the deteriorated Galilean transformations convert coordinates is shown in Figure 39. Arrows connecting coordinates of systems U and U' demonstrate which coordinates are bound with each other by the deteriorated transformation.

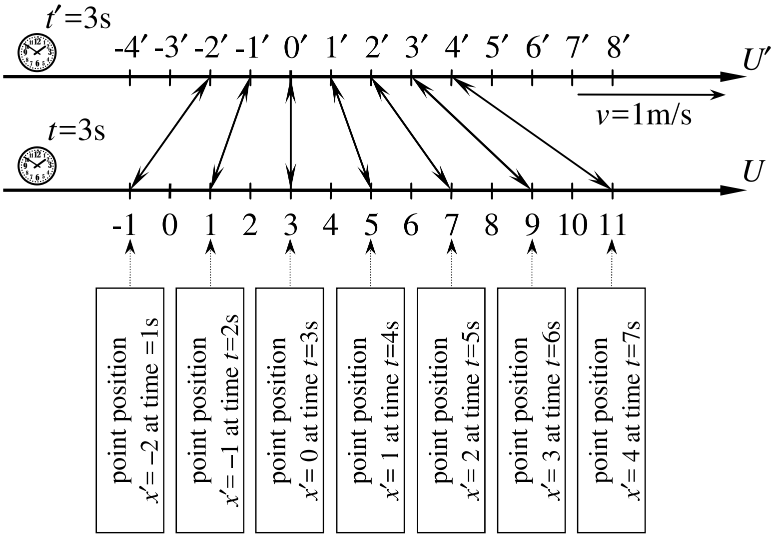

Fig. 39. The deteriorated Galilean transformation for B_2=1/v, and v=1m/s

For coordinates x'=1′m and t'=3s, we obtain (709)-(710) values x=5m and t=4s from transformations. However, points 1′ and 5 are not in the current time (t=t'=3s) next to each other. These points will be next to each other only at the calculated time t=4s, that is, in the future. Similarly, point x'=2′m, for which we obtain the values x=7m and t=5s. This means that the point 2′ is next to point 7 at time t=5s.

It follows that coordinates of the system U' are transformed to the system U at another instant of time. They are transformed into the past or the future. Only coordinate x'=0 jest is properly transformed to the present. The Lorentz transformation has the same property. For this reason, it is misinterpreted in STR. In STR, It is mistakenly believed that all coordinates of the system U' and the system U related by the Lorentz transformation are next to each other at the same moment of time.

If in positions 1′ and 2′ of the system U', at time t'=3 two events A and B will occur, they will be simultaneous from the point of view of the system U' and the system U. It is obvious in classical mechanics. These events occur at the absolute time t=t'=3s. However, if we misread the meaning of the deteriorated transformation (709)-(710), we find that in the system U, occurrences of these events are t_A=4s and t_B=5s, because such time values are assigned to events by the deteriorated transformation. Then, we draw a wrong conclusion that from the point of view of the system U, events A and B do not happen at the same time. It is worth realizing here that we have achieved this effect for a very simple Galilean transformation. Such a misinterpretation of the Lorentz transformation has led to one of the main conclusions within STR, that the simultaneity of events is relative (Section 4.4.1).

Let us try to determine relative velocities of systems U and U' on the basis of the deteriorated transformation (697)-(700), in such a way as it is understood in STR.

The velocity of the system U' relative to the system U is the velocity of movement of the origin of the system U' in the system U. We obtain

$$v_{U'/U} = \frac{x_N(t', x'=0) - x_N(t'=0, x'=0)}{t_N(t', x'=0) - t_N(t'=0, x'=0)} \tag{713}$$

$$v_{U'/U} = \frac{(vt' + (1+vB)0) - (v0 + (1+vB)0)}{(t' + B0) - (0 + B0)} = v \quad \left[\frac{\mathrm{m}}{\mathrm{s}}\right] \tag{714}$$

The velocity of the system U relative to the system U' is the velocity of movement of the origin of the system U in the system U'. We obtain

$$v_{U/U'} = \frac{x'(t_N, x_N = 0) - x'(t_N = 0, x_N = 0)}{t'(t_N, x_N = 0) - t'(t_N = 0, x_N = 0)} \tag{715}$$

$$v_{U/U'} = \frac{(-vt_N + 0) - (-v0 + 0)}{((1 + Bv)t_N - B0) - ((1 + Bv)0 - B0)} = -\frac{v}{1 + Bv} \quad \left[\frac{\text{m}}{\text{s}}\right] \tag{716}$$

By assumption, the velocity should be equal to *v*. The first of the obtained velocities is correct. The second is correct only when *B*=0, which is when the Galilean transformation is not deteriorated. This example shows that we cannot determine the velocity of the *U* system, relative to the *U′* in this way. The system *U* is resized. This means that coordinates of the system connected by the deteriorated transformation concern different moments in time. Therefore, determining the velocity in the system *U′* based on time t_N from the system *U* leads to the incorrect result (formula (716)).

The presented property of the deteriorated transformation causes that the relative velocity is calculated wrongly in STR. We will show further based on the correct interpretation of the Lorentz transformation that if the system *U′* moves relative to the system *U* at velocity *v*, then the system *U* moves relative to the system *U′* at velocity different than *v*.

Finally, notice that the Galilean transformation can de deteriorated in a different way. The deteriorated inverse transformation (699)-(700) may be obtained directly from the inverse Galilean transformation (693)-(694). It is necessary to modify the inverse Galilean transformation for time, so that it converts time *t* to changed time by adding the factor

$$\Delta t' = vBt - Bx \tag{717}$$

where *t*=*t′* is the absolute time, and *x* is a coordinate in the system *U* that is converted to the system *U′*. The deteriorated transformation converted coordinate *x* to coordinate *x′* next to which it is located at time *t*=*t′*. Time *t*=*t′* is converted to time equal to

$$t'_N = t' + \Delta t' = t' + vBt - Bx \tag{718}$$

Hence, from the inverse Galilean transformation (693)-(694) we obtain

$$t'_N = (1 + vB)t - Bx \tag{719}$$

$$x' = -vt + x \tag{720}$$

We obtained the same deteriorated inverse Galilean transformation as before.

Dependence (719) shows that determined time in the system *U′* is created by multiplying the time *t*=*t′* by (1+*Bv*) and subtracting factor with the value of *Bx*, which depends on the transformed coordinate *x* in the system *U*.

4.2. Deterioration of the STE transformation to STR

Now we deteriorate STE transformations in the manner shown above. We consider the mutual movement of systems as shown in Figure 40.

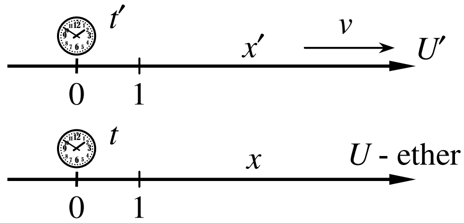

Fig. 40. The relative movement of inertial systems *U* and *U′* in STE

The STE transformation from the system to the ether takes the form (26)

$$t = \frac{1}{\sqrt{1-(v/c)^2}} t' \tag{721}$$

$$x = \frac{1}{\sqrt{1-(v/c)^2}} vt' + \sqrt{1-(v/c)^2} \cdot x' \tag{722}$$

The STE transformation from the ether to the system takes the form (27)

$$t' = \sqrt{1-(v/c)^2} \cdot t \tag{723}$$

$$x' = \frac{1}{\sqrt{1-(v/c)^2}} (-vt + x) \tag{724}$$

We scale coordinates of position and time in the system U (the ether), assuming

$$B = \frac{1}{\sqrt{1-(v/c)^2}} \frac{v}{c^2} \tag{725}$$

The transformation will determine new time t_N and a new position x_N

$$t_N = t + Bx' = t + \frac{1}{\sqrt{1-(v/c)^2}} \frac{v}{c^2} x' \tag{726}$$

$$x_N = x + vBx' = x + \frac{1}{\sqrt{1-(v/c)^2}} \frac{v^2}{c^2} x' \tag{727}$$

Having introduced (721) and (722), we have

$$t_N = \frac{1}{\sqrt{1-(v/c)^2}} t' + \frac{1}{\sqrt{1-(v/c)^2}} \frac{v}{c^2} x' \tag{728}$$

$$x_N = \frac{1}{\sqrt{1-(v/c)^2}} vt' + \sqrt{1-(v/c)^2} \cdot x' + \frac{1}{\sqrt{1-(v/c)^2}} \frac{v^2}{c^2} x' \tag{729}$$

Because

$$\sqrt{1-(v/c)^2} \cdot x' + \frac{1}{\sqrt{1-(v/c)^2}} \frac{v^2}{c^2} = \frac{1-(v/c)^2}{\sqrt{1-(v/c)^2}} x' + \frac{(v/c)^2}{\sqrt{1-(v/c)^2}} x' \tag{730}$$

so finally we obtain the deteriorated STE transformation

$$t_N = \frac{1}{\sqrt{1-(v/c)^2}} (t' + \frac{v}{c^2} x') \tag{731}$$

$$x_N = \frac{1}{\sqrt{1-(v/c)^2}} (vt' + x') \tag{732}$$

This is exactly the Lorentz transformation expressed by formulas (687)-(688). We have shown that the Lorentz transformation is the deteriorated STE transformation.

< OUT OF ELECTRONIC VERSION >

The STE transformation from the system to the ether (721)-(722) and the inverse transformation from the ether to the system (723)-(724) are not symmetrical. In STR, it is assumed that all inertial systems are equivalent. Therefore, in derivations of the Lorentz transformation it is forced that transformations from the system U' to the system U and from the system U to the U' system are identical (with the accuracy to the sign before v). We have shown above that STE transformations (i.e. from the ether to the system, and from the system to the ether) can be written in such a form that the transformation from *U'* to *U* and from *U* to *U'* are identical. It is enough to assume parameter *B* with the value of (725) and deteriorate STE transformations by this parameter. And such a form of the STE transformation has been obtained in deriving the Lorentz transformation. Transformations that bind together the ether and any inertial frame of reference have been obtained. However, they have been misinterpreted that they bind reference systems together. And in this way, formally correct Lorentz transformations led to creation of the erroneous STR.

Velocity v occurring in STR transformations is the velocity of the inertial system relative to the ether. For this reason, if any analysis is carried out in STR, then, the system of an observer is by default related to the ether. We will show it further, on examples of three paradoxes and in a discussion on formula $E=mc^2$.

4.3. Correct interpretation of the Lorentz transformation

Let the inertial system U' move relative to the system U at velocity v, as shown in Figure 41.

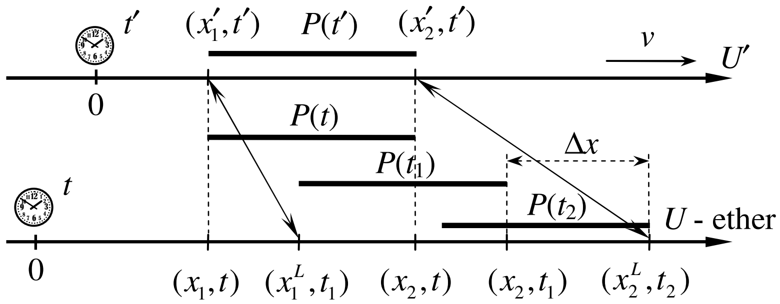

Fig. 42. The image of the rod in the Lorentz transformation

At the considered moment, all clocks in the system *U'* indicate the same time *t'*, while all clocks in the system *U* indicate the same time *t*.

In the system U', rod P is placed, the ends of which are located at the points with coordinates $x_1'>0$ and $x_2'>0$. The Lorentz transformation (687)-(688) converts these coordinates to coordinates in the system U. For the beginning of the rod, we have

$$t_1 = \frac{1}{\sqrt{1-(v/c)^2}}(t' + \frac{v}{c^2}x_1') > t \tag{793}$$

$$x_1^L = \frac{1}{\sqrt{1-(v/c)^2}}(vt' + x_1') \tag{740}$$

and for the end of the rod, we have

$$t_2 = \frac{1}{\sqrt{1-(v/c)^2}}(t' + \frac{v}{c^2}x_2') > t \tag{741}$$

$$x_2^L = \frac{1}{\sqrt{1-(v/c)^2}}(vt' + x_2') \tag{742}$$

We now look at the rod from the perspective of the system U. The rod travels at velocity v. The figure shows its position (in the system U) $P(t)$, $P(t_1)$, $P(t_2)$ at three time instants t, t_1, t_2. At time t, the beginning of the rod is in the position x_1, while the end is in position x_2 (positions relate to the same time t). From the Lorentz transformation (739)-(740) it is known, that the beginning of the rod is in a position $x^L{}_1$ at time t_1. From the Lorentz transformation of (741)-(742) it is known, that end of the rod is in the position $x^L{}_2$ at time t_2. On the basis of (739) and (741) we have

$$\begin{aligned} t_2 - t_1 &= \frac{1}{\sqrt{1-(v/c)^2}}[(t' + \frac{v}{c^2}x_2') - (t' + \frac{v}{c^2}x_1')] = \\ &= \frac{v/c^2}{\sqrt{1-(v/c)^2}}(x_2' - x_1') > 0 \end{aligned} \tag{743}$$

On the basis of (739), (741) and (743) we have $t<t_1<t_2$. It follows that the Lorentz transformation shows in the system U the beginning and end of the rod in the future, but the end in the more distant future.

Now we calculate the position of the rod end x_2 in the system U at time t_1, that is, before it is in the position $x^L{}_2$. Because in the system U, the rod moves at velocity v, so Δx shown in the figure has the value of

$$\Delta x = x_2^L - x_2 = v(t_2 - t_1) \tag{744}$$

$$x_2 = x_2^L - v(t_2 - t_1) \tag{745}$$

On the basis of (742) and (743) we have

$$x_2 = \frac{1}{\sqrt{1-(v/c)^2}}(vt' + x_2') - v\frac{v/c^2}{\sqrt{1-(v/c)^2}}(x_2' - x_1') \tag{746}$$

$$x_2 = \frac{1}{\sqrt{1-(v/c)^2}}vt' + \frac{1-v^2/c^2}{\sqrt{1-(v/c)^2}}x_2' + \frac{v^2/c^2}{\sqrt{1-(v/c)^2}}x_1' \tag{747}$$

Finally, we obtain

$$x_2 = \frac{1}{\sqrt{1-(v/c)^2}}vt' + \sqrt{1-(v/c)^2}\cdot x_2' + \frac{v^2/c^2}{\sqrt{1-(v/c)^2}}x_1' \tag{748}$$

On the basis of (740) and (748), we can calculate the length of the rod in the system U at time t_1

$$x_2 - x_1^L = \sqrt{1-(v/c)^2}(x_2' - x_1') < x_2' - x_1' \tag{749}$$

This gives us the formula for reducing the length. From the perspective of the system U the same rod is seen as shorter than from the perspective of the system U'.

Dependence (748) determines the position of the rod end as seen in the system U at the same time when dependence (740) determines the position of the rod beginning. This dependence applies to all rods. If we wanted it to convert coordinates of the system U' (ends of all rods) to the same time in the system U, then, the same point of reference, which is the same position of their beginnings x_1', should be assumed for all bars. If the reference point $x_1'=0$, then from (748) we obtain

$$x_2 = \frac{1}{\sqrt{1-(v/c)^2}} vt' + \sqrt{1-(v/c)^2} \cdot x_2' \tag{750}$$

This is precisely dependence (722), that is the position transformation of STE.

Dependence (750) determines coordinates of the system U' in the system U at the same time. It is the time of determination of the position of coordinate x'=0. On the basis of (739), time is equal to (the transformation of time from the system U' to U)

$$t = \frac{1}{\sqrt{1-(v/c)^2}} (t' + \frac{v}{c^2} 0) = \frac{1}{\sqrt{1-(v/c)^2}} t' \tag{751}$$

This is precisely dependence (721), the is the time transformation of STE.

It has been demonstrated that with the proper interpretation of the Lorentz transformation, it comes down to the STE transformation.

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Figure 43 presents a comparison of the STR transformation (Lorentz) and the STE transformation.

We assume that $-x_1'=x_2'$. From transformations (721)-(722), we can easily demonstrate that

$$x_2 - vt = vt - x_1 \tag{754}$$

All the clocks of the system U' indicate time t'. All the clocks of the system U indicate time t. The STE transformation binds together coordinates of the system U' and U, which at the moment are next to each other.

On the basis of (726), we have a time shift of the Lorentz transformation (system→ether)

$$t_2 - t = t - t_1 = Bx_2' = -Bx_1' = \frac{v/c^2}{\sqrt{1-(v/c)^2}} x_2' = \frac{-v/c^2}{\sqrt{1-(v/c)^2}} x_1' \geq 0 \tag{755}$$

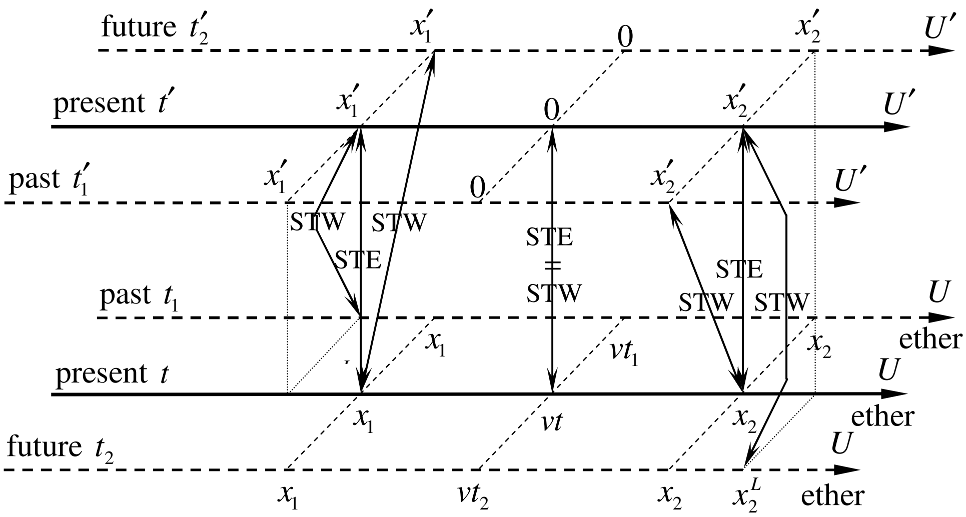

Fig. 43. A comparison of the STE transformation and the Lorentz transformation

On the basis of (727), we have a spatial shift of the Lorentz transformation (system →ether)

$$x_2^L - x_2 = x_1 - x_1^L = vBx_2' = -vBx_1' = \frac{v^2/c^2}{\sqrt{1-(v/c)^2}} x_2' = \frac{-v^2/c^2}{\sqrt{1-(v/c)^2}} x_1' \geq 0 \tag{756}$$

On the basis of (733) and (734), we have a time shift of the Lorentz transformation (ether→system)

$$t_2' - t' = t' - t_1' = B(vt - x_1) = B(x_2 - vt) \tag{757}$$

$$t_2' - t' = \frac{v/c^2}{\sqrt{1-(v/c)^2}}(vt - x_1) \ge 0 \tag{758}$$

$$t' - t_1' = \frac{v/c^2}{\sqrt{1-(v/c)^2}}(x_2 - vt) \ge 0 \tag{759}$$

There is no spatial shift in the case of the Lorentz transformation (ether→system).

4.4. Contradictions in STR

4.4.1. The paradox of the simultaneity of events

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Achieving the effect of non-simultaneity of events that in another system are simultaneous, in itself should be a reason to reject the Theory of Relativity because it proves its internal contradiction. However, this conclusion is not obvious; therefore, because of the absence of any other theory, all sorts of excuses for this effect are invented. Instead of rejecting the theory, people have become accustomed to it and concluded that space has such a property.

To demonstrate that the relativity of simultaneity of events leads to a contradiction in the Special Theory of Relativity, we will consider the situation shown in Figure 46 (this example comes from [2], but the authors did not recognize the paradox).

Next to spacecraft U, another spacecraft U' flies at velocity v as shown in Figure 46. In the figure, mutual positions of spacecrafts denoted by I, II, III, IV are shown in four successive time instants. When spacecrafts are in position I, then two meteoroids A and B hit them. Each of them hit both spacecrafts U and U' simultaneously. Meteoroid A leaves permanent marks on crafts in positions x_A and x_A'. Meteoroid B leaves permanent marks on crafts in positions x_B and x_B'. The strike of each meteoroid causes light flash that spreads in space at velocity c.

Observer O from the system U is in position x_O, exactly halfway between the places of formation of light flashes, namely

$$x_B - x_O = x_O - x_A \quad \Rightarrow \quad x_O = \frac{x_B + x_A}{2} \tag{773}$$

Flashes of light A and B reach observer O in the same instant. Because they have the same distance to travel in the system U, from the point of view of observer O two flashes were created at the same time t. So for observer O, the strikes of meteoroids were simultaneous events.

We assume that at time t (when the asteroid hit) observer O' from the system U' flew right next to observer O. According to (690), we have

$$x_A' = \frac{1}{\sqrt{1-(v/c)^2}}(-vt + x_A) \tag{774}$$

$$x_B' = \frac{1}{\sqrt{1-(v/c)^2}}(-vt + x_B) \tag{775}$$

$$x'_O = \frac{1}{\sqrt{1-(v/c)^2}}(-vt + x_O) \tag{776}$$

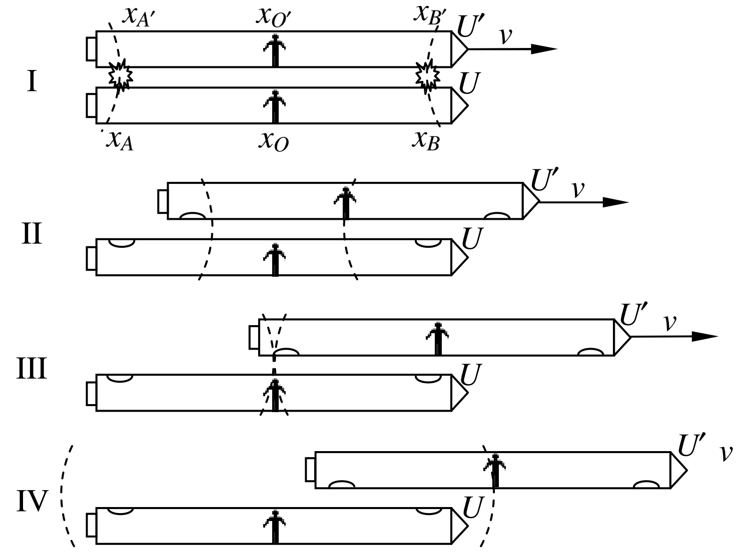

Fig. 56. The paradox of the simultaneity of events in STR

Having taken (773) into account, we obtain

$$\begin{aligned} x'_O &= \frac{1}{\sqrt{1-(v/c)^2}}\left(-vt + \frac{x_B + x_A}{2}\right) = \\ &= \frac{1}{2\sqrt{1-(v/c)^2}}[(-vt + x_A) + (-vt + x_B)] \end{aligned} \tag{777}$$

$$x'_O = \frac{x'_A + x'_B}{2} \tag{778}$$

It follows that the observer from the system U' is also located halfway between places where meteoroids struck.

From the point of view of observer O, observer O' approaches the source of light B and moves away from the source of light A. Therefore, according to him, observer O' sees flash B first in position II. Flash A will be seen only in position IV. Since the distance of observer O' to place of the formation of flash A is the same as the place where flash B is formed; therefore, observer O' will assess that the strikes of meteoroids were non-simultaneous events.

To sum up, observer O, on the basis of his measurements, claims that strikes of meteoroids were simultaneous for him, but for observer O' they were non-simultaneous.

Analogous reasoning may be carried out for observer O'. Because the considered system is symmetrical from the point of view of observers, so observer O' will draw similar conclusions.

To sum up, observer O', on the basis of his measurements, claims that strikes of meteoroids were simultaneous for him, but for observer O they were non-simultaneous.

We obtained a contradiction, that two contradictory theses based on the same assumptions and two valid reasonings within this theory. It follows from this that the Theory of Relativity is a self-contradictory theory. Conclusions drawn by means of such a theory are not objective, and the theory is useless.

An example of the paradox from Figure 46 suggests the observation that if we carried out calculations in STR in terms of the selected reference system, then the reference system is by default the ether. If we assume it, the contradictory conclusions observer O and O' have obtained are correct. If we analyze the situation from the point of view of observer *O*, then the system *U* is the ether. Flashes of light in his system (the ether) propagate at velocity *c*; therefore, he correctly notes that events *A* and *B* are simultaneous. The same flashes of light move for observer *O′* at different velocities (121) and (122). Travelling the same distance, they reach observer *O′* at different instants of time. However, on this basis, observer *O′* cannot conclude that events *A* and *B* have not been simultaneous. This observer sees flashes non-simultaneously just because one of them had higher velocity, and the second lower.

The opposite situation is obtained when we analyze the paradox from the point of view of observer *O′*. Then, the ether is by default the system *U′*. In such a situation, observer *O′* sees flashes simultaneously, while observer *O* moving in the ether sees them non-simultaneously. However, for both of them events *A* and *B* are simultaneous events.

In the considered paradox, we have two different situations. In one of them, observer *O* is in the ether, while in the other, observer's *O′* is in the ether. In each of these situations, measurements of observers are different. These two different situations cannot be treated as one, and so does STR. Because within STR it is not possible to distinguish these situations, we obtain two contradictory conclusions, that is a paradox.

4.4.2. The paradox of indications of clocks

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4.4.3. The paradox of the Doppler effect

In Section 0, two formulas for contraction of frequency of the observed light wave (the Doppler effect), that can be obtained in STR, were derived.

The dependence derived from the point of view of the observer has the form

$$f_o = f_z \frac{\sqrt{c^2 - v^2}}{c - v\cos(\alpha)} \tag{787}$$

The dependence derived from the point of view of the source has the form

$$f_o = f_z \frac{c + v\cos(\alpha)}{\sqrt{c^2 - v^2}} \tag{788}$$

The observer and the source speak on the same phenomenon. The observer says that if the source generates a light wave with frequency f_z, then he has to measure the wave with frequency f_o expressed by dependence (787). The source, however, claims that since it generates the light wave with frequency f_z, the observer has to measure the wave with frequency f_o expressed by the dependence (788).

Dependencies (787) and (788) are different. With two correct reasonings, two different formulas for the Doppler effect we derived. This is another obvious evidence that STR is self-contradictory.

If you look at this paradox and compare formulas for contracting frequency with those that have been derived in STE (Section 0), it shows that formula (787) expresses the contraction of frequency generated in the system and seen in the ether. In contrast, formula (788) expresses the contraction of frequency generated in the ether and viewed in the system. To properly determine the Doppler effect, these two formulas should be combined into one, as shown in STE (section 0). That is, at first frequency should be converted from the first system to the ether, then this new frequency from the ether to another system. In STR, this cannot be observed, because it has been mistakenly assumed that all inertial frames of reference are equivalent, which does not take the existence of a universal reference system (the ether) into account.

The analysis of the Doppler effect paradox implies similar observation as the analysis of the paradox of indications of clocks. If calculations in terms of the reference system are carried out in STR, then this reference system is by default the ether. The formula for the contraction of frequency derived from the point of view of the observer turned out to be the formula converting frequency from the system to the ether (the observer is in the ether). In contrast, the formula for contracting frequency derived from the point of view of the source turned out to be the formula converting frequency from the ether to the system (the source is in ether).

4.5. *E=mc*²

The Special Theory of Relativity [4, p. 81, 87] introduced the formula for the momentum and the kinetic energy in the form (v is the relative velocity of the body and the observer)

$$p^{\mathrm{STW}} = m_0 v \frac{1}{\sqrt{1-(v/c)^2}} \tag{789}$$

$$E^{\mathrm{STW}} = m_0 c^2 \frac{1}{\sqrt{1-(v/c)^2}} - m_0 c^2 \tag{790}$$

These dependencies are identical to (515) and (532). It follows that, in STR, only formulas for the momentum and the kinetic energy measured by the observer associated with the ether were derived. These formulas were derived only for one of many possible definitions of relativistic mass.

Figure 48 presents three inertial systems.

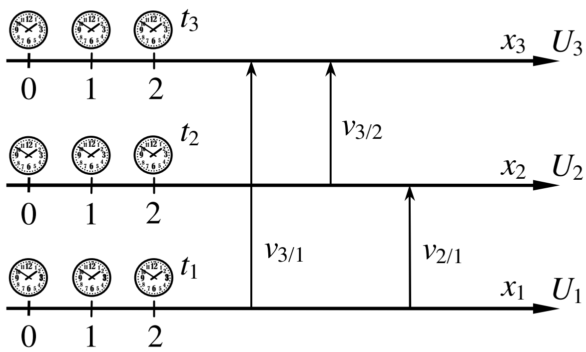

Fig. 48. Summing velocity in STR

In STR, a dependence for the summation of velocity, based on misunderstood the Lorentz transformation (687)-(690), is derived

$$v_{3/1} = \frac{v_{3/2} + v_{2/1}}{1 + \frac{v_{3/2} v_{2/1}}{c^2}} \tag{791}$$

This formula does not express the actual velocity of the system U_3 in the system U_1, because the Lorentz transformation determines the position of coordinates of one system in another one in the future or the past. Despite this, we can, based on (791), show [4, p. 90], that

$$\frac{1}{\sqrt{1-\frac{v_{3/1}^2}{c^2}}}=\frac{1}{\sqrt{1-\frac{1}{c^2}\frac{(v_{3/2}+v_{2/1})^2}{\left(1+\frac{v_{3/2}v_{2/1}}{c^2}\right)^2}}}=\frac{1}{\sqrt{1-\frac{v_{2/1}^2}{c^2}}}\frac{1+\frac{v_{2/1}v_{3/2}}{c^2}}{\sqrt{1-\frac{v_{3/2}^2}{c^2}}} \tag{792}$$

The obtained equation is multiplied by both sides by m_0c^2

$$\frac{m_0c^2}{\sqrt{1-\frac{v_{3/1}^2}{c^2}}}=\frac{1}{\sqrt{1-\frac{v_{2/1}^2}{c^2}}}[\frac{m_0c^2}{\sqrt{1-\frac{v_{3/2}^2}{c^2}}}+v_{2/1}\frac{m_0v_{3/2}}{\sqrt{1-\frac{v_{3/2}^2}{c^2}}}] \tag{793}$$

that is

$$\begin{aligned}&\frac{m_0c^2}{\sqrt{1-\frac{v_{3/1}^2}{c^2}}}-m_0c^2+m_0c^2=\\&=\frac{1}{\sqrt{1-\frac{v_{2/1}^2}{c^2}}}[\frac{m_0c^2}{\sqrt{1-\frac{v_{3/2}^2}{c^2}}}-m_0c^2+m_0c^2+v_{2/1}\frac{m_0v_{3/2}}{\sqrt{1-\frac{v_{3/2}^2}{c^2}}}]\end{aligned} \tag{794}$$

On the basis of (789) and (790), we obtain the law of the kinetic energy in STR in the form

$$E_{3/1}^{\mathrm{STW}}+m_0c^2=\frac{1}{\sqrt{1-\frac{v_{2/1}^2}{c^2}}}[(E_{3/2}^{\mathrm{STW}}+m_0c^2)+v_{2/1}p_{3/2}^{\mathrm{STW}}] \tag{795}$$

In this law there is factor m_0c^2. STR believed that it expresses the internal energy of matter. Without any basis, it was assumed that the energy present in (795), that is

$$E_{i/j}^{\mathrm{STW}}+m_0c^2 \tag{796}$$

is the total energy of the body [4, p. 91-92]. Then, if $E_{i/j}^{\mathrm{STR}}$ is the kinetic energy, then m_0c^2 is some internal energy. It was assumed then that the law (795) binds the total energy of matter together and not the kinetic energy with the correction of m_0c^2. So there is no evidence that m_0c^2 is the internal energy, it has only been assumed! In fact, factor m_0c^2 has no connection with the internal energy of matter. This is only the correction to the kinetic energy present in the law of the kinetic energy.

The law of energy (795) can be written as

$$E_{3/1}^{\mathrm{STW}}-[\frac{1}{\sqrt{1-\frac{v_{2/1}^2}{c^2}}}m_0c^2-m_0c^2]=\frac{1}{\sqrt{1-\frac{v_{2/1}^2}{c^2}}}E_{3/2}^{\mathrm{STW}}+\frac{1}{\sqrt{1-\frac{v_{2/1}^2}{c^2}}}v_{2/1}p_{3/2}^{\mathrm{STW}} \tag{797}$$

On the basis of (790), we obtain a different form of the law of the kinetic energy

$$E_{3/1}^{\mathrm{STW}}-E_{2/1}^{\mathrm{STW}}=\frac{1}{\sqrt{1-\frac{v_{2/1}^2}{c^2}}}E_{3/2}^{\mathrm{STW}}+\frac{1}{\sqrt{1-\frac{v_{2/1}^2}{c^2}}}v_{2/1}p_{3/2}^{\mathrm{STW}} \tag{798}$$

Factor m_0c^2, is introduced into kinetic energy $E_{2/1}^{\mathrm{STR}}$. This law now has a similar form as the law of the kinetic energy in classical mechanics (1028), in STE/Δp (494) and in STE/F/Δt (619). We have shown that factor m_0c^2 is related to the kinetic energy, and not to the internal energy of matter.

In Chapter 3, four descriptions of dynamics of bodies in STE were derived. In each of these cases, a different law of the kinetic energy applies. It follows that the form of the law is connected to the adopted assumptions and not to the internal energy of matter. Therefore, this correction to the kinetic energy occurring in (795) is not a property of matter but of the adopted description of dynamics of bodies.

The presented formulas do not demonstrate that there is a possibility of converting mass into energy or energy into mass. These formulas also do not describe the quantitative dependence between the mass and internal energy.

If dependence m_0c^2 is related to the internal energy of matter, this connection does not result from the model of kinematics and dynamics of bodies in space, which is derived in STR. According to us, to find the connection of mass with the internal energy of matter, it is necessary to analyze the model of the structure of matter. The decision whether it is possible to convert matter into energy can only be obtained experimentally, and not by analyzing dynamics of bodies.

During chemical transformations, e.g. combustion, energy is produced. Its amount depends not only on the amount of matter, but also on the type of fuel. It may be similar in the case of nuclear transformations. We think that there are no grounds to assume that the amount of the energy emitted by nuclear transformations depends only on the amount of matter ($E=mc^2$), but it does not depend on its type. Evidence for the fact that matter can be converted into energy is also doubtful. Even if nuclear fuel used in nuclear reactors weighs less after being used than at the beginning, it is not known whether the missing mass is converted into energy, or simply got out of the reactor in the form of some particles.

4.6. Conclusions

The cause of the internal contradiction in the Special Theory of Relativity is that the Lorentz transformation has been mistakenly interpreted in it. We have shown in this chapter, that in fact this transformation is the deteriorated transformation of the Special Theory of Ether. It converts spatial and time coordinates only between the ether and any frame of reference. It is not a transformation between any reference systems, as it is currently believed.

Misinterpretation of the Lorentz transformation based on the incorrect assumption, which was adopted in STR, that all inertial frames of reference are equivalent. A simple consequence of this assumption was erroneous generalization of the meaning of the Lorentz transformation and recognition that it applies to any two reference systems. Since there is constant c, which is the velocity of light in the ether, in the Lorentz transformation, maintaining the interpretation that it is a universal transformation (between any two reference systems) required the adoption of the second also false assumption that the velocity of light c is constant in any inertial frame.

Chapter 10 presents two ways of derivation of the Lorentz transformation. In these derivations, it is assumed that the sought transformation from the system U to the system U' has the same form as the transformation from the system U' to the system U. Obtaining such a form of transformation has turned out to be possible, it is the Lorentz transformation. However, none of these derivations implies that the Lorentz transformation applies to any two reference systems. There is also no formal reason to believe that the constant c occurring in the Lorentz transformation is the velocity of light in every frame of reference. In the derivation of the transformation using the geometric method (Section 10.4), the average value of the velocity of light on the way to the mirror and back is denoted by c. And exactly such is the meaning of c. As it has already been demonstrated on the model of STE, the velocity of light has different values in systems other than the ether. Always, however, the average velocity of light travelling along any path back and forth is constant and is equal to c, that is as much as the velocity of light in the ether. The derivation of the Lorentz transformation by the method of Szymacha (Section 10.3) does not have any assumptions on constant c. You can only demonstrate that this is the boundary velocity in the considered reference system U (the ether) [4].

The adoption in STR of assumptions that the Lorentz transformation refers to any frames of reference and that the velocity of light is constant in any frame of reference was only a hypothesis. Since the adoption of these assumptions has led to the creation of a internally contradictory theory, these assumptions must be rejected.

The Lorentz transformation in itself is formally correct. In this work, it is called a deteriorated transformation because it binds a point from the inertial system with a point in the ether, next to which the one from the system will be in the future, or was in the past. This property of the Lorentz transformation hindered its correct interpretation. This property of the Lorentz transformation is caused by the fact that at its derivation, it is assumed that the transformation from the system U (ether) to the system U' has the same form as the transformation from the system U' to the system U (ether).

In STR, it is possible to obtain a lot of examples of internal contradiction. It is enough to analyze a given phenomenon once from one inertial reference system, and then a second time from another reference system. This happens in the case of the paradox of the simultaneity of events (Section 4.4.1), the paradox of indications of clocks (Section 4.4.2) and the paradox of the Doppler effect (Section 0).

It is worth mentioning that the recognized in STR method of clock synchronization is wrong. Two clocks are located in the mobile inertial reference system. From the point located exactly halfway between the clocks, two light impulses are sent to these two clocks. According to STR, they reach the clocks at the same moment. On this basis, it is possible to synchronize clocks. We know already that velocities of light pulses will be different (unless their velocity is perpendicular to the velocity of the system in the ether). Therefore, they reach the clocks at different moments. You can on this basis synchronize the clocks, but it is necessary to take the properties of light derived in STE into account.

The assumption of equivalence of all reference systems clearly leads to STR, which does not allow to draw objective conclusions. If reality is to be rational and determining the facts in an objective way is to be possible, this space cannot have such a property that all inertial frames are equivalent. Therefore, either we have the rational reality with the ether, or all inertial frames are equivalent, but the reality is full of contradictions. Or we do not accept the results of the repeatedly verified Michelson-Morley experiment.

Classical mechanics is the theory consistent with experiments concerning low velocities. It is an internally consistent theory. Therefore, it is rightly regarded as an approximate description of kinematics and dynamics of bodies with low velocities. In the case of STR, the situation is completely different. STR is not even an approximate description of dynamics of bodies. It is self-contradictory. It is a very serious flaw that makes it a useless theory. All conclusions drawn from experiments and astronomical observations based on STR are incredible and should be verified on the basis of the Special Theory of Ether.

5. The velocity of the Solar System in the ether

In this chapter, the method to determine the velocity of the Solar System in the ether will be presented. This velocity can be determined on the basis of data obtained in accelerators of elementary particles. In these laboratories, meson K^+ (keno) and its degradation products [4, p. 41] were studied. We assume that the examined mesons are accelerated along in the direction parallel to the direction of the velocity of the laboratory in the ether.

If the velocity of the Solar System in the ether is large in relation to the rotational velocity of the Earth around its axis and around the sun, then the measured velocity of the laboratory in the ether will be approximately equal to the velocity of the Solar System in the ether (Figure 49).

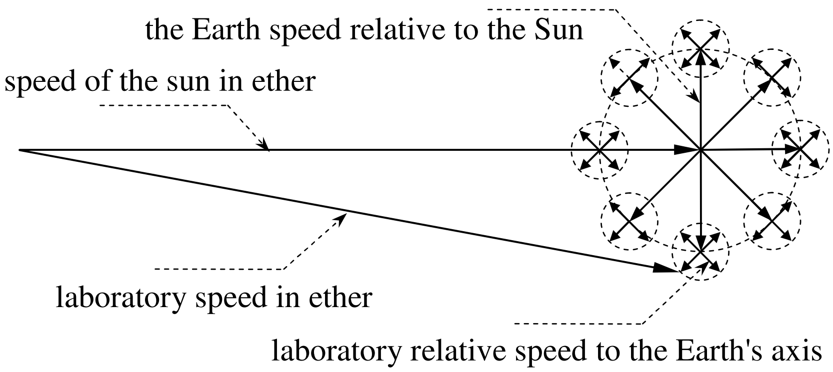

Fig. 49. The laboratory velocity components in the ether (flat model)

The velocity of the inertial system relative to the ether U_1 can also be determined by measuring the two relative velocities: the velocity of the system U_1 relative to the system U_2, and velocity of the system U_2 relative to the system U_1.

Another way of determining the velocity of the system U_1 relative to the ether is to perform measurements of the velocity of light in the system in different directions. The velocity of the system U_1 in the ether has the same direction as the slowest velocity of light. The velocity of the ether may be determined from dependence (121) or (122).

5.1. The experiment with the decay of meson K+

Some mesons K^+ decay spontaneously into meson π^+ and π^0. Mesons π^+ are interesting as they having been formed from mesons K^+ stationary with respect to the laboratory fly away in various directions, but they always have constant value of velocity [4, p. 41] with respect to the laboratory. It can be concluded that mesons π^+ always obtain the constant value of the momentum relative to the frame of reference in which meson K^+, forming them, is present. The experiment consists in that mesons K^+ are accelerated to high velocities and then some decay as before. After their decay, mesons π^+ are formed and have velocities in different directions, but some of them have the velocity in the same direction as the accelerated meson K^+. These mesons π^+ have the highest velocity relative to the laboratory among all formed mesons in the experiment.

We consider the situation shown in Figure 50. In the experiment with mesons, three velocities are measured: $v_{\pi/1}$, $v_{2/1}$, $v_{3/1}$. The sought velocity v_1 is the velocity of the laboratory relative to the ether.

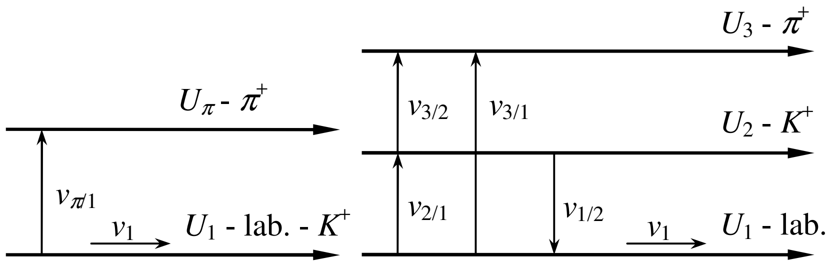

Fig. 50. Inertial systems occurring in the experiment with mesons

If meson K^+ lies in the laboratory system U_1, then after his decay meson π^+ has the velocity relative to the laboratory

$$v_{\pi/1} = 2.48 \cdot 10^8 \quad \text{m/s} \tag{799}$$

The velocity at which mesons K^+ are accelerated in relation to the laboratory is equal to

$$v_{2/1} = 2.00 \cdot 10^8 \quad \text{m/s} \tag{800}$$

The velocity of mesons π^+ formed from the accelerated mesons K^+ relative to the laboratory is equal to

$$v_{3/1} = 2.89 \cdot 10^8 \quad \text{m/s} \tag{801}$$

Velocities $v_{3/2}$ and $v_{1/2}$ shown in the figure are not known, because they cannot be measured from the level of the laboratory.

It is assumed that the velocity of light in vacuum in the ether is equal to

$$c = 299792458 = 2.99792458 \cdot 10^8 \quad \text{m/s} \tag{802}$$

5.2. Determination of the velocity by means of the STE/Δp

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Having introduced the value of (813), we obtain

$$v_1' = \frac{c^2 v_{2/1} v_{\pi/1} - c\sqrt{c^2 v_{2/1}^2 v_{\pi/1}^2 - v_{2/1} v_{\pi/1} v_{3/1}[c^2(v_{2/1} + v_{\pi/1} - v_{3/1}) - v_{2/1} v_{\pi/1} v_{3/1}]}}{v_{2/1} v_{\pi/1} v_{3/1}} \tag{816}$$

$$v_1'' = \frac{c^2 v_{2/1} v_{\pi/1} + c\sqrt{c^2 v_{2/1}^2 v_{\pi/1}^2 - v_{2/1} v_{\pi/1} v_{3/1}[c^2(v_{2/1} + v_{\pi/1} - v_{3/1}) - v_{2/1} v_{\pi/1} v_{3/1}]}}{v_{2/1} v_{\pi/1} v_{3/1}} \tag{817}$$

Having introduced the value of (799), (800) and (801), we obtain

$$v_1' = -0.00148493 \cdot \ c = -445171.9 = -0.00445172 \cdot 10^8 \quad \text{m/s} \tag{818}$$

$$v_1'' = 2.07617322 \cdot c = 622421074.1 = 6.22421074 \cdot 10^8 \quad \text{m/s} \tag{819}$$

Only the first of these values is lower than velocity c. This is the sought velocity of the laboratory in the ether. The negative sign means that mesons were accelerated in the opposite direction than the direction of the velocity of the laboratory in the ether.

The determined velocity is accurate to up to significant figures, but the obtained result could be checked.

5.3. Discussion on the sensitivity of the method

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5.4. The velocity calculated from the relative velocity

The objective is to determine velocity of the of laboratory v_1 in the ether on the basis of the value of relative velocities as shown in Figure 50.

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the sought velocity v_1 of the system U_1 relative to the ether is equal to

$$v_1' = \frac{c^2}{v_{2/1}} - c \cdot \sqrt{1 - \frac{c^2}{v_{2/1} \cdot v_{1/2}} c} \tag{838}$$

or

$$v_1'' = \frac{c^2}{v_{2/1}} + c \cdot \sqrt{1 - \frac{c^2}{v_{2/1} \cdot v_{1/2}}} \tag{839}$$

Velocities can also be written after using (826) in the form

$$v_1' = \frac{c^2}{v_{2/1}} - c \cdot \sqrt{1 - c^2 \frac{v_{2/1} - v_{3/1}}{v_{2/1}^2 \cdot v_{3/2}}} \tag{840}$$

or

$$v_1'' = \frac{c^2}{v_{2/1}} + c \cdot \sqrt{1 - c^2 \frac{v_{2/1} - v_{3/1}}{v_{2/1}^2 \cdot v_{3/2}}} \tag{841}$$

At this stage, dependences (838) and (839) cannot be used, as velocity $v_{1/2}$ is not known. Similarly, (840) and (841) cannot be used, as velocity $v_{3/2}$ is not known. These velocities cannot be determined directly from the inertial system, which is the laboratory. However, they can be determined indirectly. This will be shown in the next section.

Thanks to dependencies (838) or (839) it is possible to determine the velocity of the inertial system U_1 in relation to the ether on the basis of the measurement of two relative velocities: of the systems U_1 relative to the system U_2 and the system U_2 relative to the system U_1. Perhaps it will be technically possible to measure such relative velocities for two satellites. When they fly next to each other (in parallel to the velocity in the ether), then each satellite should measure the velocity of the other. Based on these measurements, the velocity of one of the satellites relative to the ether is determined. By changing marks of the satellites it is possible to similarly determine the velocity of the other satellite relative to the ether.

5.5. The velocity of meson π^+ relative to meson K^+

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Having taken (825) into account, we obtain

$$v_{3/2} = (v_{3/1} - v_{2/1}) \frac{c^2 - v_1^2}{c^2 - [v_1 + v_{2/1}(1-(v_1/c)^2)]^2} \tag{825}$$

From this formula, as before we obtain

$$v_{3/2} = 1.59806870 \cdot 10^8 \quad \text{m/s} \tag{853}$$

5.6. Conclusions

When velocity $v_{3/2}$ is known, then from dependencies (840) and (841) the velocity of the laboratory relative to the ether can be calculated. Having taken (800), (801) and (853) into account, we obtain

$$v_1' = -0.00148493 \cdot c = -445171.9 = -0.00445172 \cdot 10^8 \quad \text{m/s} \tag{854}$$

$$v_1'' = 2.99940951 \cdot c = 899200350.6 = 8.99200351 \cdot 10^8 \quad \text{m/s} \tag{855}$$

Only the first of these values is smaller than velocity c. It is the same as the velocity of (818). Everything agrees beautifully.

The presented theory shows that the velocity of meson π^+, resulting from the decay of meson K^+, measured in the laboratory depends on the velocity of the laboratory relative to the ether. Also it depends on the direction of the velocity of meson π^+. Since the laboratory rotates with the Earth relative to the vector of the velocity in the ether, in the daily and annual cycles, we predict that velocities of meson π^+ are correlated with daily and annual cycles of the Earth.

Because, according to the analysis carried out in Section 5.3, the velocity of the Earth relative to the ether has a negligible effect on the velocity of the meson π^+ which is why differences in measurements have probably been regarded as the measurement error. Measured velocities should be examined and check whether deviations from the average are correlated with the cycle of the Earth's motion. If the recorded data do not allow this, then the measurements should be repeated.

In order to determine the velocity of the laboratory in the ether, it should be remembered that all velocities $v_{\pi/1}$, $v_{2/1}$, $v_{3/1}$ were measured at the same time and in the same direction. Then, they will concern the same velocity of the laboratory relative to the ether.

It is not clear what effect the inclination of the direction of meson velocity in relation to the direction of the laboratory in the ether will have on the determination of velocity v_1. The presented calculation applies only if all the directions are parallel.

It is worth emphasizing that according to STR, velocity $v_{3/2}$ determined in this Chapter is equal to $v_{\pi/1}$ [4, p. 41]. It is concluded on the basis of the assumption of equivalence of all inertial systems. In connection with this assumption, the velocity of meson π^+ relative to meson K^+ is independent of the velocity of meson K^+ in relation to the laboratory. As you can see, STR predictions are wrong in this case.

Since the velocity of the Solar System in the ether is low; therefore, measurements taken in the system of the Earth are slightly different from those carried out in the system of the ether. For this reason, the results of experiments agree with predictions of STR, which is based on the Lorentz transformation concerning the inertial system and the ether.

6. The measurement of the velocity in one direction

In all previous laboratory measurements of the velocity of light, only the average velocity of light that travels the path to the mirror and back has been measured. The velocity of light in one direction has never been measured.

In this chapter, we will present our proposal of the experiment, which allows for the measurement of the velocity of light in one direction. A diagram of the measurement system is shown in Figure 56.

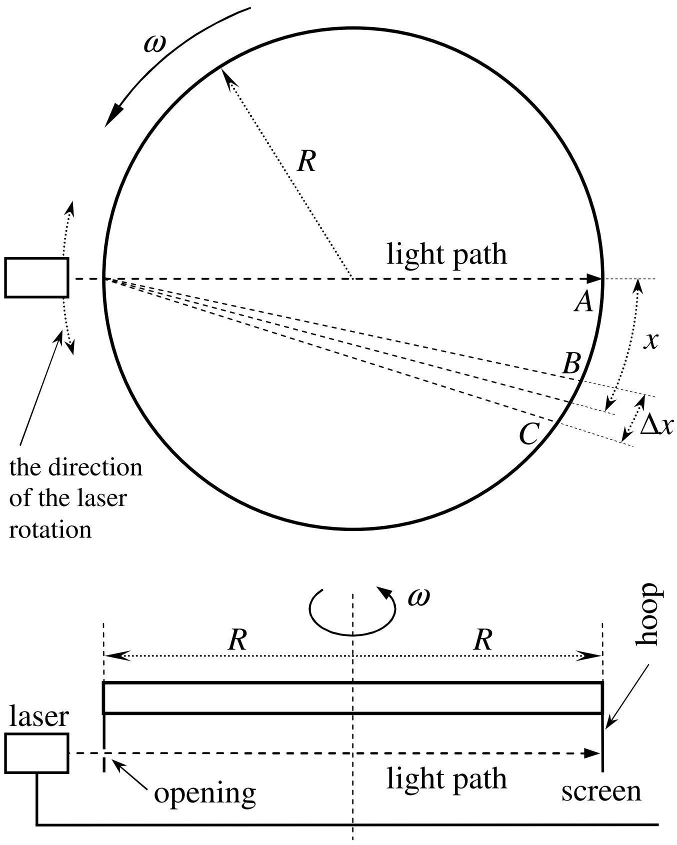

Fig. 56. The measurement system of the velocity of light in one direction

In the rim coupled with the rotary wheel, there is one opening and a scale on the opposite side. Light passes through the opening and flows along the diameter of the wheel. Light leaves a trace at point *A* on the scale. When the wheel does not rotate, then the trace is produced at point 0 on the scale. If a wheel rotates at set angular velocity ω, then the trace of light on the scale is shifted in relation to 0 (point *B* or *C*). The shift occurs because the circle will manage to turn before the light travels path $2R$. If the velocity of light is higher, then the shift on the scale is smaller (point *B*). If the velocity of light is lower, then the shift on the scale is bigger (point *C*).

The time of light flow by path $2R$ is

$$t = \frac{2R}{c'_{p\alpha}} \tag{856}$$

Distance x, by which the trace of light moves on the scale is equal to

$$x = vt = \omega Rt = \frac{2\omega R^2}{c'_{p\alpha}} = \frac{4\pi f R^2}{c'_{p\alpha}} \tag{857}$$

Having taken the account of dependencies (377) for the velocity of light in the system, we obtain (α is the angle between the path of light and velocity v of the measuring device in the ether)

$$x = \frac{4\pi f R^2}{\frac{c^2}{c + v\cos\alpha}} = 4\pi f R^2 \frac{c + v\cos\alpha}{c^2} \tag{858}$$

If the laser is turned, then the angle α of the light flow will change. Therefore, the shift of the light trace on the scale will change. The maximum change in the shift is equal to

$$\Delta x = x_{\max}(\alpha = 0°) - x_{\min}(\alpha = 180°) = 4\pi f R^2 (\frac{c+v}{c^2} - \frac{c-v}{c^2}) = 8\pi f R^2 \frac{v}{c^2} \tag{859}$$

that is

$$f R^2 = \frac{\Delta x c^2}{8\pi v} \tag{860}$$

On the basis of the dependence, we can define the minimum requirements for the measurement system from Figure 56. If the radius of the circle is large, then the frequency of its turn may be smaller. The higher radius R and the higher frequency f, the larger the shift of the light trace Δx is larger and it is easier to measure it.

Velocity v is assumed in accordance with estimation (818). If Δx is read by means of a microscope with the accuracy of 10^{-7} *m* (0.1 μm), then

$$f R^2 \geq \frac{10^{-7} \cdot 299792458^2}{8\pi \cdot 445172} = 803.29 \frac{\mathrm{m}^2}{\mathrm{s}} \tag{861}$$

For a circle with a radius R=2*m*, it is sufficient to rotate it at frequency f=200 1/s. The construction of such a device seems real. Additionally, at point A an optical system can be installed, which will enhance delicate shifts of the trace of light.

For the minimum parameters of the measuring device (861), we obtain from (858) values of the shift of the trace of light on the rotating scale

$$x_{\max}(\alpha = 0°) = 4\pi f R^2 \frac{c+v}{c^2} = 33.72\ \mu\mathrm{m} = 0.03372\ \mathrm{mm} \tag{862}$$

$$x_{\min}(\alpha = 180°) = 4\pi f R^2 \frac{c-v}{c^2} = 33.62\ \mu\mathrm{m} = 0.03362\ \mathrm{mm} \tag{863}$$

7. Kinematics in two-dimensional space (STE₂)

In this chapter, transformations for two-dimensional inertial reference systems have been derived. Dependences for the Doppler effect have been deduced.

7.1. Transformations from the ether to the system in STE₂

< OUT OF ELECTRONIC VERSION >

Transformation (869) from U_E (the ether) to the inertial system U_1 can be written in the matrix form

$$\begin{bmatrix} x_1 \\ y_1 \end{bmatrix} = \begin{bmatrix} \dfrac{\cos\alpha_{1/E}}{\sqrt{\gamma(v_1)}} & \dfrac{\sin\alpha_{1/E}}{\sqrt{\gamma(v_1)}} \\ -\sin\alpha_{1/E} & \cos\alpha_{1/E} \end{bmatrix} \begin{bmatrix} x_E \\ y_E \end{bmatrix} - \frac{1}{\sqrt{\gamma(v_1)}} \begin{bmatrix} v_1 \\ 0 \end{bmatrix} t_E$$
$$t_1 = t_E \sqrt{\gamma(v_1)} \tag{871}$$

Transformation (870) from the system U_1 to U_E (the ether) can be written in the matrix form

$$\begin{bmatrix} x_E \\ y_E \end{bmatrix} = \begin{bmatrix} \cos\alpha_{1/E}\sqrt{\gamma(v_1)} & -\sin\alpha_{1/E} \\ \sin\alpha_{1/E}\sqrt{\gamma(v_1)} & \cos\alpha_{1/E} \end{bmatrix} \begin{bmatrix} x_1 \\ y_1 \end{bmatrix} + \frac{1}{\sqrt{\gamma(v_1)}} \begin{bmatrix} {}_x v_1 \\ {}_y v_1 \end{bmatrix} t_1$$
$$t_E = t_1 / \sqrt{\gamma(v_1)} \tag{872}$$

7.2. The transformation of an angle STE₂

7.2.1. The transformation of an angle from the ether to the system

Angle $\alpha_{1/E}$ is the angle between the axis x_E of the system U_E associated with the ether and the vector of velocity v_1 of the system U_1. Angle $\alpha_{1/E}$ is seen from the ether. The axis x_1 of the system U_1 is parallel to v_1. In the chapter, the value of this angle seen from the system U_1 will also will be calculated. The value of this angle is marked by $\alpha_{E/1}$.

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$$tg\alpha_{E/1} = -\sqrt{\gamma(v_1)} \cdot tg\alpha_{1/E} \tag{879}$$

7.2.2. The transformation of the angle between systems

Two inertial systems U_1 and U_2 move in the ether at velocities v_1 and v_2, as in Figure 59.

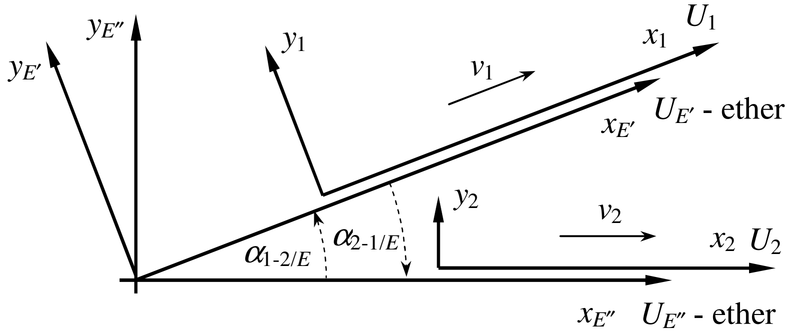

Fig. 59. The system U_1 and U_2 moving in the ether

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Having divided (885) by (886), we obtain the transformation of the angle between systems

$$\frac{tg\alpha_{2/1}}{tg\alpha_{1/2}} = -\frac{\sqrt{\gamma(v_1)}}{\sqrt{\gamma(v_2)}} \tag{887}$$

7.3. The transformation between systems in STE2

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Having introduced x_E, y_E, t_E from (894) into (895) on the basis of (889), we obtain the transformation from the system U_2 to the system U_1

$$\begin{bmatrix} x_1 \\ y_1 \end{bmatrix} = \begin{bmatrix} \cos\alpha_{1-2/E}\dfrac{\sqrt{\gamma(v_2)}}{\sqrt{\gamma(v_1)}} & \dfrac{\sin\alpha_{1-2/E}}{\sqrt{\gamma(v_1)}} \\ -\sin\alpha_{1-2/E}\sqrt{\gamma(v_2)} & \cos\alpha_{1-2/E} \end{bmatrix} \begin{bmatrix} x_2 \\ y_2 \end{bmatrix} + \begin{bmatrix} \dfrac{{}_x v_{2-1/E} - v_1}{\sqrt{\gamma(v_1)}\sqrt{\gamma(v_2)}} \\ \dfrac{{}_y v_{2-1/E}}{\sqrt{\gamma(v_2)}} \end{bmatrix} t_2 \tag{896}$$

$$t_1 = t_2\sqrt{\gamma(v_1)} / \sqrt{\gamma(v_2)}$$

7.4. Velocities in STE2

In the chapter, dependencies for the velocity between the inertial system and the ether have been determined.

7.4.1. Adding velocities

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Having taken (903) and (904) into account, we obtain the dependence for adding velocities

$$\begin{bmatrix} {}_x v_2 \\ {}_y v_2 \end{bmatrix} = \begin{bmatrix} \gamma(v_1)\cos\alpha_{1/E} & -\sqrt{\gamma(v_1)}\sin\alpha_{1/E} \\ \gamma(v_1)\sin\alpha_{1/E} & \sqrt{\gamma(v_1)}\cos\alpha_{1/E} \end{bmatrix} \begin{bmatrix} {}_x v_{2/1} \\ {}_y v_{2/1} \end{bmatrix} + \begin{bmatrix} {}_x v_1 \\ {}_y v_1 \end{bmatrix} \tag{906}$$

If $\alpha_{1/E}=0$ and $\alpha_{2/1}=0$ (then ${}_y v_2={}_y v_{2/1}={}_y v_1=0$ and ${}_x v_2=v_2$ and ${}_x v_{2/1}=v_{2/1}$ and ${}_x v_1=v_1$), this dependence comes down to (88).

7.4.2. The relative velocity I

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Having taken the account of and used transformation of time (911), we obtain a dependence for the relative velocity

$$\begin{bmatrix} {}_x v_{2/1} \\ {}_y v_{2/1} \end{bmatrix} = \begin{bmatrix} \dfrac{\cos\alpha_{1/E}}{\gamma(v_1)} & \dfrac{\sin\alpha_{1/E}}{\gamma(v_1)} \\ -\dfrac{\sin\alpha_{1/E}}{\sqrt{\gamma(v_1)}} & \dfrac{\cos\alpha_{1/E}}{\sqrt{\gamma(v_1)}} \end{bmatrix} \begin{bmatrix} {}_x v_2 \\ {}_y v_2 \end{bmatrix} - \frac{1}{\gamma(v_1)} \begin{bmatrix} v_1 \\ 0 \end{bmatrix} \tag{913}$$

If $\alpha_{1/E}=0$ and $\alpha_{2/E}=0$ (then ${}_y v_{2/1}={}_y v_2=0$ and ${}_x v_{2/1}=v_{2/1}$ and ${}_x v_2=v_2$), this dependence comes down to (89).

7.4.3. Adding relative velocities

< OUT OF ELECTRONIC VERSION >

Having taken transformations of time (917) and (918) into account, we obtain a dependence for adding relative velocities

$$\begin{bmatrix} {}_x v_{3/1} \\ {}_y v_{3/1} \end{bmatrix} = \begin{bmatrix} \cos\alpha_{1-2/E}\dfrac{\gamma(v_2)}{\gamma(v_1)} & \sin\alpha_{1-2/E}\dfrac{\sqrt{\gamma(v_2)}}{\gamma(v_1)} \\ -\sin\alpha_{1-2/E}\dfrac{\gamma(v_2)}{\sqrt{\gamma(v_1)}} & \cos\alpha_{1-2/E}\dfrac{\sqrt{\gamma(v_2)}}{\sqrt{\gamma(v_1)}} \end{bmatrix} \begin{bmatrix} {}_x v_{3/2} \\ {}_y v_{3/2} \end{bmatrix} + \begin{bmatrix} \dfrac{{}_x v_{2-1/E} - v_1}{\sqrt{\gamma(v_1)}\sqrt{\gamma(v_2)}} \\ \dfrac{{}_y v_{2-1/E}}{\sqrt{\gamma(v_2)}} \end{bmatrix} \tag{921}$$

If $\alpha_{2f-1/E}=0$ and $\alpha_{3/2}=0$ (then ${}_y v_{3/1}={}_y v_{3/2}={}_y v_2=0$ and ${}_x v_{3/1}=v_{3/1}$ and ${}_x v_{3/2}=v_{3/2}$ and ${}_x v_2=v_2$), this dependence comes down to (101).

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7.4.4. The relative velocity II

If in the formula (922) we assume that the system $U_3 \equiv U_1$, then ${}_x v_{3/1}=0$, ${}_y v_{3/1}=0$ and ${}_x v_{3/2}={}_x v_{1/2}$, ${}_y v_{3/2}={}_y v_{1/2}$. We obtain

$$\begin{bmatrix} {}_xv_{1/2} \\ {}_yv_{1/2} \end{bmatrix} = \begin{bmatrix} \dfrac{{}_xv_{1-2/E} - v_2}{\sqrt{\gamma(v_1)}\sqrt{\gamma(v_2)}} \\ \dfrac{{}_yv_{1-2/E}}{\sqrt{\gamma(v_1)}} \end{bmatrix} = \begin{bmatrix} \dfrac{v_1 \cos\alpha_{1-2/E} - v_2}{\gamma(v_2)} \\ \dfrac{v_1 \sin\alpha_{1-2/E}}{\sqrt{\gamma(v_2)}} \end{bmatrix} \tag{923}$$

If in the formula (921) we assume that the system $U_3 \equiv U_2$, then ${}_xv_{3/2}=0$, ${}_yv_{3/2}=0$ and ${}_xv_{3/1}={}_xv_{2/1}$, ${}_yv_{3/1}={}_yv_{2/1}$. We obtain

$$\begin{bmatrix} {}_xv_{2/1} \\ {}_yv_{2/1} \end{bmatrix} = \begin{bmatrix} \dfrac{{}_xv_{2-1/E} - v_1}{\sqrt{\gamma(v_1)}\sqrt{\gamma(v_2)}} \\ \dfrac{{}_yv_{2-1/E}}{\sqrt{\gamma(v_2)}} \end{bmatrix} = \begin{bmatrix} \dfrac{v_2 \cos\alpha_{1-2/E} - v_1}{\gamma(v_1)} \\ \dfrac{-v_2 \sin\alpha_{1-2/E}}{\sqrt{\gamma(v_1)}} \end{bmatrix} \tag{924}$$

< OUT OF ELECTRONIC VERSION >

Formulas for adding velocities take the form

$$\begin{bmatrix} {}_xv_{3/1} \\ {}_yv_{3/1} \end{bmatrix} = \begin{bmatrix} \cos\alpha_{1-2/E} \dfrac{\gamma(v_2)}{\gamma(v_1)} & \sin\alpha_{1-2/E} \dfrac{\sqrt{\gamma(v_2)}}{\gamma(v_1)} \\ -\sin\alpha_{1-2/E} \dfrac{\gamma(v_2)}{\sqrt{\gamma(v_1)}} & \cos\alpha_{1-2/E} \dfrac{\sqrt{\gamma(v_2)}}{\sqrt{\gamma(v_1)}} \end{bmatrix} \begin{bmatrix} {}_xv_{3/2} \\ {}_yv_{3/2} \end{bmatrix} + \begin{bmatrix} {}_xv_{2/1} \\ {}_yv_{2/1} \end{bmatrix} \tag{927}$$

and

$$\begin{bmatrix} {}_xv_{3/2} \\ {}_yv_{3/2} \end{bmatrix} = \begin{bmatrix} \cos\alpha_{1-2/E} \dfrac{\gamma(v_1)}{\gamma(v_2)} & -\sin\alpha_{1-2/E} \dfrac{\sqrt{\gamma(v_1)}}{\gamma(v_2)} \\ \sin\alpha_{1-2/E} \dfrac{\gamma(v_1)}{\sqrt{\gamma(v_2)}} & \cos\alpha_{1-2/E} \dfrac{\sqrt{\gamma(v_1)}}{\sqrt{\gamma(v_2)}} \end{bmatrix} \begin{bmatrix} {}_xv_{3/1} \\ {}_yv_{3/1} \end{bmatrix} + \begin{bmatrix} {}_xv_{1/2} \\ {}_yv_{1/2} \end{bmatrix} \tag{928}$$

7.4.5. Relative velocities of two systems

< OUT OF ELECTRONIC VERSION >

7.5. Doppler effect w STE

In the chapter, the Doppler effect in STE has been determined. In the first case, the receiver is in the ether, while the transmitter moves along a line. In the second case, the transmitter is in the ether, while the receiver moves along a line. In the third case, a formula for the general Doppler effect has been derived.

7.5.1. The receiver in the ether

The receiver is stationary in the ether. The source moves along the axis x of the system U, associated with the ether, at velocity $v \le c$ and transmits light impulses at frequency f_S'. Figure 66 shows two points *A* and *B*, where the source has transmitted impulses. The first impulse is sent at time t_S', and the other at time $t_S'+T_S'$ (in the source system). In the figure, two circles which correspond to impulses, are marked.

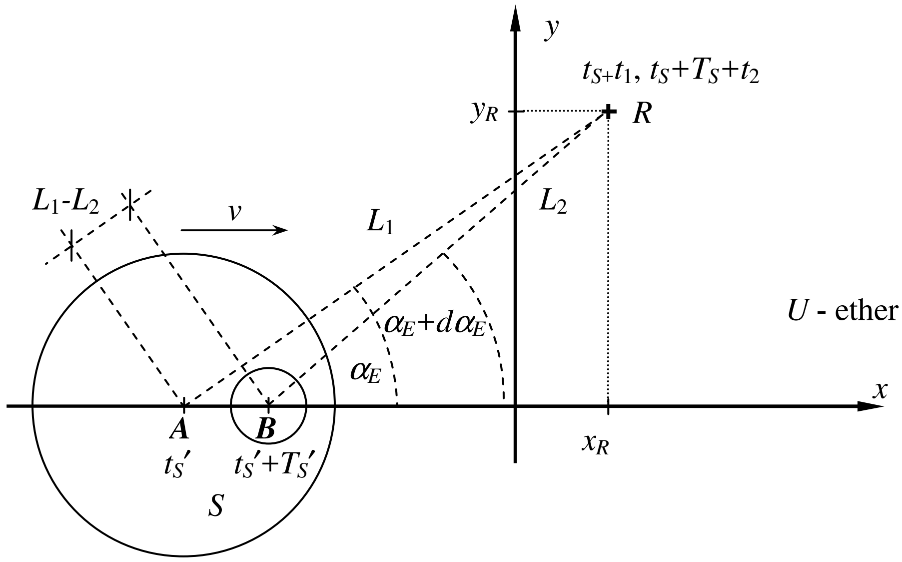

Fig. 66. Source *S* moves along the axis *x*

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Finally, we obtain

$$f_R = f_S' \frac{\sqrt{c^2 - v^2}}{c - v\cos\alpha_E}; \quad \alpha_E \in (0 \div 180^\circ) \tag{941}$$

Angle α_E is the angle seen from the ether.

7.5.2. The source in the ether

The source is stationary in the ether and transmits light impulses with the frequency f_S. The receiver moves along the axis *x* of the coordinate system *U*, associated with the ether, at velocity $v \le c$. Figure 67 shows two points ***A*** and ***B***, in which a receiver receives the impulses. The first impulse reaches the receiver at time t_R, and the other at time t_R+T_R (measured in the ether). Two circles in the figure correspond to the two impulses.

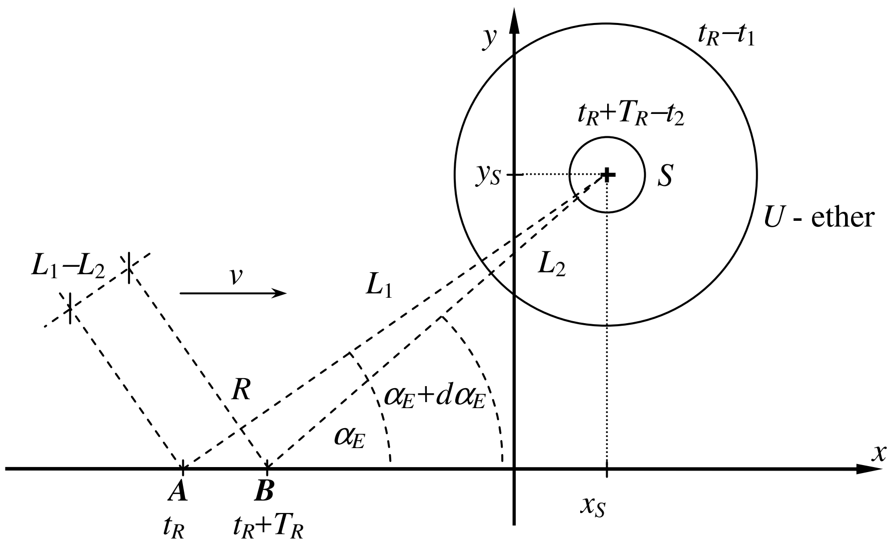

Fig. 67. Receiver *R* moves along the axis *x*

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Finally, we obtain

$$f'_R = f_S \frac{c + v\cos\alpha_E}{\sqrt{c^2 - v^2}}; \quad \alpha_E \in (0 \div 180^\circ) \tag{953}$$

Angle α_E is the angle seen from the ether.

7.5.3. The mobile source and receiver

The chapter will be discuss a case in which both the source and receiver move in the ether.

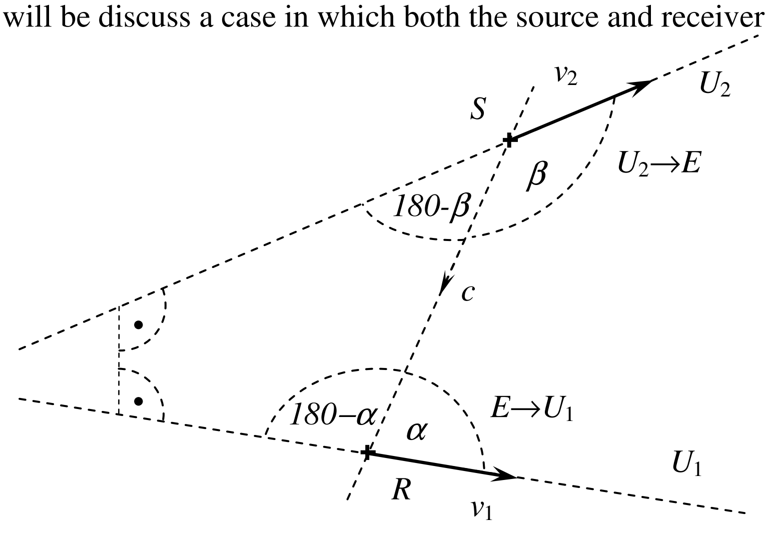

Fig. 68. Receiver *R* moves at velocity v_1,
source *S* moves at velocity v_2 in the ether

In Figure 68, light that has been sent from the source travels in the ether to receiver *R*. On the basis of (941) and (953) we have

$$f_E = f'_{Z_2} \frac{\sqrt{c^2 - v_2^2}}{c - v_2 \cos\beta}; \quad \beta \in (0 \div 180^\circ) \tag{954}$$

$$f'_{O_1} = f_E \frac{c + v_1 \cos\alpha}{\sqrt{c^2 - v_1^2}}; \quad \alpha \in (0 \div 180^\circ) \tag{955}$$

Having introduced f_E from dependence (954) to (955), we obtain

$$f'_{O_1} = f'_{Z_2} \frac{\sqrt{c^2 - v_2^2}}{\sqrt{c^2 - v_1^2}} \frac{c + v_1 \cos\alpha}{c - v_2 \cos\beta}; \quad \alpha, \beta \in (0 \div 180^\circ) \tag{956}$$

Formula (956) allows for converting the frequency between the source in the system U_1 and the receiver in the system U_2.

Angles α and β are the angles seen from the ether.

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8. Desynchronization of clocks

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9. Final Word

In this paper, we presented the formal introduction of a new physical theory, which we called the Special Theory of Ether. STE describes kinematics and dynamics of motion of bodies in space.

It is a great mystery how it is possible that the Special Theory of Relativity, which is self-contradictory and thus useless to draw objective conclusions about reality, is a theory widely recognized.

It is very probable that the results of many experiments that were contradictory to STR have not been published. Researchers who have obtained them rather pick out errors in the experiment itself or errors in the interpretation of results, than the evidence that STR is erroneous and inconsistent with experiments. It is also very probable that the results of many experiments have been distorted to match STR and easily passed the review. Some scientists to get promoted, prefer to have any publication than waste time on discussions with reviewers defending STR. They know that it is unlikely that articles contrary to the prevailing doctrine would receive positive reviews. Additionally, there is a big fear of embarrassment. Few physicists who notice contradictions in STR want to admit it. They do not want to be recognized as people not understanding this "greatest achievements of human thought".

Since the proper theory of kinematics and dynamics of bodies in space is already available, there is a need for the reassessment of the results of all physics experiments and astronomical observations previously analyzed using STR.

The following issues remain open:

1. What are the general properties of transformations (51) and (52)? What are the minimum necessary assumptions to enable these transformations to have properties resulting from the Michelson-Morley experiment? (Section 2.3.1)
2. Does the function $F(v_1, v_2)$ have to have separated parameters, that is there function $F(v_1, v_2)$ with parameters unseparted, for which the transformation has properties of Michelson-Morley? (Section 2.3.2)
3. Is it possible to calculate function $F(v_1, v_2)$ or $\gamma(v)$ without referring to the results of the Michelson-Morley experiment? (as in the derivation of the Lorentz transformation by the method of Szymacha which does not use the results of this experiment)? (Section 2.3.2)
4. For what functions $\gamma(v)$ the transformation that has the properties of Michelson-Morley, in approximately, can be obtained? (Section 2.3.2)
5. For what functions $\gamma(v)$ transformations that have the property of Michelson-Morley locally, e.g. for small velocities relative to the ether? (Section 2.3.2)
6. What is the relationship between the four outlined descriptions of dynamics of bodies STE/Δp, STE/F, STE/ΔE and STE/m? Are these descriptions of the entirely different dynamics, or are they other descriptions of the same dynamics of bodies? (Chapter 3)
7. If the descriptions of dynamics of bodies STE/Δp, STE/F, STE/ΔE and STE/m are descriptions of the completely different dynamics, it is necessary to decide which description is correct. This comes down to the determination what the relativistic mass is. Perhaps, the determination will be possible only through experiments? (Chapter 3)
8. It is advisable to search for universal methods of determining the laws for the kinetic energy and the momentum for different definitions of relativistic mass. The law of the kinetic energy is left undetermined in STE/F, whereas in STE/m a more elegant form can be searched (Chapter 3)

9. The experiment measuring the velocity of light in one direction by the method proposed in this paper should be realized (Chapter 6)
10. It is advisable to search for other than proposed in the work methods of measuring the velocity of light in one direction.
11. Experiments with the decay of meson K^+ should be repeated and it should be checked whether measured velocities correlate with the orientation of the Earth in space or the orientation of the laboratory on the Earth. (Chapter 5)
12. What are the possible methods of calculating velocities of the Solar System in the ether? (apart from the methods specified in the work). (Chapter 5)
13. Dependencies for the momentum and adding velocities at any angles must be derived for the two-dimensional space (STE_2).
14. Dependencies for adding forces at any angles must be derived for the two-dimensional space (STE_2).
15. The transformation for the three-dimensional space (STE_3) should be derived and it should be verified which of the possible descriptions of the turn of space will be the most convenient.
16. Dependencies for adding velocities at any angles should be derived for the three-dimensional space (STE_3).
17. Dependencies for the momentum and adding velocities at any angles should be derived for the three-dimensional space (STE_3).
18. Dependencies for adding forces at any angles should be derived for the three-dimensional space (STE_3).
19. It is advisable to simulate the contraction of time in the system of a satellite in the Earth's orbit in the three-dimensional model of kinematics (STE_3) and verify it with the experimental data.

10. Appendices

10.1. Classical Mechanics

10.1.1. Equations of motion in classical kinematics

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10.1.2. The Galilean transformation

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10.1.3. Classical dynamics of Isaac Newton

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10.1.4. The law of the momentum and kinetic energy

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10.2. The Michelson-Morley experiment

The Michelson-Morley experiment, conducted in 1887, consisted in checking the interference of two separated light streams running along two different paths, at different setting of the measuring device. The scheme of the measuring device is shown in Figure 75. A similar device was used to measure the wavelength of light.

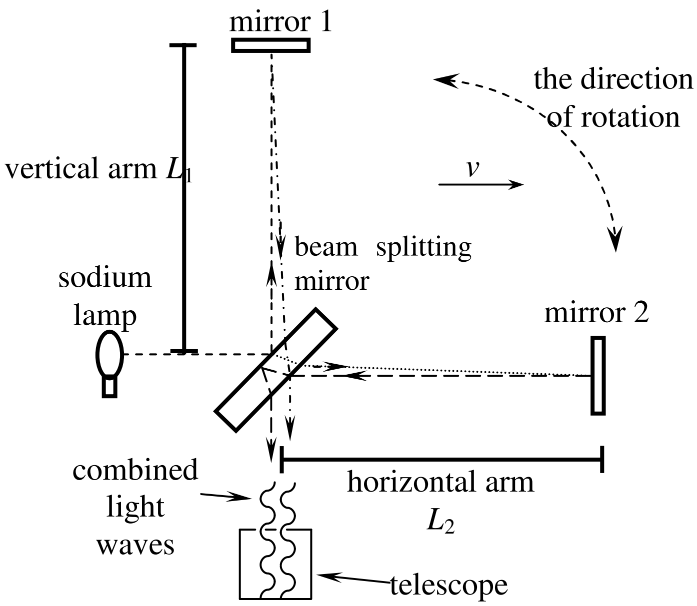

Fig. 75. The Michelson-Morley interferometer

When the Michelson-Morley experiment was planned, it was thought that light travels in the medium called the ether at velocity c. If the interferometer moves along with the Earth in the ether, then according to classical mechanics, light should have in the Earth system different velocities, depending on the direction of the light flow. Therefore, the time of the light flow along arm L_1 and L_2 should change during the rotation of the interferometer. For example, formulas (217) express times for the cases when the light path is parallel to the velocity of the Earth in the ether.

At the beginning, distances L_1 and L_2 were selected so as to achieve the phase synchronization of the combined light streams, that is interference fringes in the telescope. Then, the interferometer was rotated. Because of the time change of the light flow along the arms of the interferometer, interference fringes should change. However, during the rotation of the device, no change in interference fringes has been detected. This result was inconsistent with expectations. It could not be explained on the basis of classical mechanics.

In 1892, Hendrik Lorentz, and independently George Francis FitzGerald noted that to explain the results of the experiment, it is necessary to adopt the hypothesis of contraction. In 1895, Hendrik Lorentz presented, still in the implicit form, the transformation called the Lorentz transformation today. The exact form of that transformation was presented in 1900 by Joseph Larmor [1]. Henri Poincaré in works from 1904 introduced the concept of the relative motion and local time.

In 1905, Albert Einstein introduced the Special Theory of Relativity, which seemingly explained the results of the Michelson-Morley experiment. To that end, Einstein adopted the simplest possible assumption. He assumed that the velocity of light c is constant and does not depend on the state of motion of the body which emits light. In fact, if the velocity of light was always constant in every direction and in every inertial system, then the results of the Michelson-Morley experiment would become obvious. The rotation of the interferometer arms does not affect the velocity of light nor does it change the interference fringes. When Einstein announced STR, he claimed that he did not know about the Michelson-Morley experiment [1].

The second assumption of Einstein was that there is no absolute rest, that is, that all inertial systems are equivalent. According to the Special Theory of Relativity, there is no universal reference system called the ether. At the beginning, this theory was criticized by numerous scientific environments, but over time, it has become an accepted theory describing kinematics and dynamics of bodies in space. Today it is considered a complete theory [1] and indisputable. It is even announced as the biggest achievement of human thought.

The Special Theory of Relativity was built on an erroneous interpretation of the Lorentz transformation.

The problem is that, by the adoption of the Special Theory of Relativity, it has been widely acknowledged that the results of the Michelson-Morley experiment prove that there is no ether.

However, nobody presented a formal evidence excluding the ether!

The second problem is that the Special Theory of Relativity is a self-contradictory theory. Under this theory, contradictory conclusions can be derived. Therefore, it is a theory useless to draw objective conclusions.

We have shown that in order to explain the results of the Michelson-Morley experiment it is necessary to introduce a universal reference system – the ether. Our theory is internally coherent and is consistent with the results of known experiments.

The Special Theory of Relativity has its own development in the form of the General Theory of Relativity. Since the General Theory of Relativity is based on the assumption that all systems are equivalent, it is also an erroneous theory. Meanwhile, the whole astrophysics, the theory of the Big Bang and of the expanding universe, the model of black hole and the hypothesis of dark matter existence were built on the basis of this theory.

10.3. The Lorentz transformation by the method of Szymacha

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10.4. The Lorentz transformation by the geometric method

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10.5. The derivation of the Doppler effect for STR

It was difficult to find in the literature on STR a decent derivation of the Doppler effect. The fact that within STR two contradictory formulas describing this effect can be derived is concealed. Therefore, below our version of this derivation for the Special Theory of Relativity is presented.

If in a inertial system Z, there is a light source with set frequency, the observer located in another inertial system O will measure different frequency of this light. This effect is called the Doppler effect. Now, we will calculate the dependence between the frequency of the source and the frequency measured by the observer in two ways.

First, we will consider the task from the point of view of the observer. For him, source Z moves at velocity v, component of which in its direction is equal to $v \cdot \cos(\alpha)$. This is shown in Figure 77.

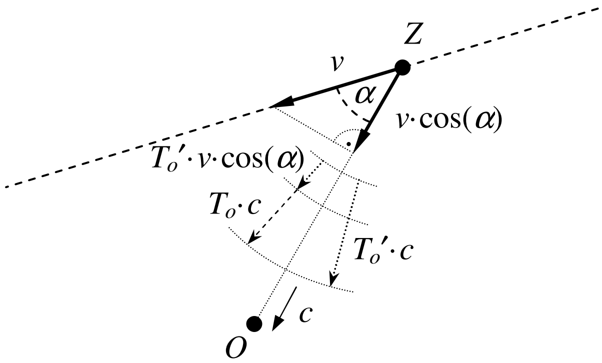

Fig. 77. Light source *Z* moves relative to the observer *O*

From the point of view of the observer *O*, time t_z in the system *Z* moving in relation to him elapses more slowly than his own time t_o, according to the dependence

$$t_o = t_z \frac{1}{\sqrt{1-(v/c)^2}} = t_z \frac{c}{\sqrt{c^2 - v^2}} \tag{1068}$$

By T_z we denote the period of the light wave in the source system. This time in the system of the observer has the value according to dependence (1068) as below

$$T_o' = T_z \frac{c}{\sqrt{c^2 - v^2}} \tag{1069}$$

At some point, the source generates an impulse of a wave which approaches an observer at the velocity of light *c*. The path in the observer system, which light travels between successive impulses is equal to

$$T_o'c \tag{1070}$$

At this time, source *Z*, which comes after the impulse of a wave, will move towards the observer over the path

$$T_o'v\cos(\alpha) \tag{1071}$$

For T_o, the wave period is seen by the observer. This amount of time is necessary for another impulse of light to reach the observer. Therefore, the distance which is between the observer and the next impulse is equal to

$$T_o c \tag{1072}$$

So we can write as shown in the figure

$$T_o c = T_o'c - T_o'v\cos(\alpha) \tag{1073}$$

So we have

$$T_o = T_o' \frac{c - v\cos(\alpha)}{c} \tag{1074}$$

Having introduced dependence (1069), we obtain

$$T_o = T_z \frac{c - v\cos(\alpha)}{\sqrt{c^2 - v^2}} \tag{1075}$$

As the wave frequency *f* is the reverse of period *T*, finally we obtain the first searched dependence

$$f_o = f_z \frac{\sqrt{c^2 - v^2}}{c - v\cos(\alpha)} \tag{1076}$$

Now we consider the task from the point of view of the source. For it, observer O moves at velocity v, the component of which in its direction is equal to $v \cdot \cos(\alpha)$. This is shown in Figure 78.

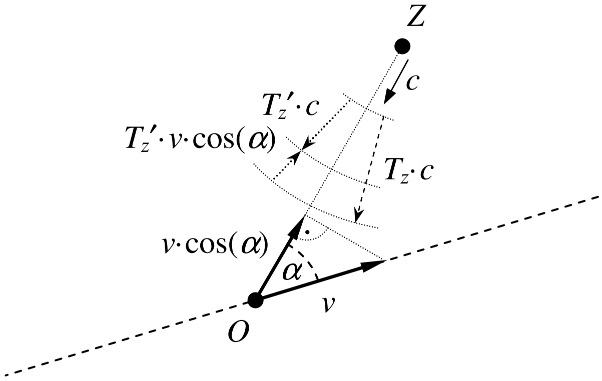

Fig. 78. Observer O moves relative to light source Z

This time, from the point of view of source Z, time t_o in the system O moving in relation it passes more slowly than its own time t_z, according to the dependence

$$t_z = t_o \frac{1}{\sqrt{1 - (v/c)^2}} = t_o \frac{c}{\sqrt{c^2 - v^2}} \tag{1077}$$

By T_o we denote the period of the light wave in the observer system. This time in the system of source has the value in accordance with dependence (1077) as below

$$T_z' = T_o \frac{c}{\sqrt{c^2 - v^2}} \tag{1078}$$

At some point, the observer receives an impulse of wave. Another impulse of wave, approaching him at velocity c, is then at the distance of

$$T_z c \tag{1079}$$

When further impulse approaches observer O, at that time, he runs towards that impulse. By T_z' we denote time, as seen from the source, after which they meet. At this time, the observer will go over the path

$$T_z' v \cos(\alpha) \tag{1080}$$

while light will travel the path

$$T_z' c \tag{1081}$$

In accordance to the figure, it can be written as

$$T_z' c + T_z' v \cos(\alpha) = T_z c \tag{1082}$$

that is

$$T_z' = T_z \frac{c}{c + v\cos(\alpha)} \tag{1083}$$

Having introduced dependence (1078), we obtain

$$T_o = T_z \frac{\sqrt{c^2 - v^2}}{c + v\cos(\alpha)} \tag{1084}$$

As the wave frequency f is the reverse of the period T, finally we obtain the second searched formula

$$f_o = f_z \frac{c + v\cos(\alpha)}{\sqrt{c^2 - v^2}} \tag{1085}$$

A commentary to these derivations is placed in Section 0.

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Substantive comments on the presented theory

and

any comments about errors in this issue

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