SPECIAL RELATIVITY THEORY AND EXPERIMENT

Nicolay Chavarga
Uzhgorod National University, Pidhirna Str., 46, 88 000, Uzhgorod, Ukraine
chavarga@mail.uzhgorod.ua

It is shown that the special relativity theory is not confirmed experimentally. In fact, Michelson's experiments demonstrate real shortening of moving bodies, experiments with moving muons demonstrate real deceleration of processes in the moving frame, and it means that the coordinate frames are not equivalent. Lorentz's time transformation does not turn into Galileo's time transformation at low motion velocities, therefore, special relativity theory does not correspond to Bohr's principle. The dependence of a body's mass on the motion velocity, and also connection of a body's mass with its energy are confirmed experimentally, but have no relation to the relativity theory.

Keywords: special relativity theory, Lorentz's transformations, Michelson's experiments, Bohr's principle.

1. Introduction

More than a hundred years passed since the Special Relativity Theory (SRT) was made up. Officially its experimental confirmation is recognized in various investigations; nevertheless, discussions about its correctness do not stop up till nowadays, especially at the Internet forums. If this problem is attentively analyzed, then it is found out that in these discussions, both sides failed to clarify accurately not only the essence of the theory itself and the questions under discussion, but also the physical meaning of the quantities belonging to the equations. The aim of the present work is to give the relativity theory in general, and the SRT in particular, in as accessible way as possible, because, as practice shows, the discussing sides speak different languages in most cases. The main problem consists in misunderstanding the essence of the relativity theory and the physical meaning of the quantities belonging to the equations. In the present work, special attention will be paid to the problem of experimental testing the theory, since shallow attitude towards this question will lead to incorrect conclusions.

We do not hope that many readers will be patient to read the article quite large in its volume; therefore, beginning with introduction, we will propose the reader to think over a simple example. It is known that any new theory must in the conditions, in which the old theory is true, give the calculations results slightly differing from ones obtained according to the old theory. The simplest problem in the relativity theory is to calculate the coordinates of some event in the moving frame, if the motion velocity V of the frame and the coordinates of the event A(x, t) in the immovable frame are given. Example: let the event's coordinate be equal to $x=10^{16}$ *m*, $t=100$ *s*, and the frame's velocity $V=900$ *m/s*. One should calculate the coordinates of this event in the moving frame according to Galileo's relativity theory and the SRT, and then compare the results concerning their convergence-divergence.

The velocity of 900 *m/s* we consider as pre-relativistic, since it is the velocity of a modern airplane (below we will return to grounding this confirmation). The distance of 10^{16} *meters* is only one third of a *parsec*, a unit of length measurement in astronomy.

In this chapter, we will not give the calculations of the space coordinate, since the divergence in the direction of motion is observed only in the twelfth digit. For making calculations of the time coordinate, one should use Galileo's and Lorentz's time transformations.

Galileo's transformation:

$$t'=t=100\ s. \qquad (1.1)$$

This result means that all chronometers in the moving frame have the same indications, as all chronometers in the immovable frame. We intuitively expect to obtain approximately the same result according to the SRT – about 99.9999999991. However:

Lorentz's transformation:
$$t'_L = \frac{t - \frac{V}{C^2}\,x}{G} = \frac{100 - \frac{900}{9\cdot 10^{16}}\,10^{16}}{\sqrt{1 - \frac{81\cdot 10^4}{9\cdot 10^{16}}}} = 0\ s \qquad (1.2)$$

As we see, the divergences are unexpected and impressive – instead of expected 99.9999999991 *s*, exactly zero is obtained. We analyzed an event at the distance of 10^{16} *m* to the right from the coordinate origin. If we analyze the point at the distance -10^{16}, i.e. at the same distance, but to the left from the coordinate origin, we will obtain a bit more than 200 *seconds*, instead of 100 *seconds* according to Galileo. For the distance equal to the Galaxy's diameter ($\sim 6\cdot 10^{20}$ *m*), we will obtain approximately minus 70 *days*, though Galileo's theory gives us exactly 100 *seconds*, as before. Below we will analyze in detail, what the cause of these divergences consists in, and what they mean in reality.

The present work is a kind of conclusion to the discussions, both oral and numerous long-time Internet discussions (in particular, at www.membrana.ru) organized chiefly on the materials stated in works [1-3]. This fact explains the detailed explanation of a series of moments, which appeared to be difficult for perception, in despite of their simplicity.

2. Space and Time Coordinates

In physics, for describing world picture, the notions of absolute space and absolute time are introduced. Newton [4] tried to give the definition of these notions most completely, but his definitions are far from being perfect and, as a matter of fact, they are descriptions of intuitive perception of both infinite space and time. It is quite possible that in this aspect, human intellect is simply unable to comprehend more. On the other hand, in our opinion, the most serious attempts of clarifying and developing the notions of space and time are represented in Burlankov's works, see, for example [5].

The notion of absolute space supposes it as independent on time, and it is mathematically represented through the notion of space coordinate frame. When a coordinate frame is being introduced, some point in space is considered as zero according to the investigator's discretion, the direction to the point under investigation is selected, the length etalon is selected, and marks are set on the coordinate axes. Thus, the coordinate x of some point A on the selected axis is the quantity of marks (etalons) on this axis from the zero point to that one under investigation, i.e. it is not simply a number, but a measured distance. Note that the coordinate x is the characterization of a place in space, rather than of the investigated material point. A material point can move into another place in space, but the coordinate x will denote that place in space, where the material point was before. Evidently, though x is an arbitrary number, in our meditations x=const, since "place in space" does not move anywhere.

The notion of time is introduced in an approximately analogous way. According to the investigator's viewpoint, some moment of time is considered as zero. Then some mechanism, which changes its state periodically, is selected, this mechanism is considered as an etalon device for measuring time, then the quantity of the device's tickings from the zero moment to the investigated, i.e. the present moment t, is considered as the "given moment of time". Therefore, the point with the coordinate t on the time axis is not an arbitrary number, but the quantity of periodical movements of the etalon mechanism from the zero moment to the investigated one, i.e. the time interval. Obviously, when making up a theory, in which the notion of motion in space and time is introduced, it is unnecessary to speak about a concrete length etalon, procedure of setting marks on the space axis, concrete chronometer mechanism and concrete synchronization procedure. In theory, we simply consider that we have a coordinate frame, the marks on the axes are set in accordance with the etalon, everywhere ideal chronometers are situated, synchronization is done ideally, and with this arsenal we begin to study material world.

This was the first moment, which often becomes an object of discussions on the SRT, as they say, a time moment is simply a number, but not a time interval, and the space coordinate is also simply a number, but not the distance from the zero point to the investigated one, and synchronization is done through slow transition of the chronometer or by means of light signals (there is no other possibility), etc. In reality, the notions of a point's coordinate on the space and time axes cannot be represented quantitatively (i.e. mathematically) in another way but through the distance and time interval; and in the equations, the absence of the dependence of the chronometers indications on the space coordinate testifies to the fact that they are synchronized.

After we introduced the notions of absolute space and coordinate frame (as its mathematical image), and also mathematical time, we made up two instruments for studying material world. Now we assume that these notions will be sufficient for studying and description of any possible situation in the infinite space and absolute time. It is understood that if we need to analyze the question how some situation is seen by a moving material observer, we will give him not a new moving space located into the absolute one, but only a coordinate frame having a shape of a three-dimension lattice built up of "material rods" having properties of a solid body. Obviously, in the moving frame, we will introduce in an analogous way not "new time", but only a system of chronometers measuring mathematical time in one or another way.

This question is not thought up, as it may seem, since in literature and discussions the notions "space shortening in a moving frame" and "time deceleration in a moving frame" are widely used without any attempt of giving the definition, what is "space in space" and what is "one's own time in a moving frame". Nobody dared to say aloud that he introduced the notion of one's own space and one's own separate time for the moving frame, and nobody explained us why the "moving coordinate frame" and "deceleration of physical processes rate" do not suit him. What physical problems cannot be analyzed without introducing new essences in the form of one's own space and one's own time in moving frames? Moreover, "space shortening" and "time deceleration" in a moving frame are widely spread in literature on the relativity theory. This was the second moment, which slides away from the discussion participants for some incomprehensible reason.

Now let us analyze the main properties of the introduced basic notions of physics – space and time, i.e. such properties that in case of their violation space will not be space any more, and time stops being time. Supposition, that all marks on the space axis are set by putting one and the same etalon, reflects the property of space homogeneity. However, the most significant feature consists in the fact, that due to the property of space extent, all points in space are individual, therefore, **coordinates of even two different points in space cannot be denoted by the same set of three numbers *x, y, z.*** The result of violating this property can be illustrated with a ruler for measuring length (or a coordinate axis), on which all points, except the zero, are denoted by the same number, for example, 9. By the well-known analogy, we will call it "length-difference relativity". By means of a similar ruler, it can be easily proven that the thickness, width and length of a matchbox are equal between each other and are equal to 9 centimeters; or that the size of the box and that one of the table, on which a hundred boxes can be located, are equal between each other. It is seen from the given example that it is strictly inadmissible to violate the basic property of space, namely – the individuality of its points. In case of its violation, the theory automatically becomes non-physical. Fortunately, nobody hit upon an idea of introducing the notion of length-difference relativity into physics yet – it is too evident absurdity.

The analogous basic property, which must not be violated under any conditions, is available in time, too: **at the given moment, the time is the same in the whole infinite space,** it is one for the whole infinite Universe. If in space every point is individual (therefore, it should be denoted by an "individual number"), then time has the reverse property – time is sole in the whole Universe. At the level of devices, this property means synchronicity of indications on all chronometers in the whole infinite space. Mathematically, however, it is represented by the fact that when we have a system of equations (each of which describes the motion of some object), then in all the equations united by a brace, we understand the symbol t as having one and the same value, even if at the given moment the distance between the objects is unimaginably large. There cannot be even two points in space, where at the given moment the time would be different.

Just such properties of space and time allow us to write equations of motion of a material point, for instance, $x=x_0+Vt$, where x is the value of the space coordinate at the present time moment, x_0 is the initial condition (these properties, on the one hand, supplement each other and, on the other hand, are absolutely independent of each other). If somewhere in space there were points whose coordinates would have the same value, or in which the time would be different, then the above-mentioned equation would be simply invalid. This was the third moment, to which the investigators studying any relativity theory, not only the SRT, must pay special attention.

3. Essence of the Relativity Theory

Any relativity theory begins with that moment, when with respect to an absolute reference system denoted usually as *K*, another reference system *K′* is started for motion, and one tries to answer the question: how one and the same situation is seen when observed from different reference systems? Obviously, if a problem has no collation of viewpoints from different coordinate frames, then the problem has no relation to the relativity theory, even if one analyzes a moving object, for instance, motion of a rocket with alternating mass (this motion is described by Tsiolkovsky's equation).

In any relativity theory, first and foremost, one should answer only two questions:

a) If in the resting frame *K* the space coordinate of some arbitrary point A (resting in *K*) is equal to *x*, then what will be the value of the coordinate for the same point in the moving frame *K′* at an arbitrary time moment?

b) If all chronometers in frame *K* indicate the moment *t*, then what will the chronometers in the moving frame *K′* indicate at the same time moment?

Answers to these questions are contained in the equations called space and time transformations. The example of answers to the second question we have already given in the introduction. Mathematically the essence of any relativity theory is contained in space and time transformations. All the rest are only conclusions from the theory, obtained after appropriate mathematical elaboration, or the interpretation of the theory essence, for example, on *x*-*t*-diagrams, etc.

If after this elaboration it is found out that the coordinate frames are equivalent in all parameters, one can make a conclusion that it is excessive to attribute the properties of an absolute coordinate frame to frame *K*, to consider it as the distinguished frame. However, any relativity theory should be made up beginning with introduction of an absolute frame, with respect to which a frame *K′* equivalent to it moves uniformly, and it is inadmissible to consider these frames equivalent a priori, until their equivalence is proven. In all similar meditations, it is understood that before the beginning of the experiment both frames were resting, the marks on the coordinate axes coincided, all the chronometers were synchronized and their rate was the same (the way of synchronization is not mentioned), the quantity of chronometers is infinitely large, they are located as tightly as possible and they do not hinder anybody by their presence.

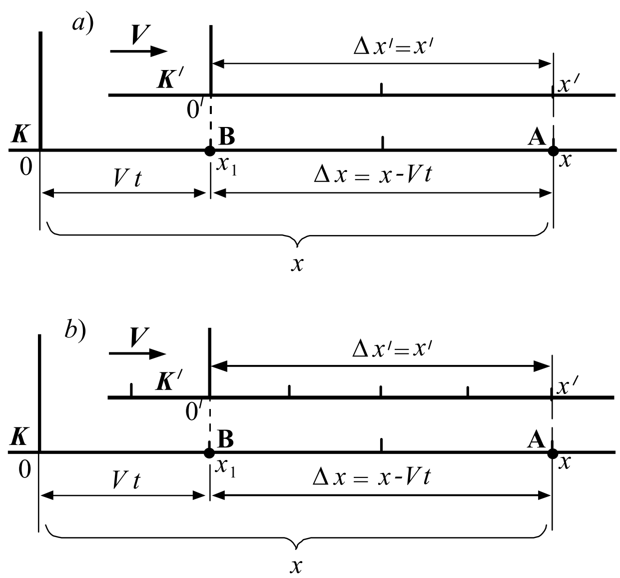

Fig. 3.1. Derivation of Galileo's and Lorentz's space transformations:

a) between points B and A of the absolute space the equal quantity of marks is situated on axes *x* and *x′*;

b) the moving axis is shortened in accordance with *G*=0.5, therefore, between points B and A on the moving axis twice as many marks can enter (Fitzgerald – Lorentz's shortening as a real effect).

For making up space transformations of the coordinates, in frame *K*, one should analyze an arbitrary point A with coordinate *x*. In this case, the following question is to be answered: what is the value of the coordinate for the same point according to the data of measurements made in frame *K′* with devices resting in *K′* ? The answer depends on the properties of the instruments in the moving frame, and the coordinate axes themselves serve as the model of solid bodies and the instrument for measuring length. Supposing the availability of some properties in moving material bodies, we attribute these properties to the space axes of the moving frame.

For example:

a) the bodies' dimensions remain unchanged at all coordinates (Galileo),

b) the bodies' dimensions are shortened at all coordinates (such a theory does not exist),

c) the bodies' dimensions are lengthened at all coordinates (such a theory does not exist),

d) the bodies' dimensions are shortened in the direction of motion and remain unchanged at other coordinates (Lorentz), etc.

For obtaining the space transformation, the coordinate frames are to be "connected" to each other through comparison of the measurements results for one and the same amount of absolute space with instruments of different frames. From the viewpoint of mathematics, it is most rational to compare the amount of space between an arbitrary point A and some point B, opposite which at the analyzed moment the origin $0'$ of frame K' is situated, Fig. 3.1. In contrast to point A, for which $x=const$, the value of the coordinate x_1 for point B in frame K depends on the observation time, and numerically it is equal to Vt, i.e. $x_1=Vt$.

If the division value on the moving axis does not depend on its motion velocity with respect to K, Fig. 3.1, *a*), then $\Delta x=\Delta x'$. On the other hand, one can see from the figure that

$$\Delta x=x-Vt \tag{3.1}$$

$$\Delta x'=x' \tag{3.2}$$

Thus,

$$x'=x-Vt \tag{3.3}$$

We have obtained the space transformation of Galileo's relativity theory (transformation collating the coordinates of an arbitrary point resting in K).

However, if moving material bodies shorten their dimensions in the direction of motion, for instance, proportionally to G (we will call G non-Galileoity coefficient, from *Galileo*), moreover

$$G=\sqrt{1-\frac{V^2}{C^2}} \tag{3.4},$$

then between points A and B of absolute space a larger amount of marks will enter on axis x', since $\Delta x'=\Delta x/G$, Fig. 3.1, *b*), therefore, equation (3.3) will have the following form:

$$x'=\frac{x-Vt}{G} \tag{3.5}$$

Equation (3.5) is Lorentz's transformation for the space coordinate. Note that we made it up on the supposition about **real** shortening of moving bodies, since mathematics does not take bribes, one cannot make arrangements with it, as they say, *let the shortening of moving bodies be apparent, but we will write equations as for really shortened bodies, and the moving axis will be depicted in the figure as really shortened, and on this basis, we will explain the results of Michelson's experiments, but in reality, no real shortening is available…*, i.e. after "successful explanation of the experiment" with inculcation of real shortening effect we will state that *shortening was apparent. Note that the equality* (3.4) *does not follow from anywhere yet, for such a value of G, one can simply successfully explain Michelson's experiments.*

Let us clarify the physical meaning of the quantities belonging to (3.5). The right part represents the quantities measured with instruments of frame K. The quantity x is the coordinate of an arbitrary point A in absolute space (the coordinate of an arbitrary place in space), its value is not connected with the value of the time moment t at all. The quantity t is an arbitrary time moment, at which we were interested in the value of the space coordinate x' of the same point A, but in the frame moving with velocity V. Just the fact, that we have transformation for recalculating the values of the coordinate of an arbitrary point and arbitrary time moment A (x, t), gives us the possibility to recalculate the coordinates of a material point moving *according to any law*, when the space and time coordinates of a point are connected by a concrete law of its motion. Experimentally the independence of the quantities x and t is manifested through the fact that the space and time transformations are checked in principally different experiments: the space – in Michelson's experiments, the time – in experiments with muons. If in Michelson's experiments the effect of physical processes' rate deceleration is not analyzed, then in the experiments with muons Fitzgerald-Lorentz's shortening effect is not analyzed.

Properly speaking, the idea about the shortening of moving bodies was made up first by Fitzgerald, then by Lorentz, for explaining the results of Michelson's experiments, therefore, we will move aside from the common way of stating the relativity theory, let us stop on the space transformation, though we have not yet spoken about the time transformation, and analyze the problems connected with Michelson's experiments, since only in Michelson's investigations, space transformation of coordinates is experimentally tested, more exactly, three transformations – in addition to (3.5), two more transformations are tested, too: $y'=y$ and $z'=z$. Let us only emphasize once more (as an intermediate conclusion) that the essence of any relativity theory consists in the collation of viewpoints towards one and the same fact, situation from different coordinate frames, and the notion "viewpoint" denotes just the result of measurements made with instruments resting immovable in this frame. Therefore, in all equations having relation to the relativity theory, both primed and unprimed quantities must be present. Here we want to prepare the reader to the fact, that later on we will come across the situations, when correlations between quantities, measured with instruments of one frame, are represented as those having relation to the relativity theory.

4. Michelson's Experiments

Michelson's interferometer is schematically depicted in Fig. 4.1. From the source S photons are directed into the silvered plate P, which can divide the ray into two parts – in the direction towards the mirrors M_1 and M_2. Reflected from the mirrors, the photons come together on the plate, interfere (interact) and move to the observer O, who observes interferential stripes. If the length of one of the device's arms is changed at the half of the photon's wavelength, the interferential pattern will change – the light stripes will occupy the place of the dark ones, and vice versa. By means of this phenomenon Michelson tried to find out the fact of the Earth's motion with respect to the light-carrying environment. In this case, it was supposed that the ether moving with respect to the earth (ether wind) will "dispose" the photons in the direction of motion and in the perpendicular direction differently, therefore, the interferential pattern will depend on the orientation of the device.

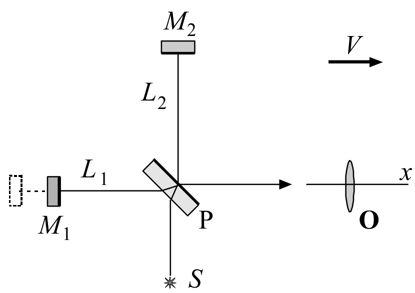

Fig. 4.1. Scheme of Michelson's Interferometer

In literature, very often we come across the statement that in Michelson's experiments the light velocity is measured and the constancy of the light velocity is experimentally confirmed, i.e. it is found out that it does not depend on the velocity and mutual direction of motion of the photon and reference system. This statement is deeply incorrect. In reality, in these experiments it is found out that the interferential pattern does not depend on the orientation of the moving device. That is all, nothing more. Only an unequivocal conclusion can be made from it – that the photons separated by the plate in the direction towards the mirrors M_1 и M_2 come back to the plate simultaneously. Michelson's experiments give no other result. Physicists' task consists in the interpretation of this result. In literature, only four variants of explaining the independence of the interferential pattern on the device's orientation are suggested, and we will analyze them.

4.1. Bodies' dimensions in the direction of their motion do not change if their motion velocity with respect to frame K changes (Galileo's relativity theory is correct), but Ritz's ballistic hypothesis, based upon the photons' corpuscular properties, is carried out. Ritz supposed that the velocity of photons-corpuscles depends on the velocity of the atoms, which emitted them, by analogy with the fact that a bullet's velocity with respect to the Earth depends on the velocity of the aircraft, on which the gun is located.

Elementary calculations show that in this case, photons really will come to the primary position strictly simultaneously. The problem consists only in the fact that astronomical observations more than persuasively demonstrate us that the ballistic hypothesis is not carried out, i.e. in reality the photons' velocity does not depend on the velocity of the sources, which emitted them. This conclusion is made on the basis of the observations at two stars, which can be located at a constant distance from each other thanks to their rotation around a common center – the gravitation force is compensated by the centrifugal force. Linear motion velocity of the stars on the orbit will appear to be significant in this case.

If the ballistic hypothesis were carried out, then photons emitted by a star moving in the direction towards us would have a higher velocity, than photons emitted by a star moving in the direction from us. As a result, faster photons from a distant star would be able to surpass in their way towards the observation place the slower ones (emitted at a different time) several times, so that photons from different places of the stars' trajectory would arrive to the observer simultaneously. Thus, instead of two point depictions of stars, we would see diffuse depictions, or even a ring, if stars are located far enough. However, astronomers do not observe anything similar; that is why the ballistic hypothesis is not seriously analyzed nowadays, in spite of its attractiveness from the viewpoint of simplicity and beauty.

4.2. Photons' velocity does not depend on the velocity of the sources, which emitted them, but all bodies really shorten their dimensions in the direction of motion, in accordance with

$$l = l_0 \, G \qquad (4.1)$$

where l is the moving body's dimension according to the measurements in the immovable frame, l_0 is the same body's dimension, but in resting state with respect to frame K, G is the non-Galileoity coefficient (3.4).

All quantities belonging to this formula are measured with instruments of frame K and, in fact, they concern different objects. Equation (4.1) links the value of the projection of the shortened moving rod with the length of the same rod (or its twin-brother) in resting state, Fig. 4.2, therefore, it has no relation to the relativity theory, however, it can be used for deriving Lorentz's space transformation (and we have already used it, when deriving (3.5)).

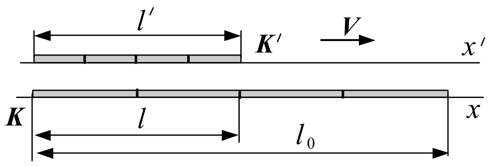

Fig. 4.2

As seen from the figure, the moving rod occupies l marks on the space axis of frame K and l' marks on its own space axis. Obviously, that l' is the result of measuring the length of the moving rod with instruments of frame K', and l is the result of measuring the length **of the same rod**, but with instruments of frame K.

$$l' = \frac{l}{G} \qquad (4.1)'$$

Collation of the results of measuring one and the same object with instruments in different coordinate frames is the "field of activity" or "sphere of interests" of the relativity theory. Relation (4.1)′ represents different observers' viewpoints concerning the moving rod's length, therefore, contrast to (4.1), relation (4.1)′ has already relation to the relativity theory, it is the particular occasion of Lorentz's space transformation (when t=0), if one understands l' as the coordinate of the moving rod's edge. Misunderstanding the difference between (4.1) and (4.1)′ often serves as the object of long and fruitless discussions. This misunderstanding is usually manifested through the expression: "A body's length is maximal in the coordinate frame, in which it is resting". In this case, for proving the equivalence of the frames, near Fig. 4.2 they tend to draw another figure, in which the rod l_0 is depicted smaller than the rod l', though it is evident that both direct and indirect transformations should be represented by the same figure.

Simple calculations show (first Larmor, then Fitzgerald and Lorentz made them), that in this case (case of moving bodies' real shortening), photons will come to the primary place strictly simultaneously, too, therefore, the interferential pattern will not depend on the orientation of the moving device, i.e. Michelson's experiments can be also explained by Fitzgerald – Lorentz's shortening hypothesis. The problem consists only in finding out the physical cause of the bodies' shortening. If it is a constantly acting external force, then, firstly, it must be tremendous in its quantity and, secondly, it must brake the body moving freely in the vacuum, so that the inertia law will not be carried out. In such conditions of motion, the planets would have fallen on the stars long ago, etc. Due to the mentioned difficulties, the question remained without answer for a hundred years.

4.3. The third variant of explaining Michelson's experiments was proposed by Einstein. It supposes violations of the common sense logic and consists in the fantastic supposition about the **independence of a photon's velocity with respect to the moving frame**, moreover, both on the value of the frame's velocity and on the mutual direction of the photon's and frame's motion. How namely could a similar supposition appear? Probably, young Einstein, thinking over the fact of the independence of the photon's velocity on the source's velocity (when a light-carrying environment is available, there is nothing strange in it – the sound velocity does not depend on the velocity of the whistle on a locomotive), formally attributed this idea to the radiation receiver – if the photon's velocity does not depend on the source's velocity, then perhaps it does not depend on the receiver's velocity, either?! Is it impossible to explain Michelson's experiments by means of this idea, without assuming real shortening of bodies in the direction of motion? The main essence of the idea is that if there is no real shortening, then the force for deformation of bodies is not needed, either – the inertia law will be carried out! Such a kind of thinking, when the formal aspect prevails over the physical meaning, when mathematics is set in front of physics, is very characteristic to modern theoretical physics. It could seem, that it would be sufficient to imagine a photon flying to meet two receivers (the latter are coordinate frames at the same time), which move with different velocities, and it will become clear that a photon cannot move simultaneously with one and the same velocity with respect to these two receivers having different velocities and moving, by the way, in different directions. A similar paradox must deny any hypothesis.

The fact of fantastic independence of light velocity on the receiver velocity can be illustrated by means of an imaginary experiment. Assume that the frame K' is moving with respect to the absolute frame K with the velocity close to light velocity, for example, an electron with the velocity V=0.999 C. Let two photons be simultaneously emitted into different sides with respect to the absolute frame with the velocity C. We are tried to be persuaded that photons are so unusual objects that their motion velocity is equal to C even with respect to an electron, which is moving itself with the velocity of 0.9999 C, moreover, irrespective of the mutual motion direction – both in the direction of the electron's motion and reversely! The problem, across which we have just come, is not only physical and mathematical, but also philosophical. How could it happen that the assumption, obviously contradicting to logic and common sense, could be not only proposed for scientific society, but also attentively listened to and recognized? What happened to the physicists that they took a similar supposition into consideration at all? For answering, for the vivid illustration of the essence of Einstein's supposition, let us analyze a simple situation, Fig. 4.3.

Assume that with respect to the Earth (frame K) a long train is moving with the velocity of V according to measuring data in frame K. With the velocity of U two airplanes are moving with respect to K in opposite directions. At the moment $t=0$ both airplanes were located opposite the train middle, which was, in turn, located opposite point $x=0$ of frame K. The question arises: is it possible to do in such a way that the airplanes' velocity with respect to the train (this velocity is measured with instruments in the train) would be equal to U, too, moreover, in both directions simultaneously, and what should be done for it? The absurdity of raising this question is evident, but it non-principally differs from its corresponding raising in the SRT. If a photon is allowed to move with one and the same velocity in the direction towards and opposite the motion of a relativistic electron, then why is a similar action not allowed to the airplane in relation to the train? Why is the airplane worse than a photon?

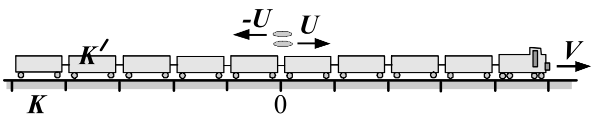

Fig. 4.3

The train's velocity with respect to frame K is equal to V. The airplanes velocities with respect to K are equal to U and $-U$. If in the front of the train the chronometer is set behind (in comparison with the train center, $x=0$), and in the back of the train it is set ahead, then one can reach the fact, that the airplanes velocity, measured with the instruments on the train, will appear to be numerically equal to U in both directions, i.e. independent on the reference system.

Obviously, an answer to similar questions within the limits of logic and common sense simply does not exist. A similar conclusion, obtained as a result of analyzing some assumption, must deny any hypothesis, the SRT, however, became a theory. One of the causes of this state consists in the fact that the paradox was obtained not as a result of analyzing the theory, but was put into the hypothesis as its primary point, its cornerstone, and soon followed the mathematical "explanation" (the latter acted upon theoreticians hypnotically), and the conclusion about "experimental confirmation" was made, of course, by theoreticians.

How can the light velocity constancy postulate be explained mathematically? What measurement procedure does this postulate represent? In Fig. 4.3 the train velocity V is determined by the measuring instruments of frame K, i.e. instruments immovable in frame K – the ruler in frame K (x axis) and synchronized chronometers situated along this ruler. The airplanes' velocity U is determined with the same measuring instruments of frame K. In our case, the relativity theory begins at the moment, when we try to compare the results of measurements of the airplanes' velocities, obtained with the instruments available in the train, with the results of measurement of the same objects' velocities with instruments on the Earth. The main moment here consists in the expression "with measuring instruments available in one or another reference system". Above we have already given the example, how one can in a guileless way and with a guileless instrument (a ruler, on which all the marks are denoted by the same number) "prove" that the dimensions of a matchbox and a table, on which a hundred boxes can enter, are equal. In that example, the main property of the basic notion in physics – space, the property of space points individuality (according to which, even two of them could not be denoted by the same coordinate set x, y, z), was violated.

Now if we by analogy change the main property of the second basic notion of physics – time, then it will not be time already, and the science will not be physics, but at the same time one will be able to explain mathematically the paradoxical postulate of light velocity constancy and even of the airplane's velocity with respect to the train. For this purpose, the observers on the train should use specially dissynchronized chronometers. In order that the airplane catch up the locomotive running away, it needs more time than in the case if the train were resting, therefore, for obtaining the same value of the airplane velocity, as in the immovable frame, the chronometer in the front of the train must be set "behind at the necessary value", for numerical compensation of the difference in time, and the chronometer in the back should be set "ahead appropriately". Now, if the moment of the airplanes' starting is fixed according to the chronometer in the center of the train (origin of K'), and the arrival – according to the chronometer going behind in the front or ahead in the back of the train, one can obtain the same value of the airplane velocity, as in the measurements with instruments of the immovable frame, moreover, both in the direction of the train's motion and reversely! That is where is the essence of the mathematical "explaining" the constancy of the velocity of the airplane or any other object – in changing the main property of the basic notion of physics, in prescription of using dissynchronized chronometers for measuring objects' velocity.

The idea of the chronometers dissynchronization on the train (i.e. in frame K') can be easily represented mathematically. If we denote space coordinates as x, the indications of all the chronometers on the railway (frame K) as t, then the indication t' of the dissynchronized chronometer on the train must depend on the fact, opposite what coordinate x on the railway it is situated at the given moment, i.e. not $t'=t$, as according to Galileo, but

$$t'=t-kx \tag{4.2}$$

Where coefficient k characterizes the degree of the dissynchronization, and it must depend both on the velocity of the train and on the velocity of the airplane, since for each concrete case, its own degree of dissynchronization is needed.

Expression (4.2) prescribes the moving dissynchronized chronometers to go in the same rate as the resting ones. In order to be sure of it, one should make the dissynchronization zero, accept k=0, so that Galileo's transformation is left: $t'=t$.

Now let us exercise a little in the question of the moving chronometer's going rate. If all dissynchronized chronometers in the moving frame should be "made" go slowed, the right part of (4.2) must be multiplied by the coefficient smaller than one, for example, non-Galileoity coefficient G.

$$t' = G(t - kx) \qquad (4.2)'$$

If k=0, expression (4.2)′ turns into $t'=tG$ – we have the decrease of the chronometer's rate without dissynchronization. Depending on the sign before the coefficient k, the dissynchronization can be manifested in the calculations of the quantity t' both through the increase of t' (the quantity Vt is added to t – we have peculiar "acceleration" of the chronometer's going rate) and through its decrease (the quantity Vt is subtracted from t), but it is evident that through G we prescribe all processes, including chronometers, to go in the decreased rate, since G<1.

And now attention! If we want to prescribe all moving dissynchronized chronometers to go in the increased rate, equation (4.2) will have the following form:

$$t' = \frac{t - kx}{G} \qquad (4.2)''$$

Obviously, if we omit dissynchronization (k=0), expression (4.2)″ turns into $t'=t/G$ – we have acceleration of the chronometer's going rate without dissynchronization.

Through manipulation with the chronometers dissynchronization on the train, one can achieve the fact, that the **measured** velocity of the airplanes will be equal both for the airplane flying along the train and that one flying against the train motion. The described manipulation with chronometers on the train is represented practically one-to-one in Lorentz's time transformation.

$$t' = \frac{t - \frac{V}{C^2}x}{G} \tag{4.3}$$

If $k=V/C^2$, equation (4.3) has the form of (4.2)″. It is not difficult to be sure that this equation prescribes to use dissynchronized chronometers. It is enough to substitute t=0 instead of t into (4.3), and it will become clear that at this moment, in the train center (where x=0) we have t'=0, too, but in the front of the train, where $x\neq0$, the formula prescribes the chronometer to go behind (it is denoted by the "minus" sign), and in the back of the train – to go ahead (the "minus" sign is compensated by the minus at the coordinate of the train's back). Note that Lorentz did not derive the time transformation, but simply found out that if such an expression is substituted for time, Maxwell's equation remain invariant. It is a very brilliant example of the fact, when mathematics, set in front of physics, served for physics badly.

The intermediate conclusion: in discussions concerning the correctness of the SRT and its correspondence to the experiment, one must clearly understand that:

a) expression $t'=t$ prescribes the moving synchronized chronometers to go in the same rate as the absolute chronometer (i.e. to indicate time correctly),

b) expression (4.2) prescribes the moving dissynchronized chronometers to go in the same rate as the absolute one, in this case, dissynchronization changed the main property of the notion of time as the basic notion in physics,

c) expression (4.2)′ prescribes the moving dissynchronized chronometers to go in the decreased rate (the main property of the basic notion of physics is changed),

d) expression (4,2)″ prescribes the moving dissynchronized chronometers to go in the increased rate (the main property of the basic notion of physics is changed). It is a very important moment; later on we will come back to its discussion.

As for the very procedure of the mathematical "proof" of the constancy of light velocity, it looks approximately as follows. One analyzes the process of the photon's motion from two coordinate frame, one of which is resting. In frame K, the equation of the photon's motion has the form $x=Ct$ (if the initial position is $x_0=0$), in frame K', it has the form $x'=C'\,t'$. The question arises: what is C' numerically equal to? For answering, the equation of the photon's motion should be transmitted into the primed frame by means of space and time transformations, i.e. everywhere Ct must be substituted instead of x.

$$x' = \left.\frac{x - Vt}{G}\right|_{x=Ct} = \frac{Ct - Vt}{G} = \frac{t(C-V)}{G} \tag{4.4}$$

$$t' = \left.\frac{t - \dfrac{V}{C^2}x}{G}\right|_{x=Ct} = \frac{t - \dfrac{V}{C^2}Ct}{G} = \frac{t\left(1 - \dfrac{V}{C}\right)}{G} = \frac{t(C-V)}{CG} \tag{4.5}$$

C' is determined as the relation of x' to t'

$$C' = \frac{t(C-V)}{G} \Big/ \frac{t(C-V)}{CG} = C \tag{4.6}$$

When analyzing (4.4), it is not difficult at all to see, that for determining the moving point's space coordinate, in accordance with the SRT (as well as in accordance with Galileo's theory), one should take into consideration the dependence of the photon velocity on the frame velocity. We have one of the most unexpected results of the thorough analysis of the SRT essence – **in the SRT, the independence of the photons velocity on the frame velocity is postulated, but the same dependence is taken into account in the intermediate calculations!**

The SRT time transformation (4.5) also prescribes us to take into consideration adding-subtracting the velocities of light and the moving frame, but additionally it contains the "instruction", how to conceal this fact in the calculations with taking into account the result obtained already in (4.4), namely – through the term Vx/C^2, representing the dissynchronization, i.e. the relativity of simultaneity (the contribution of this term into the value of t' for $x>0$ is manifested through the decreasing of t', it is also called "time deceleration"), and also through coefficient G in the denominator (the contribution of this coefficient is manifested through the increasing of t', it is also called "time acceleration").

As H. Weyl spoke, "Mathematics is only a hasher, and if we load it with orach, we will obtain only orach on the outlet". Now we know how expensively the physical science paid for the mathematical explanation of the light velocity constancy. If it is allowed for measuring velocity to use chronometers dissynchronized in a special way, one should not be surprised that the measured photon velocity does not depend on the frame velocity. It is enough to dissynchronize the chronometers in some other way, and we will obtain the "constancy of the velocity of an airplane", or any other object. Therefore, it should be clearly stated that the special relativity theory is the theory, which prescribes to use a ruler with dissynchronized chronometers for making measurements. Another theory, equivalent in the depth of the distortion of the physics basic notion, can be made up by using space coordinate axes with marks denoted by one and the same number.

When we say "chronometers dissynchronized in a special way", then we mean that Lorentz's time transformation prescribes to make dissynchronization for every velocity in its own way, moreover, asymmetrically with respect to the coordinate origin – into one side from the zero mark the chronometers are prescribed to be set ahead, into the opposite side – behind. It may be strange, but physically it means that in the time transformation, in reality, the information about the direction of motion of frame K' is put – otherwise how can one know in what direction the chronometers should be set behind, and in what – ahead, if you do not know in what direction your frame is moving? In frame K', what must the experimenter do, who performs the procedure of synchronization, if at the given moment he does not see frame K for some reason? In a month or two he will see it, but synchronization must be made right now.

However, if in case of an attempt to synchronize the chronometers with photons, the dissynchronization is performed automatically, then it just means that we deal with the dependence of light velocity on the frame velocity and direction of motion. In other words, the time transformation contains information not only about the dependence of light velocity on the frame velocity, but also the prescription, how to conceal this fact – according to what law the chronometers are to be dissynchronized, so that the result of measuring light velocity would not depend on the direction and velocity of the frame's motion. Not light velocity is independent on the velocity of the frame, in which it is measured, but the **result of measuring** light velocity. But the result of measurements, as it is known, can be correct, and it can be incorrect – what results of measuring objects' length we will obtain, if we use a ruler, in which one and the same number is drawn at each mark?

It is noticeable that in all discussions about the SRT, the discussing parties do not pay attention that in reality, **Michelson's experiments cannot be explained by the chronometers' dissynchronization**, since photons do not fix the moments of their start from the silvered plate and the moments of arrival to the mirrors. If, according to the time transformation, the time is different on the silvered plate and the mirrors (in reality, the indications of the dissynchronized devices measuring time are different), then mathematically one can obtain one and the same measured value of the photons velocity (both in the direction of the frame's motion and reversely). Then, after Einstein, one can state, that though there is no real shortening of bodies in the direction of motion, the interferential pattern in Michelson's device remains unchanged, since the measured velocity of the photon's propagation does not depend on the velocity and the direction of the device's motion. In this case, the following fact slides away from the reader's attention: the value of the measured (in reality, calculated) photon's velocity is obtained artificially, through the dissynchronization, and photons are not interested in the indications of chronometers on the plate and mirrors of the interferometer, and they are not busy calculating their own velocity. Either they will come back to the plate at the necessary time, if the device's arm is really shortened and in the necessary proportion (in Fitzgerald–Lorentz's shortening proportion, i.e. proportionally to G), so that the interferential pattern will not depend on the device's orientation, or they will come late. Experiments show that photons come to the primary positions simultaneously in case of any orientation of the interferometer. Therefore, we have to state clearly, that Michelson's experiments demonstrate us real shortening of moving bodies (confirming Lorentz's space transformations at the same time), however, real shortening means that the coordinate frames are not equivalent, i.e. in reality, Michelson's experiments deny the SRT in Einstein's interpretation. One must recognize that it is an absolutely unexpected conclusion after a hundred years of "experimental confirmation" of the SRT by Michelson's experiments, after the SRT "was made up" on the basis of Michelson's experiments.

Note that in discussions concerning Michelson's experiments, one party suggests to use specially dissynchronized chronometers for measuring light velocity, motivating it by the viewpoint that correct synchronization cannot be fulfilled in principle (relativity of simultaneity). Another party tries all the time to make up various imaginary experiments, from which "obviously follows the dependence of light velocity on the frame velocity", as in the above-mentioned example – to direct a photon towards the relativistic electrons, and to try to answer the question: how the photon can move with the same velocity opposite both electrons simultaneously. In fact, we are speaking about different things, and it should be clearly remembered. In reality, in discussions about Michelson's experiments, and the SRT as a whole, one should discuss the question, whether it is admissible or inadmissible to use dissynchronized chronometers for measuring objects' velocity, and also the question, how the dissynchronization of chronometers in different parts of Michelson's device influences photons' behavior. What will change in photons' behavior depending on the degree of the chronometers' dissynchronization in different parts of the interferometer – what will the chronometers indicate on the silvered plate and what on the mirror running away from the photon (or towards the photon)?

Now it is reasonable to recollect about Sagnac's experiments with the rotating interferometer. In this device, a beam of photons is also divided into two parts, in one of which the photons catch up the mirrors running in circular direction (by analogy with the airplane catching up the train locomotive). In the other part, the photons are spread in the direction towards the running mirrors (like the airplane flying towards the train's back). In these experiments (and also in the equivalent Michelson–Gel's experiments) one can easily fix the fact of changing the device's rotation velocity, in other words, the fact of dependence of the photons velocity on the rotation direction. And now we know why – in Sagnac's experiments, photons do not pay attention to the "relativity of simultaneity", i.e. to the different indications of chronometers at different mirrors (this discrepancy is prescribed by the dissynchronization), and these photons come back into initial positions as they can, i.e. not simultaneously. As a result, the device clearly fixes the changing of its own rotation velocity – when the device's rotation velocity changes, the interferential pattern changes.

4.4. The fourth variant of explaining Michelson's experiments was proposed by the author of the present work. The explanation is based on the assumption that **all so-called "solid" elementary particles, and also photons, are electromagnetic solitons.** Solitons are wave formations, in which the wave process is not spread farther than some distance, which determines the soliton's dimensions. For formation of solitons, the environment must have properties of nonlinearity and dispersion (dependence of the wave's velocity on its frequency). Some kinds of solitons have both properties of solid particles (in collisions, they perform properties of elastic balls) and wave properties, therefore, in the solitons hypothesis, the enigmatic corpuscular-wave dualism has elementary explanation by means of classical physics.

It is known that all "solid" particles may annihilate with their antiparticles and vice versa – they may be formed from radiation (for example, a couple "electron-positron" may be formed in case of collision of two photons with energies not less than 0.51 *MeV*). Thus, it is logical to assume that the light-carrying environment exists, and its nonlinear properties and dispersion properties necessary for formation of "hard" solitons are manifested only in case of photons' high energies. We suppose that a high-energy photon deforms the environment, changes its properties so much, that another photon cannot pass through this place already without feeling this fact on itself, i.e. without interacting with another photon. However, for low energies, the superposition principle is carried out – photons ignore each other even in the solar crown.

Some kinds of two-dimensional solitons have the characteristic feature of decreasing longitudinal dimensions in accordance with (4.1) [6]. Assume that this relation is carried out for three-dimensional solitons, too. It was quite recently shown that there exist nonlinear equations whose solutions describe three-dimensional solitons [10]. Using this relation for obtaining coordinate transformations leads to the expression exactly coinciding with Lorentz's space transformation. In this case, Michelson's experiments obtain their natural explanation through real shortening of bodies in the direction of motion and through the preservation of their dimensions in perpendicular direction, the question of ether wind becomes incorrect, the inertia law is carried out in a natural way, since solitons do not give their energy to the environment – inner or kinetic. Elementary calculations testify that the experiments on determining light velocity through measuring the time of the photon's passing towards the mirror and back (i.e. by means of one chronometer), taking into consideration the shortening of the device's arm, give the exact value of light velocity C irrespective of the orientation of the device, which consists of solitons. It means that in the soliton world, it is impossible to fix the fact of one's motion with respect to the light-carrying environment through measuring light velocity in different directions by means of one chronometer.

In the Soliton Relativity Theory, the time transformation has the form $t'=tG$. In fact, the physical meaning of this transformation is the following: in the material world built up from electromagnetic solitons, all process (including the chronometers' going) really decrease their rate as the absolute velocity increases, therefore, the moving chronometers measure time incorrectly, namely – in accordance with $t'=tG$.

In the soliton relativity, the analogous situation is also available with measuring a body's length: all material objects (including instruments for measuring length) decrease their dimensions as their velocity increases, therefore, in the moving frame, the length is measured incorrectly – in accordance with $l'=l/G$, where l is the moving body's length measured with instruments of frame *K*, i.e. "correctly measured". The theory is well agreed with Bohr's principle. In detail, one cat get acquainted with the soliton relativity theory at the site [3].

5. Other Experiments Connected with the Relativity Theory

5.1. Experiments with Muons. Time Transformation

The further experiments, having relation to the relativity theory and considered to confirm the SRT, are the experiments with fast-moving muons. A muon is an elementary particle having an electric charge, like an electron, mass 207 times larger, but lifetime only $\sim 2.2\cdot 10^{-6}$ *s*. Muons are formed in collisions of high-energetic particles, in the interaction of cosmic rays with the Earth's atmosphere, etc. Theoretically, even if a muon is given a velocity equal to light velocity $C=3\cdot 10^8$ *m/s*, with lifetime $t=2.2\cdot 10^{-6}$ *s*, it will be able to fly not more than $S=C\cdot t=3\cdot 10^8\cdot 2.2\cdot 10^{-6}=660$ *m*, however, muons are also found at the distances of about 20 *km* from their birthplace. If one makes muons run in circular motion in an accelerator, the length of their path will depend on their velocity, as if their lifetime t_m (measured with the instruments of the immovable frame) increased according to the following law:

$$t_m = \frac{t_0}{G} \tag{5.1}$$

where t_0 is the muon's lifetime in the resting state.

Nowadays it is officially considered that these results confirm the assumption about "time dilation" in the moving frame as the conclusion from the SRT. Mathematically the idea is formulated in the following way. Lorentz's time transformation is analyzed:

$$t' = \frac{t - \frac{V}{C^2}x}{G} \tag{5.2}$$

It is considered that to the muon the frame *K′* is fixed. The origin of this frame is moving according to the law $x=Vt$, where V is the muon's velocity. If we substitute the quantity Vt instead of x into transformation (5.2), we will have:

$$t' = \frac{t - \frac{V}{C^2}Vt}{G} = \frac{t\left(1-\frac{V^2}{C^2}\right)}{G} = \frac{tG^2}{G} = tG \tag{5.3}$$

If at the moment of the muon's birth it was $t'=t=0$, then, in accordance with (5.3), t and t' have the meaning of time intervals from the initial moment to the present one – this is the physical meaning of the coordinate on the time axis. Since $t'<t$, in the SRT they speak about "time dilation in the moving frame". Later on we will return to the analysis of the derivation of (5.3). Certainly, this formula has direct relation to the relativity theory, since this formula collates the results of measuring the lifetime of the same muon with instruments of different coordinate frames. However, is it reasonable to introduce the notion of "one's own time in the moving frame", to speak about its "dilation", or it is enough to assume that in the moving frame, all processes, including the oscillation process in a muon, are decelerated for some reason? The notion of time we represented mathematically as the "quantity of tickings of the etalon, mathematical chronometer". Now, why is it insufficient for us to say simply, that in the moving frame, the material etalon chronometer decreases its going rate, that it simply incorrectly measures time, i.e. measures in accordance with (5.3)? The mathematical chronometer located nearby indicates time correctly, and the material one – in accordance with (5.3). What is so peculiar, which exists in the nature, that it cannot be explained by the deceleration of the process rate, and what makes us introduce the notion of one's own time in the moving frame? What for to multiply

essences? Most probably, it is simply the absence of understanding the physical cause of decelerating all processes. If we do not know this cause today, it does not mean that we will not know it tomorrow. Note that in the soliton relativity theory, the deceleration takes place in a natural way and elementarily [3].

Assume that by nature, in the resting state, a muon should make a million inner oscillations (all micro-objects have wave properties, therefore, inner oscillations exist in them), then it disintegrates by analogy as a conventional clock goes out of action after making a certain amount of tickings, i.e. it simply wears out. Then it is logical to assume, that in the moving state, the muon also makes the same million oscillations, as in the resting state, up till its complete "wear" and disintegration, but in the decreased rate. If one considers the quantity of inner oscillations, made by the moving muon, as the measured time, then the result of measurement (for one muon) will be the same as for the resting one, i.e. the result of measuring the particle's lifetime does not depend on the coordinate frame, if measurements are made by means of this frame. The analogous situation is concerning the measurement of length, too. For example, if four marks are set on the rod, then the quantity of these marks will never change, irrespective of the fact, whether the rod is shortened, remains unchanged or even prolonged, as the velocity increases.

In order that our experiments with the muon have relation to the relativity theory, one should look after this muon from two coordinate frames, and then collate the results of observation. Assume that we can make muons in the immovable frame and in the moving one in such a way, that the death of one muon is accompanied by the birth of another, etc. – in each frame, we have its own muonic chronometer. Suppose that our moving muon was born opposite some point A and died opposite point B of the immovable frame. Let the experiment show then, that during this time, 100 muons may be born and die in *K*. The value of the muon's lifetime, measured in K' (a million oscillations) we can also represent through the quantity of died muons; in this case, the chronometer's scale will be a million times roughened. According to measurements data in frame K', it will be 1 died muon, one mark on the scale of the moving device. According to measurements data in frame *K*, the process of motion from A to B will last so long, that 100 muons will have time to be born and die in *K*. Thus, the result of measuring the duration of the muon's motion from point A to point B is the following: 100 died resting muons during the lifetime of one moving muon, 100 marks on the scale of the resting chronometer (t=100) in contrast to one mark on the scale of the moving chronometer (t'=1). The result is well agreed with the formula $t' = t\,G$, if G=0.01, but physically it means that the coordinate frames are not equivalent! We specially represented the devices' indications when measuring the duration of one and the same process in the "quantity of died muons", in order to prevent the attempts of manipulation with more abstract notions t and t'. Now, there are no mathematical manipulations already, with which it would be possible to represent one moving muon as a hundred moving muons, and a hundred resting as one resting. But the equivalence of the coordinate frames cannot be obtained without it! And if it is "possible" for somebody, then we will understand that it can be done only through the mathematical error.

Obviously, it would be also possible to observe from different coordinate frames the birth-death of the muons resting in *K*. The results of measurements would be, of course, the same – a hundred died muons resting in *K* opposite one in K'. It means that from frame K', the processes in frame *K* must seem to be accelerated, if in K' the motion velocity is not felt, but in this case, the equivalence of the coordinate frames cannot be obtained in any way!

The above-mentioned manipulation with formulae in the SRT is made in the derivation of the reverse time transformations. Certainly, now our task is to find that step in the mathematical transformations, where an error was made. It may be strange, but it is the first step, and it appeared to be unnoticed due to its "evidence". The simple question is raised: if V is the motion velocity of frame K' with respect to *K*, then what will be the motion velocity of *K* with respect to K' ? For a hundred years, the answer has been considered evident: $V' = -V$. The reasoning is approximately the following: if K' is moving with respect to *K* with the velocity V, then *K* is moving with respect to K' with the velocity $-V$, what else?! In the experiment, there are only two objects moving towards each other! One and the same velocity of approaching!

However, we will not believe this evidence, and we will analyze this problem in detail. What is V as the velocity of one body with respect to another? How is this quantity obtained in practice? Let body 1 (it is frame K) be considered immovable, Fig. 5.1. Let us fix the space coordinate axis to it and set synchronized chronometers at each mark. Since our chronometers are mathematical, absolute, we do not mention the synchronization procedure, but simply state or understand it. What do the experimentalists in K do? They fix, for instance, the moments t_0 and t_1 of passing by body 2 between the marks x_0 and x_1 they selected in advance on their axis, and then determine the quantity V:

$$V = \frac{x_1 - x_0}{t_1 - t_0} \tag{5.4}$$

In this case, they see frame K' simply as a point material object.

Now let us answer the question, what V' is. The answer depends on the fact, what instruments are available in frame K', i.e. in the frame connected with object 2. In frame K', the same procedure should be fulfilled as in frame K, in this case, they see object 1 as a point object, too, since the space coordinate axis of object 1 is a mathematical abstraction. One can consider that objects 1 and 2 are spaceships trying to determine each other's velocity, and no coordinate axes are seen at the neighbor. Evidently, if in K' the rulers and chronometers are the same as in K (Galileo's theory), then the result of measuring the velocity of K with respect to K' will be $-V$. Everything would be OK, but, unfortunately for the SRT, Lorentz's space transformation prescribes the moving rulers to be shortened proportionally to G.

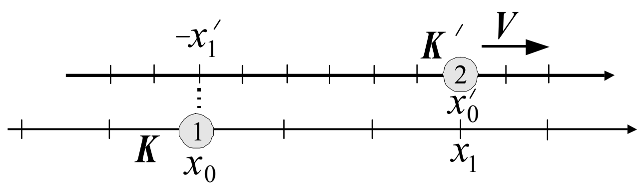

Fig. 5.1

Lorentz's space transformation prescribes moving bodies to be shortened, therefore, for fulfilling $V' = -V$, it is necessary that the moving chronometers go in the accelerated rate, however, the experiments with muons testify to the deceleration of processes in the moving frame.

Since in the moving frame, according to this prescription, the marks on the space axis are located denser, Fig. 5.1 (and Michelson's experiments are already explained by it), then <u>for obtaining $V'=-V$, the moving chronometer should go in the accelerated rate</u>, since in the calculations of velocity, the larger quantity of marks (entering between x_0' and $-x_1'$) must be divided by the larger quantity of the chronometer's tickings, in order to obtain the same value of the velocity. But the experiment clearly testifies to the deceleration, i.e. it proposes us to divide by the smaller quantity of tickings – the experiment unequivocally confirms formula $t'=tG$. That is how insidious the evidence appeared to be! We either recognize the reality of shortening the moving bodies, and explain Michelson's experiments on this basis, and obtain the right to write down and use Lorentz's space transformation, or we deceive ourselves and our interlocutor, and speak about the apparent shortening, but in this case, we automatically lose the right to use Lorentz's transformation – what is apparent for us, cannot be apparent for mathematics and for photons. The apparent shortening cannot influence photons' behavior.

Now let us look how in the SRT one can mathematically obtain $V' = -V$, if moving bodies are really shortened, as Michelson's experiments demonstrate to us. Let the space axis of frame K' be shortened in accordance with Lorentz's transformation. The observers in K try to determine the velocity of frame K'. For this purpose, they fix the time of the transition of frame K' with respect to K from x=0 to x=x_1, Fig. 5.1. Since all chronometers in K are synchronized according to the condition of the problem (x_0=0, t_0=0), the velocity is determined as

$$V = \frac{x_1}{t_1} \tag{5.5}$$

In accordance with the figure, at the moment t_1, the origin of frame K (x=0) is located opposite point $-x_1'$. If we want to collate the results of measuring velocity correctly, the observer in K' must make the same procedure of measuring velocity, as in K, but with his own instruments. He should measure the same amount of space between x=0 and $x=x_1$ with his ruler, start and finish the measurements at the same moments, as K. The coordinate transformations give us the possibility to get to know the results of his measurements of length:

$$x_1' = \left.\frac{x - V t_1}{G}\right|_{x=0} = -\frac{V t_1}{G} \tag{5.6}$$

The SRT prescribes to use dissynchronized chronometers, it gives us the possibility to get to know the chronometers' indications not in the whole moving frame, but only in the point, which is located at the given moment opposite the point with coordinate x in frame K. In our case, for determining the velocity V' one should fix the indications of the chronometer on the moving axis (the chronometer, which at the moment t_1 was located at the point with coordinate x=0 in frame K, i.e. the chronometer, which at the moment t_1 was located in the point $-x_1'$ of frame K'), Fig. 5.1. We will find out this result from Lorentz's time transformation:

$$t' = \left.\frac{t_1 - \frac{V}{C^2}x}{G}\right|_{x=0} = \frac{t_1}{G} \tag{5.7}$$

Thus,

$$V' = \frac{x_1'}{t_1'} = -\frac{V t_1}{G} : \frac{t_1}{G} = -V \tag{5.8}$$

It is not worth while being strongly surprised at this result. If equation (5.6) takes into consideration the increase of the quantity of space marks on the moving axis between points x=0 and $x=x_1$, then equation (5.7) represents the acceleration of the chronometers' ticking rate (!). That is how difficultly in the SRT the desirable $V' = -V$ is reached, and through this expression – also reverse space and time transformations having the same structural form as the direct ones, i.e. those allowing to "prove" mathematically the equivalence of the coordinate frames. It is known that devil is hidden in the details. Expression (5.7) is just that detail, in which "the devil of the SRT" was hidden for a hundred years. If we accept this "proof" (in fact, the manipulation with formulae), then, looking at one muon, which was earlier flying but now is resting and has died, in contrast to a hundred resting in K and having died at the same time, we are to be able to illustrate also the reverse time transformation for the same muons. Now, accepting the viewpoint of K', pointing with a finger to one muon, which died and flew, one should venture to confirm, that from your viewpoint it is a hundred, and pointing with the same finger to a hundred died resting muons, one must learn to confirm that from your viewpoint it is only one muon, otherwise it will be impossible to illustrate the equivalence of the coordinate frames. It is beyond all manner of doubt, that a similar ability demands a specific type of intellect.

In the above-mentioned statements, the most unexpected is the fact, that equation (5.7) clearly demonstrates us the acceleration of processes' rate in the moving frame (!), i.e. the fact, which contradicts to the experiments with muons. The same result can be also obtained from the space and time transformations strictly analytically. Let us investigate point A (resting in K) with the space coordinate x. The space coordinate of this point in frame K' is equal to

$$x' = \frac{x - Vt}{G}$$

In the differential form:

$$dx' = \frac{dx - V\,dt}{G}$$

Since we analyze the resting point (a place in space), then dx=0, therefore,

$$dx' = -\frac{V\,dt}{G} \tag{5.9}$$

By analogy, we will obtain Lorentz's time transformation in the differential form for a resting point:

$$dt' = \left. \frac{dt - \frac{V}{C^2} dx}{G} \right|_{dx=0} = \frac{dt}{G} \tag{5.10}$$

Thus,

$$V' = \frac{dx'}{dt'} = -\frac{V\,dt}{G} : \frac{dt}{G} = -V \tag{5.11}$$

In order to obtain (5.11) taking into consideration the shortening of moving bodies, we again needed to demand the acceleration of processes' rate in the moving frame through (5.10), which contradicts to the experiments. Therefore, we have additionally made sure, that in Lorentz's time transformation, in reality, there is the prescription for all processes in the moving frame to accelerate proportionally to $1/G$. The correction for the dissynchronization, available in the numerator of Lorentz's time transformation in the direction towards the positive values of x imitates the deceleration of processes (and acceleration in the direction towards the negative values of x), moreover, more effectively (proportionally to G^2) than the denominator prescribes the acceleration, see the derivation of (5.3) – there we had promised to return to this question, meaning the present moment. Lorentz's time transformation through the dissynchronization procedure subtracts from the quantity t more, than it is added to it through the physical processes' acceleration represented in the denominator. Maybe it is more correctly to write Lorentz's time transformation in the form of two addends, the first of which represents the prescription concerning the processes' velocity, and the second – dissynchronization:

$$t' = \frac{t}{G} - \frac{Vx}{C^2 G} \tag{5.12}$$

If we want to ignore or simply not to introduce the dissynchronization, the second term in the equation should be simply crossed out. Only the remaining element must be checked (but is not confirmed) in the experiment with muons – the information about the acceleration of the physical processes' rates. It should be also emphasized especially, that if coefficient G represents some effect, reflecting, as it is assumed, the objective property of the material Universe, of the non-living nature, then the term, responsible for the dissynchronization, is the result of human activity, and this result cannot be available in the equations describing the nature's properties. It can be available in the engineers' calculations allowing to estimate the error given by the dissynchronization, but not in the nature laws, in particular, in coordinate transformations.

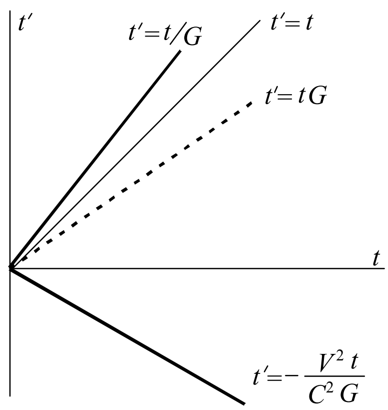

Fig.5.2. On the problem of the physical meaning of Lorentz's time transformation

The physical meaning of expression (5.12) can be illustrated graphically. Let us make up a diagram, in which we will set the time t of frame K on the abscissas axis, and the time t' of frame K' – on the ordinates axis. On this diagram, the dependence of t' on t, according to Galileo's theory, will be depicted by a straight line ($t'=t$) passing through the coordinate origin and slanted to t axis at the angle of 45 degrees, Fig. 5.2.

In contrast to Galileo's theory, the term t/G from expression (5.12) on this diagram will be represented by the line slanted at a larger angle, since $G<1$, the higher is the velocity V, the larger is the line slant. Obviously, this line illustrates not deceleration, but "time acceleration" as an objective process, as some natural effect, which accompanies the motion.

The second term of equation (5.12) (the term representing the result of the chronometers' dissynchronization, i.e. the result of the engineers' activity, but not a natural phenomenon), for the case $x=Vt$ (the moving chronometer is located in the origin of the moving frame) has the following form:

$$-\left.\frac{Vx}{C^2G}\right|_{x=Vt}=-\frac{V^2t}{C^2G}$$

and it is represented on the diagram by the line with negative slant. The total result of natural and human activity, prescribed by Lorentz's time transformation (5.12), will be represented by line $t'=tG$ as "time deceleration". As we see, the effect from dissynchronization overpowers the effect from the processes' acceleration so much, that we obtain the result of the calculations exactly $t'=tG$, see the derivation of (5.3). In other words, it was found out, that in turn, in the analysis of Lorentz's time transformation, a wrong conclusion was made concerning the dependence, which must be tested experimentally. In reality, in the experiments with muons, one should test only that element, which is, in accordance with Lorentz's time transformation, prescribed by the nature, i.e. $t'=t/G$, which, as we know, is not confirmed by the experiment.

5.2. Experiments as if Connected with Relativity Theory

5.2.1. Dependence of a Body's Mass on its Motion Velocity

And what about other experiments, as if having relation to the relativity theory? In this aspect, the increase of a material body's mass, as its velocity increases, is considered to be the most persuasive. First and foremost, it should be said that the increase of the mass, as the velocity increases, was first experimentally discovered by Kaufmann in 1901, four years before the SRT occurred, but theoretically the formula of the dependence of the mass on the velocity was obtained by Lorentz before Kaufmann's experiments. Together with somewhat different Abraham's formula, it served for Kaufmann as the reference in the analysis of his experimental data [7, p. 35]. It means that if the SRT were never proposed, if we knew nothing at all about the relativity theory (even Galileo's theory), the creators of synchrotrons, having come across the problem of high-energy electrons' lacking behind to the accelerating parts of the device, would finally recollect about Kaufmann's experiments and Lorentz's electronic theory, and the problem of accelerating the particles to high energies would be solved as well as it was solved in reality. And the formula would probably be called Lorentz–Kaufmann's formula.

However, how can the increase of a body's mass be connected with the relativity theory? The connection of what with what must be available in the corresponding equation, so that it would be attributed to the relativity theory? In Tsiolkovsky's equation, there is the connection of the velocity of the moving rocket with its mass, but nobody attributes this equation to the relativity theory. Obviously, since the relativity theory is the collation of the viewpoints towards some fact from different coordinate frames, then in the equation for the increase of a body's mass, there must be represented the results of measurements with instruments resting in different coordinate frames. Nowadays nobody can do it yet, and if could, then there would be introduced one more transformation in the theory – mass transformation. The number of independent notions (physical quantities) and the number of transformations in the theory should be the same.

However, is it possible to measure the mass of a moving body with instruments of the immovable frame? It is found out that possible, if the body has an electric charge, and the value of this charge is known. Kaufmann made use just of it. The stream of electrons emitted by radioactive radium nuclei with high velocity he directed towards the place in space with electric and magnetic fields. Under the influence of Lorentz's and Coulomb's forces, the trajectory of the electrons' flight becomes a complicated curve instead of a straight line. The shape of this curve can be calculated, if one knows the velocity, mass and charge of the electrons, and also the force characteristics of the fields. It was found out that the trajectory of the electrons' flight is different from the calculated value, moreover, the higher is the electrons' velocity, the larger is the difference; therefore, one can reach the agreement with the calculations only in case, if one assumes, that the mass *m* of the moving electron increases, as its velocity increases, in accordance with

$$m = \frac{m_0}{G} \tag{5.13}$$

where m_0 is the mass of the resting electron.

In fact, Kaufmann invented an immovable instrument for measuring mass of a moving electrically charged body (by analogy with the fact that a camera able to make instant photographs can serve as an immovable instrument for measuring the length of a moving body). All quantities represented in this formula are measured with instruments of the immovable coordinate frame. Thus, we make a conclusion that the dependence of a body's mass on its velocity in this presentation, in which we use it, and in which the creators of accelerators use it, simply has no relation to the relativity theory; therefore, it cannot serve as an argument for verification not only of the SRT, but also of any other relativity theory. It can be an argument in favor of the substance structure theory, from which it follows that a body's mass increases, as its velocity increases, but not in favor of the relativity theory. Note that in the soliton substance structure hypothesis, formula (5.13) is easily obtained in case of supposition that the inert mass of a soliton is equal to the energy contained in it [3].

5.2.3. Connection of a Body's Mass and Its Inner Energy

And, finally, let us analyze the most famous experiment, which they connect with the relativity theory. Assume that we have an object in the excited state (an atomic nucleus, atom, molecule). It is known that in the process of returning to the basic state, the object radiates an electromagnetic energy. If in the excited state the object's inner energy was equal to E_1, after radiating and returning to the basic state it became equal to E_0, then the experiment shows that the object's mass decreases proportionally to the value of the radiated energy, moreover, the proportionality coefficient is equal to C^2, i.e.

$$E_1 – E_0 = E = \Delta m \, C^2 \tag{5.14}$$

where *E* is the total energy of radiation, Δm is the value, at which the mass of the radiating object decreased, or the mass, which can be conditionally attributed to the radiated energy, in the ultimate case – to one photon.

It is obvious, that formula (5.14) does not collate any viewpoints, either – all quantities belonging to (5.14) are measured with instruments of frame *K*, in this case, the radiating object is resting before and after the radiation (if the impulse of radiation is neglected), frame K' is not taken into consideration, and even not mentioned. Therefore, the connection of mass with energy (5.14) has no relation to the relativity theory at all, thus, it is not an argument in the question of experimental testing not only of the SRT, but also of any other relativity theory. We do not doubt in the experimental confirmation of (5.14), but one can only be surprised, how it could be considered as the facts confirming the SRT, and how it remained unnoticed for a hundred years.

6. SRT and Bohr's Principle

If we have already persuaded the reader, that the SRT is not confirmed experimentally, then we should search for other difficulties in the theory, moreover, by means of the theory itself. In principle, the incorrectness of the theory must be discoverable by means of this theory, too.

We have already mentioned two such incorrectnesses above. We mean the equations (4.4) and (4.5), where we found the prescription to add the light velocity with the frame velocity by means of the SRT, which contradicts to the basic postulate of the SRT, and also the equations (5.7) and (5.10), where the prescription to accelerate the moving chronometer's rate was found. Each of these incorrectnesses is quite sufficient, for denying the theory, but it is found out, than the theory suffers from one more serious drawback.

It was already demonstrated in the introduction, that the usage of dissynchronized chronometers leads to the disagreement between the SRT and Bohr's principle. According to this principle, any new theory, which claims to describe reality more completely, than the old one, must in the conditions, in which the old theory is well agreed with the experiment, give the calculations results close to those ones given by the old theory. The divergences must be lower than the exactness set by practical necessities. Now it is time to return to the example, given in the introduction, and analyze it in detail.

For checking a new theory concerning its agreement with Bohr's principle, one should make strict calculations for both theories and compare the results, as it was already done in the introduction. But if one does not wish to make complex calculations, one can also do in another way: in the equations of the new theory, omit those terms, which make an insignificant contribution into the calculations results under conditions of carrying out the old theory. In this case, the equations of the new theory must turn into the equations of the old one. This will just be the analytical testing of the new theory concerning its agreement with Bohr's principle. In the discussions about the agreement of the SRT with Bohr's principle, among physicists-theoreticians, first and foremost, the most unprofessional question will follow: what are the conditions of the utmost transition between the SRT and Galileo's theory? The answer is the simplest: there is no clear borderline, more exactly, there is simply no borderline between relativistic velocity and pre-relativistic one, therefore, there are no conditions of the utmost transition. For example, assume that we have a steel wire with the diameter of 2 *mm*, a steel rod with the diameter of 20 *mm* and a billet with the diameter of 100 *mm*. The question arises: what are the conditions of the utmost transition from the wire to the rod and from the rod to the billet? At what diameters should the wire be considered as a rod, and the rod as a billet, and vice versa? The answer is as follows: there is no borderline at all, everything is relative. For a watch-maker, a wire of 2 *mm* is a billet, from which he turns the details. For builders of big bridges, when the thickness of the ropes reaches a *meter*, the billet of 100 *mm* is only a wire, thus, the notion "low thickness" is relative.

By analogy, the notion "low velocity" is also relative, it is quite difficult to represent it mathematically, since it is a subjective notion. Everything depends not only on the velocity, but also on the calculations exactness demanded by practice. If practice demands 20 digits, then a bicycle is quite a relativistic object, but if only 6-7 digits, then a rocket having the third cosmic velocity is a deeply pre-relativistic object.

First we will check analytically, whether Lorentz's transformations turn into Galileo's transformations, then we will illustrate it by a numerical example. The notion "low velocity" we will mathematically link with the terms of the second and third orders of lowness.

In Lorentz's time transformation, there is a term of the second order of lowness V^2/C^2 under the radical sign:

$$x' = \frac{x - Vt}{\sqrt{1 - \frac{V^2}{C^2}}}$$

If the neglecting of these terms (crossing them out from the appropriate equations) makes the changes within the limits of the demanded exactness in the calculations, then the velocity of frame K' can be considered as low. <u>Evidently, it has no relation to the mathematical operation called ultimate transition</u>. Assume that the velocity of the moving frame and the exactness demanded by the conditions of the problem is such, that the contribution of the term of the second lowness order into the calculations can be neglected. In this case, the term V^2/C^2 can be simply crossed out, since it stands separately in Lorentz's space transformation. The denominator turns into one, and Lorentz's space transformation turns into Galileo's transformation $x'=x-Vt$. It means that in the space transformation, the SRT corresponds to Bohr's principle, and we have shown it analytically, without concrete numerical calculations.

Now let us analyze **Lorentz's time transformation.**

$$t' = \frac{t - \frac{V}{C^2}x}{\sqrt{1 - \frac{V^2}{C^2}}}$$

As before, in case of low velocities *V*, the radical in the denominator turns into one. The numerator, however, has its own term of the second lowness order: $-V/C^2$, but it is not self-sufficient, it is connected with the coordinate *x* of an arbitrary point. There can be any numerical value of this coordinate, and this value can be whatever large in its module. Practically any low value of V/C^2 we can compensate by such a value of the space coordinate that it will significantly influence the calculations results for *t′*. It means that in the time transformation, the SRT does not correspond to Bohr's principle, and its physical cause consists in the usage of dissynchronized chronometers.

Sometimes in literature [8] or in discussions, the demand $V/C^2 \to 0$ is raised as the condition of the utmost transition. This is an incorrect demand, it is equivalent to the demand $V\to 0$, since *C*=const, and the units of measurement can be selected in such a way, that it will be obtained *C*=1. In this case, Lorentz's time transformation "almost turns" into Galileo's transformation (in reality, an uncertainty like $0\cdot\infty$ occurs in the numerator). The mentioned demands we are obliged to use for the space transformation, too, but in this case, Lorentz's space transformation turns into $x'=x$, and it means that there is no motion any more, therefore, no relativity theory, either. In the example with metallic billets, it corresponds to the demand "the diameter of the billets tends to zero", i.e. the analysis objects themselves disappear.

Most frequently it is stated in literature, that in Galileo's theory, light velocity is equal to infinity, and the demand $C\to\infty$ is raised [9]. It is also an incorrect demand. Firstly, *C* is a constant, and it cannot be varied, as well as the number π, the base of the natural logarithm *e*, etc. Secondly, if light velocity is not available in Galileo's transformations, it does not mean that it is considered to be equal to infinity; moreover, it does not mean to have been neglected. All these awkward evasions, testifying to the formal, shallow, in fact, unprofessional knowledge of mathematics by many physicists, can be easily denied by simple and strict calculations made in accordance with Galileo's theory and the SRT, since any theory has only two functions: *a*) to explain the phenomenon qualitatively, *b*) to give appropriate quantitative evaluations.

The simplest calculations in the relativity theory is the recalculation of the values of a material point's space and time coordinates from the immovable frame into the moving one. The couple of numbers corresponding to the space and time coordinates of an arbitrary point is called an event in the relativity theory – somewhere at a space point with the coordinate *x* something occurred at some time moment *t*. Mathematically an event is denoted as A(*x*, *t*). For mathematics it makes no difference, what an event consists in, what occurred namely, and where – if at the moment *t* nothing occurred at the point *x*, it is also an event for the theory.

Assume that we should make calculations for the situation, when the velocity of frame *K′* is equal to *V*=900 *m/s* (the velocity of a modern fighter). Intuitively we assume that this is a "low velocity", pre-relativistic velocity, however, the quantitative estimation is not excessive. In fact, the notion "low velocity" can be mathematically linked with the permission to neglect the separately standing terms of the second lowness order. For estimating the velocity, one should calculate the term of the second lowness order in Lorentz's transformations $V^2/C^2=81\cdot10^4/9\cdot10^{16}=9\cdot10^{-12}$. The obtained result means that approximately up till the twelfth digit the calculations, made in accordance with Galileo's theory and the SRT, will coincide. We assume that for modern measurement instruments and calculations, the exactness of 7-8 digits is quite sufficient, therefore, we will consider the velocity of 900 *m/s* as deeply pre-relativistic, i.e. well corresponding to the notion "low velocity". It means that in case of the mentioned velocity, the results of calculations of the space and time coordinates for an arbitrary event (the calculations are made in accordance with both theories) should slightly differ from each other, if only the SRT is agreed with Bohr's principle, i.e. if the SRT is a physically correct theory.

Assume that some event A(*x*, *t*) occurred at the point with the coordinate $x=10^{16}$ *m* in 100 *seconds* after the synchronization of the chronometers was made, i.e. after the origin of frame *K′* coincided with the origin of frame *K*. The coordinates of this event in the moving frame are to be determined. Let us make calculations.

6.1. Space coordinate.

a) Galileo: $x'_G = x - V\,t$ = 10^{16}–900·100= 9 999 999 999 910 *m*

b) Lorentz: $x'_L = \frac{x - V\,t}{G} = \frac{10^{16} - 900\cdot 100}{\sqrt{1 - \frac{81\cdot 10^4}{9\cdot 10^{16}}}}$ = 9 999 999 999 955 *m*

Let us analyze the relation r_x of the calculations results "Galileo/Lorentz" in the space coordinate. Indeed, we observe the coincidence in the results up till the twelfth digit:

$$r_x = \frac{x'_G}{x'_L} = 0.999\,999\,999\,995\,5$$

Not only analytical, but also strict numerical calculations showed, that in the space transformation, in case of "quite significant low velocities", the SRT turns into Galileo's theory. It is noticeable that the relation appeared to be lower than one. The reason consists in the fact, that in the SRT, the moving bodies are prescribed to get shorter, therefore, at one and the same place of space, in the moving shortened frame, a larger quantity of marks entered than in case of Galileo's theory.

Note that the given calculations could also be made simpler, but it badly influences the transparency of the physical aspect of this question:

$$r_x = \frac{x'_G}{x'_L} = \frac{x - V\,t}{\frac{x - V\,t}{G}} = G = \sqrt{1 - \frac{V^2}{C^2}} = \sqrt{1 - \frac{81\cdot 10^4}{9\cdot 10^{16}}} = 0.999\,999\,999\,995\,5$$

As we see, the relation r_x analytically does not depend on the value of the space coordinate – one can analyze any point on the space axis – from minus infinity to plus infinity, and it will not influence the exactness of calculations. None of the compared relativity theories appends absolutely any limitations upon the value of the event's space coordinate.

6.2. Time coordinate.

a) Galileo: $t'_G = t = 100\ s$ (5.15)

b) Lorentz: $t'_L = \frac{t - \frac{V}{C^2}\,x}{G} = \frac{100 - \frac{900}{9\cdot 10^{16}}\,10^{16}}{\sqrt{1 - \frac{81\cdot 10^4}{9\cdot 10^{16}}}} = 0\ s$ (5.16)

Instead of some 99.999 999 999 8 *s* intuitively expected, we obtained exactly zero (!), and the relation of the calculation results "Galileo/Lorentz" for the time coordinate tends to infinity:

$$r_t = \frac{100}{0} \to \infty\,,$$

and depends on the value of the space coordinate. Now one can understand, why we selected the velocity of 900 *m/s* and the distance of x=10^{16} *m* – so that it would be easy to check the calculations without using the calculation instruments, so that there would remain no doubts about the correctness of the calculations – even a pencil and paper were unnecessary for us. The distance of 10^{16} *meters* is only one third of a *parsec*, a unit of distance measurement in astronomy. The time of 100 *seconds* can be felt at the everyday level; therefore, we must not be accused of selecting too large or too small quantities. At the distance equal to the Galaxy's diameter (approximately 20 kiloparsecs, 6·10^{20} *m*), for the mentioned velocity of *K′*, according to Galileo, instead of 100 *seconds*, the SRT gives the result of minus 70 *days*!

And what will be obtained, if instead of the space coordinate x=10^{16} *m*, one analyzes an event at the point x= –10^{16} *m* at the same time moment t=100 *s*? It is not difficult to see that now in the SRT we will obtain t'_L=200 *s*, and the relation r_t in the calculations for different theories will appear to be equal to 2 instead of infinity – we have the divergence in the first digit in comparison with twelve digits for the space coordinate. So we cannot call the calculation result 200 *s* instead of 100 *s* "time deceleration". That is what surprises are given to us by the dissynchronization called "simultaneity relativity". If some of the readers are not persuaded by the logical conclusions, maybe the results of these elementary calculations will persuade them? The non-coincidence of the results (5.15) and (5.16) must reject any attempts of speculations around the question concerning the transition of Lorentz's time transformation into Galileo's transformation in case of low velocities. The calculations were made with high exactness and strictly – we approached nothing to zero, we approached nothing to infinity, we did not separate anything into a series, in order to omit the disadvantageous elements of the series, but instead of approximately 100 *s* for the distance equal to the Galaxy's diameter, we obtained minus 70 *days*! For the same distance, but in the direction towards the negative value of *x*, we will obtain plus 70 *days* instead of expected 100 *seconds*.

Since one cannot doubt about the results of the calculations at all (because in the relativity theory, simpler problems, than to transform the coordinate of an event from the resting frame into the moving one, do not exist), among opponents, the most frequently occurring arguments against the given calculations are as follows: Bohr's principle is philosophical, not physical, it is not obligatory for physics; or: **this is just Galileo's theory incorrect at long distances, it is not agreed with Bohr's principle**!! In its physical value, this "achievement" of thought is equivalent to the conviction that multiplication table can appear to be incorrect in case of large numbers – in reality, who checked multiplication table with large numbers by means of sticks and summing up? We will leave this achievement of intellect without commentary, but only notice that in the space coordinate, Galileo's theory is correct for long distances, too, up till infinity. So what hinders it "to check the chronometers' indications at the same time"?

One can notice one more difficulty, to which the usage of dissynchronization leads. In Galileo's time transformation, the quantity t' has the meaning of the measured time on the whole infinite axis of the moving frame. In contrast to it, in the time transformation of the SRT, the quantity t' has the meaning of the chronometers' indications not on the whole moving axis, but only at some point, which is at the moment t situated opposite the point with coordinate x on the immovable axis, see Fig. 3.1. Therefore, Lorentz's time transformation cannot turn into Galileo's transformation in principle, at any velocity or distance – the physical meanings of the quantities do not coincide. This one argument must be quite sufficient for understanding, that the SRT is not agreed with Bohr's principle, thus it is not a physical theory.

In this work, we did not give the calculations of the time of photons' motion in Michelson's interferometer in accordance with Ritz's ballistic hypothesis and in accordance with Fitzgerald–Lorentz's shortening hypothesis, due to their elementariness, on the one hand, and the large volume of the article, on the other hand. With these calculations, and also with some questions not analyzed here, for example, with the representation of the relativity theory on *x*-*t*-diagrams, Doppler's effect, etc. one can get acquainted in the works [1-3].

Conclusions

1. Michelson's experiments confirm Lorentz's space transformation, if real shortening of moving material bodies is assumed. The reality of shortening bodies makes the coordinate frames nonequivalent, and it contradicts to the relativity principle of the SRT.

2. Experiments with muons testify to the real deceleration of the physical processes' rate in the moving frame. The reality of the processes' deceleration also testifies to the nonequivalence of the coordinate frames, and contradicts to the relativity principle of the SRT.

3. Lorentz's time transformation is made up through the violation of the main property of the basic notion in physics – time; it requires chronometers' dissynchronization and acceleration of physical processes' rate, i.e. it contradicts to the experiment, see item 2.

4. The contradiction in the SRT is found by means of the SRT – Lorentz's space and time transformations prescribe to add the light velocity to the moving frame velocity, which contradicts to the basic postulate of the SRT.

5. Through chronometers' dissynchronization one can reach the independence of the measured photons' velocity on the velocity of the coordinate frame, but the results of Michelson's experiments cannot be explained through it, since photons move irrespective of the presence or absence of synchronization. **Synchronization of chronometers is not a Natural phenomenon, but a product of engineers' activity; therefore, it cannot be present in coordinate transformations, which are, in fact, the laws of the Nature.**

6. In case of low velocities, Lorentz's time transformation does not turn into Galileo's transformation. The SRT is not agreed with Bohr's principle, and this disagreement makes this theory non-physical.

7. The dependence of a body's mass on its velocity has no relation to the relativity theory; therefore, it cannot serve as the instrument of checking the relativity theory.

8. The connection of a body's mass with energy contained in it has absolutely no relation to the relativity theory; therefore, it cannot serve as the instrument of checking the relativity theory, either.

Bibliography

1. Chavarga N. Problem of Rational and Irrational in Physics. – Uzhgorod: Patent, 2000. – 236 p.
2. Chavarga N. Relative Motion of Solitons in the Light-Carrying Ether. // Uzhgorod University Scientific Herald, series "Physics", Issue 7, 2000. – P. 174–194.
3. www.chavarga.iatp.org.ua
4. Taylor E.F., Wheeler J.A. Spacetime Physics. – San Francisco and London: W.H. Freeman and Company, 1966. – 320 p.
5. Burlankov D.E. Space, Time, Outer Space, Quanta. – N. Novgorod: University Publishers, 2007. – 144 p. www.phys.unn.ru/docs/bigpop.pdf
6. Philippow A.T. Multifaceted Soliton. – Moscow: Nauka, 1990. – 288 p.
7. Shpolsky E.V. Atomic Physics. V. I. – Moscow: Nauka, 1984. – 576 p.
8. Marion J.B. Physics and the Physical Universe. –New York – London – Sydney – Toronto: John Wiley & Sons, Inc., 1971. – 624 p.
9. Einstein A. The Collection of Scientific Works in Four Volumes, v.1. – Moscow: Nauka, 1965. – 700 p.
10. Fokas A. Integrable Nonlinear Evolution Partial Differential Equations in 4+2 and 3+1 Dimensions// Phys. Rev. Lett. 96. 19021 (2006).