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The Special Theory of Relativity Can Be Disproved Experimentally

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> It is true that you may fool all the people some of the time; you can even fool some of the people all of the time; but you can't fool all of the people all the time.
>
> Abraham Lincoln (USA, 1809-1865).

Content

1. What the special relativity states. What is the postulate of invariability.

The special theory of relativity is based upon two postulates. The first postulate or the principle of relativity states that the laws of physics are the same in all inertial frames of reference. In accordance with this postulate all physical phenomena are identical in all frames moving without acceleration. It means that any experiment carried out within an inertial frame of reference cannot determine in which direction and how fast the frame moves. However, as pointed out Galileo Galilei, the observation of the external signals allows discover the movement of the frame relative to other frames. If you go out on the deck, you will see that your ship moves relative to the shore, he said. This postulate states that only internal signals do not allow discover the movement of the inertial frame.

Einstain expanded the principle of relativity on electromagnetic phenomena and chiefly on the propagation of light. But at that time many experiments and observations seemed to contradict to the principle of relativity. In order to conform it to the principle of relativity he proposed his second postulate in accordance with which the speed of light received a strange property of the invariability.

The second postulate of the special theory of relativity – the postulate of the invariability - states that the speed of light in vacuum is C=299 792 458 m/s in all inertial frames of reference and this speed depends neither on the movement of the light source nor on the movement of the observer measuring this speed.

In all real circumstances the speed of light does not depend on the movement of the source. The independence of the light speed from the movement of the source is verified by all known experiments and observations. The observations of the double star systems most convincingly prove the independence of the light speed from the movement of the source.

However, the independence of the light speed from the movement of the observer has never been proved by any reliable experiment or observation.

What does the independence of the light speed from the movement of the observer mean? The independence of the speed of light from the movement of the observer means that both the immovable observer O_1 and the observer O_2 which moves, for example, toward the light source receive absolutely identical value when both of them measure the speed of light of that source. In other words the postulate of invariability states that in the vacuum the same beam of light goes relative to immovable observer with the same speed C as it goes relative to the observer which moves toward the beam with any great speed V.

The independence of the light speed from the movement of the observer necessarily leads to revolution in our ideas of time and space. In the relativity it is usually demonstrated with next imaginary situation (Fig.1.1).

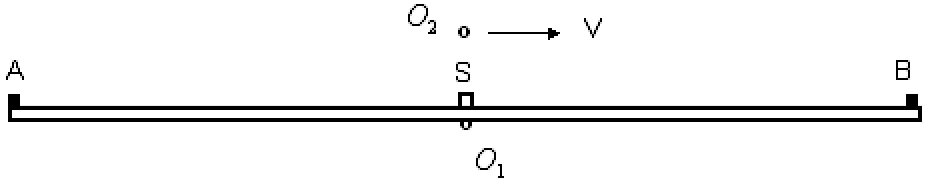


Fig.1.1

The observer O_1 and the light source S are in the middle of a long space ship. The observer O_1 turn on the source S and sees that the light goes relative to him with identical speed C in all directions and reaches the points A and B simultaneously. The observer O_2 moves relative to the space ship to the right and that moment is beside the observer

O_1. In accordance with the postulate of invariability he supposes that the light goes with identical speed C in all directions relative to him too. But, because the space shift moves relative to him to the left, the observer O_2 says that the light reaches the point B before than it reaches the point A. Thus, two events - the arrival of the light in the point A and the arrival of the light in the point B - turn out to be simultaneous in one inertial frame of reference and not simultaneous in all other frames. It is necessary to emphasize that such unusual situation is possible only on the condition that the speed of light does not depend on the movement of the observer.

As the result of similar reasoning the theory of relativity draws the conclusion that the time slows down, the mass increases and the length contracts in the moving frames of reference (so-called "consequences" of the special relativity).

2. The optical experiments and observations that forced to receive the postulate of invariability of the light speed.

In accordance with accepted in 19th century hypothesis of the light ether, the speed of light had not to depend on the movement of the source but it had to depend on the movement of the observer that is the observer moving relative to ether had to measure the light speed that was different from C.

2.1. In 1810-1813 D.Arago carried out several experiments in order to discover the influence of the orbital movement of the Earth with which the light of a stars entered his measuring instrument. Moving together with Earth with orbital speed V=29,9 km/s, he watched through a telescope the star toward which the Earth moved at that moment and then he watched the star from which the Earth at that moment receded. He supposed that the light met with the object lens of his telescope with speed (C+V) in the first event and with the speed (C-V) in the second event and wanted to discover the change of the focal distance concerned with the light speed change. D.Arago carried out the analogous experiments with the prism in which he wanted to discover the change of the index of refraction if the speed of light changed from (C+V) to (C-V). Though in these experiments the observer moved together with the Earth with great speed and watched the signals which were external to his inertial frame, he detected neither the change of the focal distance nor the change of the index of refraction. Therefore it is generally assumed that the Arago's experiments prove that the speed of light does not depend on the movement of the observer.

2.2. The interference experiment with moving water carried out by Fizeau in 1851 and similar experiments with the movement of a transparent media are considered in the relativity as the proof of the postulate of invariability. The fringe shift in these experiments was less than it was expected for a complete dragging of the light by the moving medium. It is generally assumed that these experiments prove an impossibility to force the light to go relative to the interferometer at speed $C_1 > C$ that is the Fizeau's experiment confirms the main thesis of the relativity that C is limiting value of the light speed. The result of the Fizeau's experiment has exerted an influence on the explanation of other phenomena and experiments with the movement of the source and the observer.

2.3. The purpose of the interference Michelson-Morley's experiment (1886) was to discover the movement of the Earth relative to the hypothetic ether in which the light spread. Both the light source and the observer moved with the orbital speed of the Earth V=29.9 km/s, that is in that experiment the observer dealt not with the external light signals but with the light of the source that was immovable relative to the observer and his inertial frame of reference moving with speed V relative to the ether.

This experiment with the great accuracy proved the falsity of the ether hypothesis because no influence of the speed V on the speed with which the light moved relative to the interferometer was detected. Although the ether hypothesis was discarded, the special relativity considers the Michelson-Morley's experiment as the proof of the postulate of invariability of the light speed.

2.4. Later, when the first articles on the relativity were already published, the most important confirmation of the postulate of invariability was found when **De Sitter (1911-1913)** showed that the observations of the double star systems proved that the light from the moving stars went to the Earth with the identical speed. At that time, when the ether hypothesis was already discarded, it was impossible to image that in the absolute vacuum of the interstellar space the light speed did not depend on the movement of the source. But the observations of the double star systems convincingly proved that the light speed did not depend on the movement of the source. Because in the special relativity, in accordance with the first postulate, the movement of the observer is equivalent to the movement of the source, the conclusion was drawn that the light speed did not depend on the movement of the observer, too.

2.5. In accordance with **the Doppler effect** moving at speed V observer sees the increased frequency when he approaches a light source or the decreased frequency when he recedes from it. But when the speed V is considerably less than C, the frequency change is practically the same if with speed V the source moves and therefore the Doppler effect does not allow to distinguish the movement of the light source from the movement of the observer.

2.6. Ives and Stilwell in 1938 experimentally discovered the transverse Doppler effect. It is generally assumed that the transverse Doppler effect arises because of the time dilation that is this effect is the relativistic effect. The experiments of Ives and Stilwell and similar modern laser experiments are considered as the confirmation of the time dilation effect in the moving frames.

2.7. In 1727 Bradly discovered the phenomenon of the **stellar aberration**. That phenomenon is that the visible positions of the stars shift in the direction of the observer movement and therefore the moving observer sees the stars not in their real positions but in the shifted positions. The phenomenon of the star aberration evidently contradicts to the special relativity because the star aberration takes place when the observer moves and absents when the light source moves.

2.8. It is generally assumed that that two of three so-called **"consequences"** of the relativity – the time dilation and the increase of the mass - have an experimental confirmation and that it confirms the validity of the relativity theory. But the third "consequence"- the length contraction has no one experimental confirmation.

2.9. In order to confirm the theory of relativity many **different electromagnetic experiments** were carried out. But all these experiments confirm the postulate of relativity and have no concern with main postulate of the relativity theory - the postulate of invariability of the light speed.

3. The influence of the medium on the speed of the light.

In 19th century they thought that the light could propagate in the ether only. In accordance with wave theory the light couldn’t propagate in the absolute vacuum. The hypothesis of the ether was well confirmed by the phenomenon of the stellar aberration. With help of the ether hypothesis Fresnel could explain the strange result of the Fizeau’s interference experiment with moving water. However the results of the Arago’s experiments contradicted to the ether hypothesis. Michelson-Morley’s experiment had convincingly proved that the ether hypothesis was wrong. The hypothesis of the ether was forgotten but the new stranger hypothesis arose. The light received the property of the invariability that became the base of the special relativity.

In 20th century the postulate of invariability received a strong confirmation when De Sitter had showed that the speed of light did not depend on the movement of the stars in double-star systems. Because at that time they thought that the space between the Earth and the stars was absolute vacuum, this new fact was considered as the proof of the independence of the light speed from the movement of the observer in absolute vacuum. The fact that the speed of light in absolute vacuum did not depend on the movement of the source compelled to believe that the speed of light did not depend on the movement of the observer, too, because in absolute vacuum the movement of the observer, in accordance with the principle of relativity, had to be equivalent to the movement of the light source. Later the experiments similar to the Michelson-Morley’s experiment and different experiments with the movement of the source were carried out but there was no one experiment with the movement of the observer.

According to modern notions, the light does not need the ether for its propagation. The light can propagate both in absolute vacuum and in every transparent medium.

It is well known that the speed of the light relative to the transparent medium is determined by its index of refraction n only. Therefore the speed of light in the medium does not depend on the speed with which the light enters this medium. For example, in free air the light propagates in all directions with equal speed C/n_A. When the light enters the glass plate its speed immediately changes from C/n_A to $C/n_G < C/n_A$ (n_A and n_G - refractive indexes of air and glass). Going out from a glass plate, the light again increases its speed and goes in the air at speed C/n_A. So the speed of light can change only in the case if the light propagates in the medium in the following manner.

At the moment when the photon of light meets one of the atoms of the medium the electron of this atom begins to absorb the photon. During the absorption lasts, the speed of the photon relative to this atom becomes equal to zero. Then the photon is reradiated again in the same direction with speed C relative to the atom. Reradiated photon moves at speed C till it meets next atom and is re-radiated again. Thus, the photon moves through the medium intermittently. Its speed relative to the medium is zero during the time of the absorption and is C when a photon moves between the reradiative atoms. The resultant speed is determined by the absorption's durations and by the number of the reradiations. The light speed in the gaseous medium depends on the density of the medium. When the density of medium decreases the light speed increases and in the most low-density medium becomes practically equal to C.

The speed of light relative to a gaseous medium is determined by its refractive index only and therefore does not depend on the movement of the source. Radiated by a moving at speed V source, at first the photons go in all directions with identical speed C relative to the source. Before the photons are reradiated by the atoms of a medium, they move relative to the medium with initial speeds $(\bar{C}+\bar{V})$ that is they go in the different directions with different speeds. The distances which the photons pass with the speed $(\bar{C}+\bar{V})$ before they are reradiated are determined by the density of the medium. But after they are reradiated by the atoms of a medium, the photons go in all directions relative to the medium with identical speed C/n_m which does not depend on the speed V. An immovable observer can detect the movement of the source only on the aberration and on the Doppler change of the frequency.

4. The new explanation of the main known phenomena and experiments.

All known phenomena and experiments concerned with propagation of the light can be explained without the postulate of invariability of the light speed if to take into consideration the influence of the medium on the speed of light. Basic real situations with propagation of the light and known phenomena with the movement of an observer and a source are re-examined below.

4.1. Arago's experiment.

In 1813-1815 D.Arago tried to detect the influence of the orbital movement of the Earth on the speed with which the light of the stars entered his metering equipment. As we know, that experiment was the only attempt to test how the movement of the observer influenced on the speed of the light.

D.Arago wanted to compare the speed of the light coming from the star toward which the Earth moved at that moment with the speed of the light coming from the star from which the Earth receded. His attempt met with no success. The theory of relativity considers Arago's experiment as the proof of the independence of the light speed from the movement of the observer.

The negative result of Arago's experiment is explained simply if to take into consideration the influence of the Earth's atmosphere on the speed of light (Fig. 4.1).

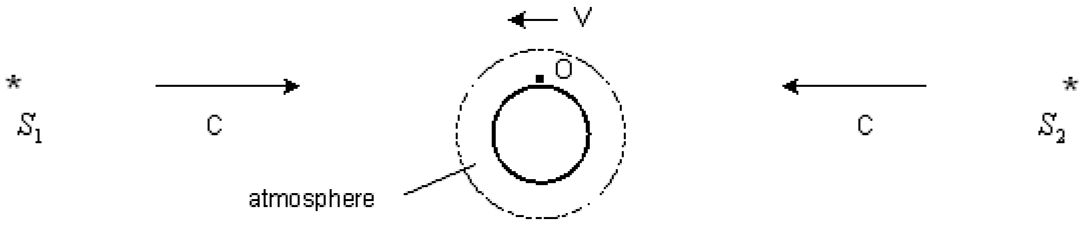


Fig.4.1

Relative to interstellar space the light from the stars S_1 and S_2 goes to the Earth at speed close to speed C. The Earth together with the observer O moves relative to interstellar space at some speed V toward the star S_1 and therefore beyond the atmosphere the light of this star goes relative to the Earth at speed $(C+V)$. But the light changes its speed as soon as it enters the atmosphere of the Earth. Entering the atmosphere at speed $(C+V)$, the light of the star is reradiated and goes relative to the air with the speed C/n_A that is the light of the star goes in the atmosphere with the same speed as the light radiated by any other source on the Earth. Reciprocally, the light of the star S_2 entering the atmosphere with the speed $(C-V)$ changes its speed and goes relative to the atmosphere with the same speed C/n_A. Both the light of star S_1 and the light of the star S_2 enter the metering equipment with identical speed C/n_A that is D.Arago dealt not with real speeds $(C+V)$ and $(C-V)$ but with changed speed C/n_A. D.Arago could not detect an influence of the Earth's movement on the speed of light in principle because the speed with which the light entered his equipment had no information about the speed V. The information about that the light had the speed $(C+V)$ or $(C-V)$ before it entered the Earth's atmosphere is in the frequencies of the light only: because of the Doppler effect the frequency of the light coming from the star S_1 is more than the frequency of the light coming from the star S_2.

In this experiment the observer was immovable relative to the medium in which the light propagated that is in reality the observer did not move relative to the light beams. Therefore the Arago's experiment cannot be considered as the proof of the independence of the light speed from the movement of the observer.

4.2. The interference Fizeau's experiment with moving water.

In 1851 Fizeau carried out the interference experiment in which he wanted to test how the moving water dragged the light. He received unexpected result: the fringe shift was less than estimated shift. In his experiment, when the water was moving with speed V, the fringe shift was such as if the light changed its speed not on V but only on $V(1-1/n^2)$. It is generally assumed that the interference experiment with moving water proves that moving at speed V water drags the light only partially and changes its speed less than on V. The Fizeau's experiment is considered as one of the main confirmations of the special relativity.

In this experiment the displacement of interference fringes is always less than it is expected for the complete dragging. And therefore a conclusion is drawn that the light moves relative to the interferometer not at the speed $(C/n \pm V)$ which corresponds to complete dragging of the light but only at the speed

$$C_1 = C/n \pm V(1-1/n^2), \quad \textbf{(4-1)}$$

where C- the speed of light in vacuum, n - the index of refraction of the moving medium.

In all experiments with dragging of the light the interfering beams are passed through the medium that moves relative to the interferometer at a speed V and always it is assumed that the displacement of the fringes in the interferometer depends only on the speed of light relative to the interferometer.

Fizeau made a mistake when he assumed that the fringe shift in his interferometer with moving water is simply determined by the difference $\Delta t = t_2 - t_1$. As it is shown below, in this interferometer the beams really change their speeds from $\frac{C}{n}$ to $\left(\frac{C}{n}+V\right)$ and to $\left(\frac{C}{n}-V\right)$. When the water moves at speed V, every photon of the beam 1 passes the distance L in the moving water for the time $t_1 = \dfrac{L}{\frac{C}{n}+V}$ and every photon of the beam 2 passes the same distance L for the time $t_2 = \dfrac{L}{\frac{C}{n}-V}$. But although the photons move at speeds $\left(\frac{C}{n}+V\right)$ and $\left(\frac{C}{n}-V\right)$, the interference fringes in the interferometer with moving water have to shift not on δ_V but only on $\delta = \delta_V\left(1-\frac{1}{n^2}\right)$ that is less than δ_V. Our analysis of the interferometer with moving water shows that:

- besides main shift δ_V, the additional shift δ_λ arises in the interferometer,
- the additional shift δ_λ is directed against main shift δ_V and therefore resultant shift $\delta = \delta_V - \delta_\lambda$ is less than δ_V,
- the additional shift δ_λ arises because the beams of light change their frequencies and pass the distance L in the interferometer with the different wavelengths,
- the shift δ_λ is the measuring error, the bias of Fizeau's experiment.

The fringe shift δ_λ arises because of the change of the frequencies of the interfering beams but it is unrelated to the dispersion of the light. The shift δ_λ arises because the phase of the oscillations in the photons with the frequency $\nu_1 < \nu_2$ (the beam 1) changes slower than the phase of the oscillations in the photons with the frequency ν_2 (the beam 2), when the photons pass the distance L in the interferometer, and therefore the photons come to the exit from the moving water with the additional phase deviation.

At first let us determine the fringe shift on the condition that the fringe shift in the Fizeau's interferometer depends, as it is generally received, on the difference $\Delta t = t_2 - t_1$ only that is on the condition that the light is completely dragged with moving water but the change of the frequencies of the interfering beams does not influence on the fringe shift. And then we will determine the additional fringe shift δ_λ arising in the interferometer because of the change of the frequencies of the interfering beams.

4.2.1. The received calculation of Fizeau's interferometer.

In the Fizeau's interferometer (Fig.4.2.) the coherent beams 1 and 2 pass in the opposite directions the same distance L in the pipe with water.

When the water is at rest, both beams go at identical speed $\frac{C}{n}$ and pass the distance L during the identical time $t_0 = \frac{Ln}{C}$. The interference fringes are in some initial position "a".

When the water in the pipe moves at speed V, the beam 1 passes the distance L at the speed $\left(\frac{C}{n} + V\right)$ during the time $t_1 = \frac{L}{\frac{C}{n} + V} < t_0$ and the beam 2 passes the distance L at the speed $\left(\frac{C}{n} - V\right)$ during the time $t_2 = \frac{L}{\frac{C}{n} - V} > t_0$. As result, the path length difference $C(t_2 - t_1) = C\Delta t$

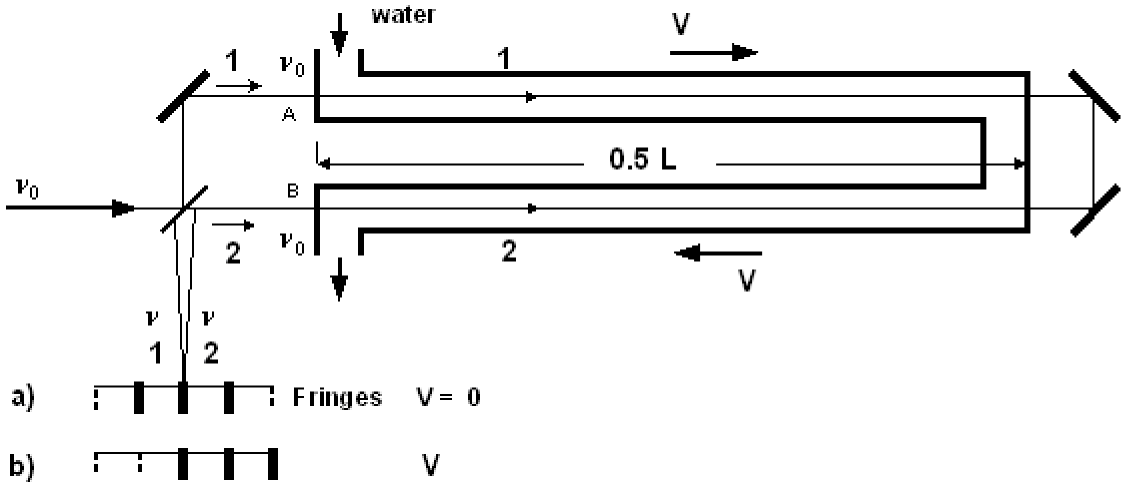


Fig.4.2

arises and the fringes shift on $\delta_V = \frac{C\Delta t}{\lambda_0}$ (position "b" on Fig.4.2):

$$\delta_V = \frac{2LVC}{\lambda_0\left(\frac{C}{n}+V\right)\left(\frac{C}{n}-V\right)} \quad \textbf{(4-2)}$$

That is in the received calculation it is assumed that the fringe shift depends only on the speeds $\left(\frac{C}{n}+V\right)$ and $\left(\frac{C}{n}-V\right)$ of the interfering beams (if L, n and λ_0 are invariable) and does not depend on the change of their frequencies.

Below it is shown that the change of the frequencies of the interfering beams essentially influences on the value of the fringe shift and therefore the expression (2) is wrong because this expression was derived without regard to the change of the frequencies. The expression (2) gives the estimated fringe shift δ_V which is more than actual fringe shift δ. If to take into account the change of the frequencies of the interfering beams, in case when the light completely dragged by moving water the fringe shift δ is determined not by the expression (2) but, as it is shown below, it is determined by the expression

$$\delta = \frac{2LVC}{\lambda_0\left(\frac{C}{n}+V\right)\left(\frac{C}{n}-V\right)}\left(1-\frac{1}{n^2}\right)$$

which gives the value of the fringe shifts exactly coinciding with the experimental values.

4.2.2. The change of the frequencies of the interfering beams in the interferometer with moving water.

In essence, the interferometer is the optical device for the measurement of the relative phase of the coherent beams. The beams enter the interferometer without some relative phase deviation. The phase deviation arises during the time while the interfering beams passes the base distance and therefore the interference pattern shifts.

In Fizeau’s experiment (Fig.4.2) the coherent beams pass in opposite direction the same distance L in the same pipe. In order to simplify analysis, let us imagine that the beams pass the identical distance L in two different pipes in which the water can move in opposite directions with identical speed V (Fig.4.3).

When the water is at rest, the beams 1 and 2 pass the distance L with identical speed $\frac{C}{n}$ and with identical frequency ν_0. The wave fronts of both beams enter the water with interval T_0, move in the water at speed $\frac{C}{n}$ and during each interval T_0 pass in the water the distances $\frac{C}{n}T_0 = \frac{C}{n}\frac{\lambda_0}{C} = \frac{\lambda_0}{n}$ that is the beams go in the water with identical wavelength $\frac{\lambda_0}{n}$ as it is shown in a conditional scale on the Fig.2,a. In the both pipes the wave fronts pass the distance L for the identical time $t_0 = \frac{Ln}{C}$ and therefore an additional phase deviation does not arise and the interference fringes are in the some initial position.

In generally received analysis of the Fizeau's interferometer the fringe shift for completely dragging is calculated on the condition that the wave fronts entering the moving water change their speeds and go at speeds $\left(\frac{C}{n}+V\right)$ and $\left(\frac{C}{n}-V\right)$ but their frequency does not change and remains equal to ν_0. That is the expression (2) is derived on the condition that the wave fronts enter the moving water with the intervals T_0 and go in the moving water with the same intervals T_0 as it takes place, for instance, in the case when the acoustic waves enter the moving water (Fig.2,b). Moving at speed $\left(\frac{C}{n}+V\right)$, the wave fronts of the beam 1 pass during each interval T_0 relative to the interferometer the distances $\left(\frac{C}{n}+V\right)T_0 = \frac{\lambda_0}{n}+VT_0$. These distances are more than the distances $\left(\frac{C}{n}-V\right)T_0 = \frac{\lambda_0}{n}-VT_0$ which the wave fronts of the beam 2 pass during the same interval T_0 at speed $\left(\frac{C}{n}-V\right)$. That is during each interval T_0 each wave front of the beam 1 shifts ahead on $2VT_0$ relative to the corresponding wave front of the beam 2 and the shift δ_V accumulates on the distance L in accordance with the expression (2).

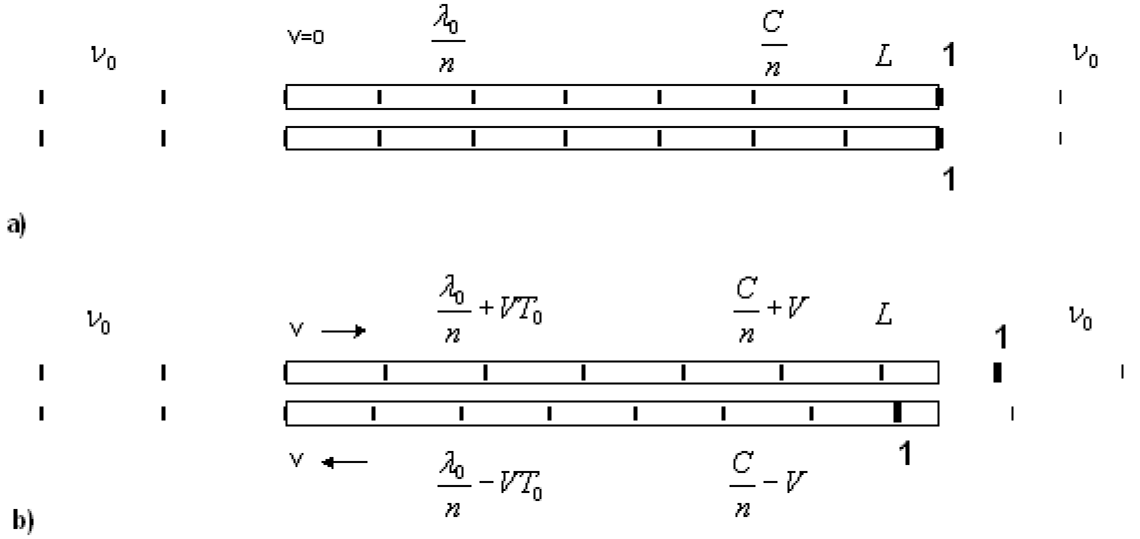


Fig.4.3

Because in the water the intervals between the wave fronts of the beam 1 are equal to $\left(\frac{\lambda_0}{n}+VT_0\right)$ and they go at speed $\left(\frac{C}{n}+V\right)$, from moving water the wave fronts go out with intervals T_0. The wave fronts of the beam 2 go in the water with the intervals $\left(\frac{\lambda_0}{n}-VT_0\right)$ and at speed $\left(\frac{C}{n}-V\right)$ and go out from the water with intervals T_0 too. That is both beams go out from the moving water with identical frequency ν_0 and therefore the fringes in the interferometer are immovable. The expression (2) was derived under such assumptions.

However the situation described above is unreal. In the interferometer the wave fronts cannot go so as it is shown, in accordance with the expression (2), on the Fig.2,b for next reason. If the wave fronts of the beam 1 go relative to the interferometer at speed $\left(\frac{C}{n}+V\right)$ and the distances between them are equal to $\left(\frac{\lambda_0}{n}+VT_0\right)$, the frequency of light relative to the interferometer is ν_0. But relative to the water the wave fronts go at speed $\frac{C}{n}$ and therefore the imaginary observer, moving together with the water, will see that relative to him and relative to the water the light go with the frequency $\nu_1' = \frac{C}{n(\frac{\lambda_0}{n}+VT_0)} = f_1(V,n)$. That is he will see that the frequency of the light depends not only on the speed V which the water moves with but it else depends on the index of refraction n. But it obviously contradicts to the experience because it is well known that the frequency of the light in the moving medium does not depend on the index of refraction of this medium.

The analogous situation takes place for the beam 2. If the wave fronts go with interval $\left(\frac{\lambda_0}{n}-VT_0\right)$ and their speed relative to the water is equal to $\frac{C}{n}$, the frequency of light relative to the water turns out to be equal $\nu_2' = \frac{C}{n(\frac{\lambda_0}{n}-VT_0)} = f_2(V,n)$. That is the frequency of the beam 2 also depends not only on the speed V but else it depends on the index of refraction n.

Thus, the assumption that the light, likewise to the acoustic waves, goes in moving water with the same frequency ν_0 is wrong. Therefore the expression (2), which is derived under the condition that the interfering beams do not change their frequency, is wrong, too, and therefore this expression gives wrong value of the fringe shift.

In reality in the Fizeau's interferometer the light entering the moving water changes its frequency likewise the light changes the frequency when it enters, for example, into a moving glass rod. We imagine the process of the spreading of the light in the transparent medium and the interaction of the light with moving medium in this manner.

When the light with frequency ν_0 and the wavelength $\lambda_0 = \frac{C}{\nu_0}$ enters from the air into immovable glass rod, the photons change their speed and go relative to the glass at speed $\frac{C}{n_{cr}}$. During each oscillation period $T_0 = \frac{1}{\nu_0}$ each photon passes relative to the glass the distance $\frac{C}{n_{cr}}T_0$ that is the light goes with the wavelength $\frac{\lambda_0}{n_{cr}}$. In the glass the photons move intermittently. Each photon periodically meets the re-radiating atom of the glass which absorbs it and after some delay radiates it again with speed C in the same direction. At speed C relative to the re-radiating atom the photon moves until next atom re-radiates it again. The resultant speed of the photon $\frac{C}{n_{cr}}$ is determined by the delay durations and by the number of the re-radiations. The photon goes out from glass with the speed C relative to the glass.

When the light with frequency ν_0 and the wavelength $\lambda_0 = \frac{C}{\nu_0}$ enters from the air into the glass rod moving at speed V in the same direction, the wave fronts enter the glass at speed $(C - V)$ and the intervals between them are equal to $T_1 = \frac{\lambda_0}{C - V} > T_0$ that is in accordance with the Doppler effect the light changes its frequency and goes in the glass with the frequency $\nu_1 = \frac{1}{T_1} = \nu_0 (1 - \frac{V}{C})$ which is less than ν_0. If to neglect the dispersion, relative to the glass the light goes at speed $\frac{C}{n_g}$.

From moving glass the photons go out with speed C relative to the glass and with the wavelength $\lambda_1 = \frac{C}{\nu_1} = \frac{C}{\nu_0 (1 - \frac{V}{C})}$. Because the glass rod moves at speed V, the photons move relative to the immovable air at speed $(C + V)$ and therefore their frequency relative to the air is $\nu = \frac{C + V}{\lambda_1} = (C + V)\frac{\nu_0 (1 - \frac{V}{C})}{C} = \nu_0 (1 - \frac{V^2}{C^2})$. In the air the photons are re-radiated by the atoms of the air and go with the frequency $\nu = \nu_0 (1 - \frac{V^2}{C^2}) < \nu_0$ and with the speed $\frac{C}{n_g}$ which is practically equal to C. That is the immovable observer sees the frequency $\nu = \nu_0 (1 - \frac{V^2}{C^2}) < \nu_0$. Thus, after the interaction with moving re-radiator the light decreases its frequency. The frequency decreases in both cases: when the re-radiator moves in the direction of the light beam and when it moves in opposite direction. This decrease of the frequency evidently contradicts to special theory of relativity but nowadays this effect can be easy proved by the simple laser experiment with the movement of the glass re-radiator at speed about 100-150 mph (see chapter 5.2.3).

In the Fizeau's interferometer, when the beams enter the moving water, the beam 1 decreases its frequency from ν_0 to $\nu_1 = \nu_0 (1 - \frac{V}{C})$ and the beam 2 increases its frequency from ν_0 to $\nu_2 = \nu_0 (1 + \frac{V}{C})$. With these frequencies the beams pass the distance L in the water. When the beams go out from moving water, the frequency of the beam 1 changes in $(1 + \frac{V}{C})$ and becomes equal to $\nu = \nu_0 (1 - \frac{V^2}{C^2})$ and the frequency of the beam 2 changes in $(1 - \frac{V}{C})$ and becomes equal to $\nu = \nu_0 (1 - \frac{V^2}{C^2})$, too. Both beams go out from water with identical frequency $\nu = \nu_0 (1 - \frac{V^2}{C^2}) < \nu_0$ and therefore the interference pattern on the screen is immovable. Thus, in the Fizeau's interferometer the beams 1 and 2 enter the moving water with identical frequency ν_0, pass the distance in the water with the different frequencies ν_1, ν_2 and than go out from water and interfere with identical frequency ν.

Because the photons go in the moving water with changed frequency, the interference pattern cannot be immovable if the water moves in the interferometer only in one pipe. In that case the photons come to the screen with two different frequencies $\nu = \nu_0(1 - \frac{V^2}{C^2})$ and ν_0, and therefore the fringes continuously move. In real experiments the interference pattern is immovable because both interfering beams pass through the moving water and interfere with the identical frequency $\nu = \nu_0(1 - \frac{V^2}{C^2})$.

4.2.3 The influence of the change of the frequencies of the interfering beams on the fringe shift.

In the interferometer with moving water the photons of the beam 1 move at speed $\left(\frac{C}{n} + V\right)$ and the photons of the beam 2 move at speed $\left(\frac{C}{n} - V\right)$. The beams pass the distance L for the different durations t_1 and t_2. The phase deviation arises and, in accordance with the expression (2), the interference pattern has to shift on δ_V. But the additional phase deviation arises because the interfering beams pass the distance in the water with different frequencies ν_1, ν_2 and therefore the resultant fringe shift decreases on δ_λ. The interference fringes shift not on δ_V which corresponds to the expression (2) but only on $\delta = \delta_V - \delta_\lambda$ which is less than δ_V. The additional phase deviation arises in this way.

The photons of the beam 1 pass the distance L during the time $t_1 = \frac{L}{\frac{C}{n} + V}$. During the time t_1 relative to the water they pass with the speed $\frac{C}{n}$ the distance $L_1 = \frac{C}{n} t_1 < L$. The photons of the beam 2 pass the distance L during the time $t_2 = \frac{L}{\frac{C}{n} - V}$. During the time t_2 relative to the water they pass with the speed $\frac{C}{n}$ the distance $L_2 = \frac{C}{n} t_2 > L$.

Instead the scheme Fig.4.3 in which the beams pass the identical distance L with the different speeds $\left(\frac{C}{n} + V\right)$ and $\left(\frac{C}{n} - V\right)$, it is possible, in accordance with the expression (2), to consider the equivalent scheme Fig.4.4 in which the beams 1 and 2 go with identical speed $\frac{C}{n}$ in the immovable water but the pipes have the different lengths $L_1$and L_2.

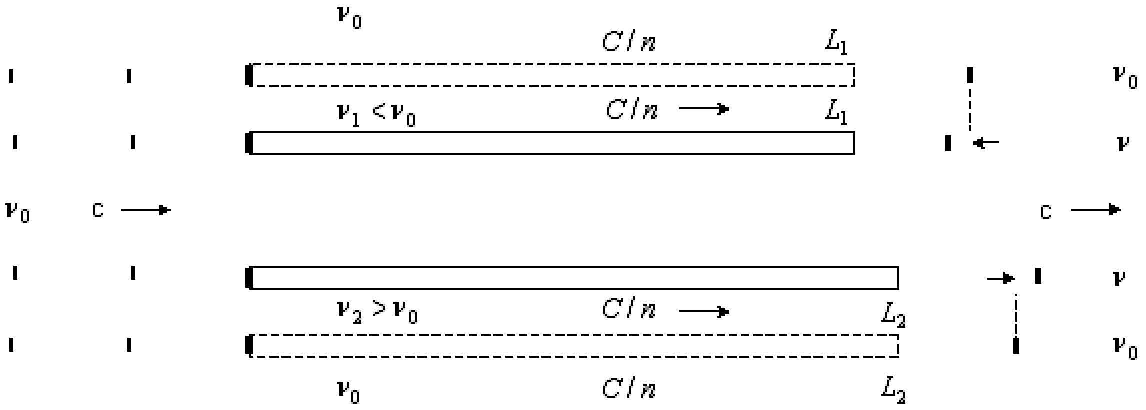


Fig.4.4

However this scheme is equivalent to the scheme Fig.4.3 only in the case if the beams pass the distances L_1 and L_2 with the identical frequency. The fringe shift is equal to δ_V only in the case if the interfering beams entering the moving water do not change their frequency. If the beams pass the distances L_1 and L_2 with the different frequencies ν_1 and ν_2, the additional phase deviation arises and the fringe shift changes.

On Fig.4.4 above the pipe 1 in which the photons go with the frequency $\nu_1 < \nu_0$ there is the pipe of the same length L_1 (shown in dotted line) in which the photons go with the same speed $\frac{C}{n}$ but have the frequency ν_0. The photons with the identical frequency ν_0 enter the both pipes. Let in some moment the photons enter in the pipes in phase that is, in terms of the wave optics, the wave fronts of both beams enter the both pipes simultaneously. After re-radiating by the atoms of the water, the photons with the frequency ν_0 arise in the upper pipe and the photons with the frequency $\nu_1 < \nu_0$ arise in the pipe 1. The photons move in both pipes with the identical speed $\frac{C}{n}$ and after the time $t_1 = \frac{L_1 n}{C}$ go out from the water simultaneously. The photons which go out from upper pipe move in the air with the frequency ν_0. The photons which go out from pipe 1 move in the air, as it is shown above, with the frequency $\nu < \nu_0$.

Although the photons pass the distance L_1 with identical speed and come to the exits from the pipes simultaneously, their oscillations do not coincide on phase when they go out from the water. The oscillation period of the photons in the pipe 1 is equal to $T_1 = \frac{1}{\nu_1}$. During the time t_1 while they pass the distance L_1 their phase changes on $\varphi_1 = 2\pi\nu_1 t_1$. But during the same time t_1 the phase of the oscillations of the photons with the frequency ν_0 changes on $\varphi_0 = 2\pi\nu_0 t_1 > 2\pi\nu_1 t_1$, that is the phase of the photons in the pipe 1 changes less and they come to the exit from the water with the phase delay $\varphi_0 - \varphi_1$.

An analogous phase deviation takes place in the beam 2. But the frequency ν_2 of the beam 2 is more than the frequency ν_0, and therefore during the time t_2 while the photons pass the distance L_2 the phase of the oscillations $\varphi_2 = 2\pi\nu_2 t_2$ of the photons of this beam changes more than the phase of the photons with the frequency ν_0 going in the pipe of the same length L_2 (shown on Fig.4.4 in dotted line under the pipe 2). That is the photons in the pipe 2 come to the exit from the water with the phase advance on $\varphi_2 - \varphi_0$.

The additional phase delay of the photons of the beam 1 and the additional phase advance of the photons of the beam 2 lead to the decrease of the fringe shift in the Fizeau's interferometer on the δ_λ and the resultant fringe shift δ becomes less than δ_V determined by the expression (4-2).

4.2.4. The fringe shift δ_λ conditioned by the change of the frequencies of the interfering beams.

When in the Fizeau's interferometer the beams enter the moving water the oscillation period in the beam 1 increases to $T_1 = T_0 \dfrac{C}{C-V}$ and the oscillation period in the beam 2 decreases to $T_2 = T_0 \dfrac{C}{C+V}$ that is each oscillation of the photons of the beam 1 lags on $\Delta T_1 = T_0 \dfrac{V}{C-V}$ and each oscillation of the photons of the beam 2 advances on $\Delta T_2 = T_0 \dfrac{V}{C+V}$. During the time ΔT_1 the wave fronts of the beam 1 should shift in the water on $\Delta\lambda_1 = \dfrac{C}{n}\Delta T_1 = \dfrac{\lambda_0}{n}\dfrac{V}{(C-V)}$ and during the time ΔT_2 the wave fronts of the beam 2 should shift in the water on $\Delta\lambda_2 = \dfrac{C}{n}\Delta T_2 = \dfrac{\lambda_0}{n}\dfrac{V}{(C+V)}$ that is during each oscillation period T_1 the wave fronts of the beam 1 lag on $\Delta\lambda_1$ and during each oscillation period T_2 the wave fronts of the beam 2 advance on $\Delta\lambda_2$.

During the time $t_1 = \dfrac{L}{\dfrac{C}{n}+V}$, while the photons of the beam 1 pass the distance L, $N_1 = \dfrac{t_1}{T_1} = \dfrac{L(C-V)}{\left(\dfrac{C}{n}+V\right)CT_0}$ oscillations happen and during this time t_1 the delay $\Delta\lambda_1 N_1$ accumulates. During the time $t_2 = \dfrac{L}{\dfrac{C}{n}-V}$, while the photons of the beam 2 pass the distance L, $N_2 = \dfrac{t_2}{T_2} = \dfrac{L(C+V)}{\left(\dfrac{C}{n}-V\right)CT_0}$ oscillations happen and during the time t_2 the advance $\Delta\lambda_2 N_2$ accumulates. As a result of it, the interference fringes shift on

$$\delta_\lambda = \frac{\Delta\lambda_1 N_1 + \Delta\lambda_2 N_2}{\lambda_0} = \frac{2LVC}{\lambda_0 n^2\left(\dfrac{C}{n}+V\right)\left(\dfrac{C}{n}-V\right)} . \quad \textbf{(4-3)}$$

The expression (4-3) determines the additional fringe shift δ_λ arising in the interferometer because the interfering beams go in the water with the different frequencies. The fringe shift δ_λ is directed against the main fringe shift δ_V.

4.2.5. The total fringe shift δ in the interferometer with moving water.

The expression (4-2) determines the fringe shift δ_V on the condition that the complete dragging of the light takes place but this expression is derived without regard to the change of the frequencies of the interfering beams. The expression (4-3) determines the additional fringe shift δ_λ which arises in the interferometer because of the change of the frequencies of the interfering beams. The total fringe shift δ is equal to the difference $(\delta_V - \delta_\lambda)$:

$$\delta = \delta_V - \delta_\lambda = \frac{2LVC}{\lambda_0\left(\frac{C}{n}+V\right)\left(\frac{C}{n}-V\right)} - \frac{2LVC}{\lambda_0 n^2\left(\frac{C}{n}+V\right)\left(\frac{C}{n}-V\right)}$$

and differs from δ_V with the multiplier $(1-1/n^2)$:

$$\delta = \frac{2LVC}{\lambda_0\left(\frac{C}{n}+V\right)\left(\frac{C}{n}-V\right)}\left(1-\frac{1}{n^2}\right). \quad \textbf{(4-4)}$$

The expression (4-4) takes into account the change of the frequencies of the interfering beams and determines the total fringe shift in the Fizeau's interferometer with moving water.

The received explanation of the results of the Fizeau's interference experiment with moving water is wrong in principle. The fact that the fringe shift in the experiments always is less than the shift δ_V determined by the expression (4-2) does not prove that the speed of the light changes less than on V. The expression (4-2) gives wrong value of the fringe shift because this expression was derived without regard to the influence of the frequency change of the interfering beams on the fringe shift.

The expression (4-4) is in accord with an experiments and proves that in reality the light in Fizeau's interferometer is completely dragged by the moving water and goes relative to the interferometer at speeds $\left(\frac{C}{n}+V\right)$ and $\left(\frac{C}{n}-V\right)$. The multiplier $(1-1/n^2)$ is not "the coefficient of dragging". This multiplier determines only the systematic bias δ_λ of the Fizeau's experiment.

The Fizeau experiment is unfit for the measuring of the speed of the light in the moving media and cannot be considered as the confirmation of the main postulate of the special theory of relativity. This experiment does not confirm the postulate but, on the contrary, proves the falsity of that postulate.

4.3. Michelson-Morley's experiment.

The Michelson-Morley's experiment had played a very important role in the creation of the special theory of relativity. In 1881 Michelson tried to detect the movement of the Earth relative to the ether and received a negative result. In 1886 Michelson and Morley retried this experiment and with great accuracy proved that the speed of light relative to the interferometer depended neither on the speed nor on the direction of the Earth's movement. Michelson-Morley's experiment convincingly proved the falsity of the ether hypothesis and verified the principle of relativity but it has no concern with the postulate of invariability because in this experiment both the light source and the observer do not move relative to the medium in which the light propagates.

The Michelson-Morley's experiment is simply explained if to take into consideration that the light propagates not in the ether but in the atmosphere which moves together with Earth. The interference pattern has not to shift in this experiment at all because the light propagates relative to the Earth's atmosphere in all directions with identical speed C/n_B and therefore the speed of light relative to the interferometer does not change when the interferometer turns round its vertical axis. The speed of light relative to the interferometer depends only on the refractive index n_B of the air. Even some negligible change of the refractive index of the air leads to the shift of the interference pattern. But the movement of the Earth does not influence on the speed with which the light go relative to the interferometer.

4.4. Why the light goes from the binary stars with identical speed.

In 1911-1913 De Sitter had published the results of the observations of the double stars which convincingly proved that the speed of light did not depend on the movement of the stars. If the binary star system is located so that the Earth is in the orbital plane of this star system, at every moment one of the stars moves toward the Earth and other one moves away. De Sitter showed that the light of the star moving toward the Earth goes to the Earth with the same speed as the light of the star moving away from the Earth. If the light of each star had different speed, during the long time while the light goes to the Earth the light of one star would go before the light of the other star and the astronomers would see a faulty orbits of the stars. But observable orbits of the double stars have practically no any significant distortions. Because at that time they thought that the interstellar space was an absolute vacuum, the fact that the speed of light did not depend on the movement of the stars seemed to be a convincing proof that the speed of light did not depend from the movement of the source in vacuum.

Since then the notions about interstellar space were radically changed. Nowadays it is well known that the space between the stars is not absolute vacuum but it is filled with rare gas. Tha space between the stars is rarefied medium with a refractive index n practically equal to 1. Relative to this medium the light from any source propagates in all directions with identical speed which is practically equal to C. The light of the stars goes in the gaseous medium and therefore its speed does not depend on the movement of the stars relative to the interstellar medium. The light of the star moving toward the Earth and the light of the star moving in opposite direction have an identical speed relative to interstellar rarefied medium.

The interstellar space is very rarefied and therefore, naturally, the question arises: on which distance are all photons reradiated or, in other words, on which distance from moving star does the speed of light become equal practically to C?

At first the light goes in the star’s atmosphere with the speed C / n_{AS} relative to the star (n_{AS} - the refractive index of the star’s atmosphere). Since the star’s atmosphere together with the star moves relative to interstellar medium with the speed V_S, the light has relative to interstellar medium the speed $(C / n_{AS} + V_S)$. But, as soon as the light goes out from the moving star’s atmosphere and enters the immovable interstellar medium, its speed becomes practically equal to C and with such speed the light goes to the Earth for many years. In principle, the propagation of the light in rare interstellar medium does not differ from the propagation of the light in the Earth’s atmosphere: the photons move from reradiating atom to reradiating atom with the speed C but the resulting speed turns out very close to C because the distances between a reradiating atoms in the interstellar space are measured with the centimeters but not with parts of the micrometers.

Thus, the independence of the light speed from the movement of the stars is explained only by the influence of the interstellar medium. Therefore the independence of the light speed from the movement of the stars cannot be considered as the proof of the postulate of invariability which states that the speed of light does not depend on the movement of the source in absolute vacuum.

4.5. The Doppler-effect without the invariance of the light speed.

In all real situations the light propagates in a medium. There are no such real situations where the light propagates in absolute vacuum. At the moment of a radiation the photons move relative to the source at speed C but as soon as they meet the atoms of the medium their speeds change and they go relative to the medium with the speed which is determined by the refractive index of this medium. Because of the influence of the medium on the light speed, the movement of the observer is not equivalent to the movement of the light source. These conditions allow reconsider the Doppler-effect for different situations with a movement of the observer and the light source.

4.5.1. The observer moves relative to the medium, the source is immovable.

The light source S and a transparent medium are immovable relative to some inertial frame but the observer O moves with the speed V at an angle α to the line OS

The observer moves relative to the medium in which the light propagates or, in other words, he moves relative to the light beam. Relative to the observer the light goes with the velocity $\overline{C}_1$ which is the vector sum of the velocities $\overline{C}$ and $\overline{V}$ ..

The velocity $\overline{C}_1 = \overline{C} + \overline{V}$ can be determined from the triangle OBS:

$C_1 = \sqrt{(V + CCos\alpha)^2 + (CSin\alpha)^2} = \sqrt{V^2 + 2VCCos\alpha + C^2}$.

Because the speed C_1 differs from C, the observer receives not the frequency ν_0 that is radiated by the source S but the changed frequency

$\nu = \nu_0 \sqrt{1 + 2\beta Cos\alpha + \beta^2}$, where $\beta = V / C$. **(4-5)**

The expression (4-5) determines the Doppler-effect for the situation when the observer moves with speed V relative to the medium in which the light propagates.

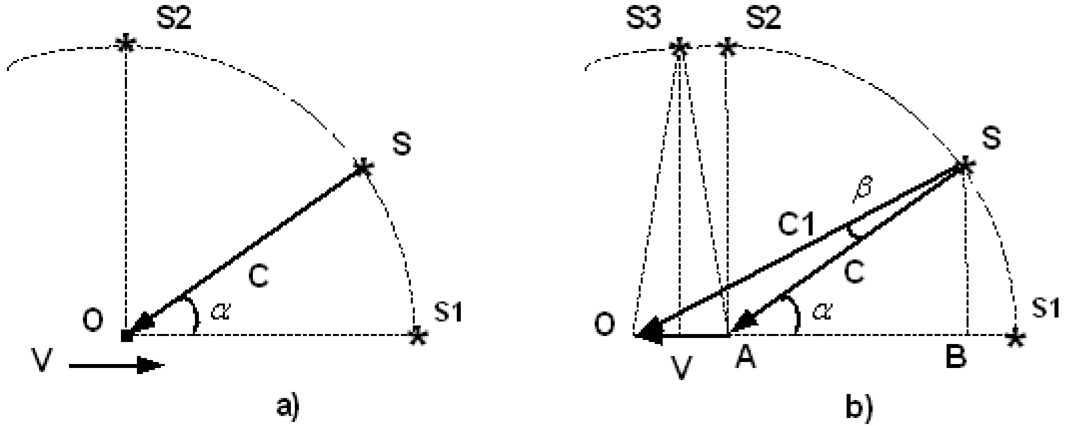


Fig.4.4

The longitudinal Doppler-effect takes place when the observer moves toward the source (α =0) or when he moves away from source (α =180^o) and the observer receives the frequency

$\nu = \nu_0 (1 \pm \beta)$ **(4-6)**

The situation when the observer moves at angle 90^o is considered below (see the chapter 4.6).

4.5.2. The light source moves relative to the medium, the observer is immovable.

The observer O and the transparent gaseous medium are immovable relative to some inertial frame but the source S moves with the speed V relative to the medium and the observer (Fig.4.5).

Fig.4.5

The immovable observer is located relative to the source in one of the directions D or D_1, D_2 , D_3 .

Depending on the direction in which the observer is located, he receives because of the Doppler-effect the different frequency.

At the moment of an emission the photons move relative to the source in all directions with identical initial speed C but then they are reradiated by the atoms of a medium and go relative to the medium in all directions with identical speed C / n_M .

When the light source is immovable, in the frame connected with the medium and the observer, the initial velocities of the photons are described by the diagram 1 (the vectors from point S to circle 1) that is relative to the observers located in different directions D, D_1, D_2 , D_3 the photons move with identical initial speed C. When the photons are reradiated their frequencies do not change and therefore all observers receive the frequency ν_0 .

When the source moves the photons receive the additional speed V and at the moment of an emission they move in different directions with the different initial velocities. Their velocities are determined by the vector sum $\overline{C}+\overline{V}$ and are described by the diagram 2 (the vectors from the same point S to circle 2).

If the light would propagate in absolute vacuum, the photons would come to the different observers with different speeds and therefore the observers located in different directions D, D_1, D_2, D_3 in accordance with Doppler effect would receive the different frequencies. The reemission of the photons by the atoms of a medium does not influence on the frequency which the observer receives. After reemission the photons go in all directions with different frequencies and with identical speed C/n_M relative to the medium and therefore the observers located in different directions receive the different frequencies.

In some direction D at an angle φ to the speed V the photons move with speed C_1:

$$C_1 = BS = dS + Bd = \sqrt{C^2 - V^2 Sin^2\varphi} + VCos\phi$$

With such initial speed C_1 the photons meet the atoms of the medium, are reradiated and go in the medium not with the initial frequency $\nu_0 = C/\lambda_0$ but with the new frequency $\nu = C_1/\lambda_0\ \nu_0$:

$$\nu = \nu_0\sqrt{1-\beta^2 Sin^2\varphi} + \beta Cos\varphi$$, where $\beta = V/C$. **(4-7)**

The expression (4-7) determines the Doppler effect for the situation when the source moves with speed V relative to the observer immovable relative to the medium in which the light propagates.

When the light source moves toward the observer ($\varphi = 0$) or moves away from the observer ($\varphi =$ 180°) the longitudinal Doppler effect takes place:

$$\nu = \nu_0(1 \pm \beta)$$ **(4-8)**

The situation when the source moves at angle 90^o is considered in the chapter 4.6.

4.5.3. The light source and the observer move relative to the medium.

Let us consider only the most interesting situation when the light source and observer move with identical speed V along the line "source-observer".

When the observer moves with speed V toward the immovable light source, in accordance with formula (4-6) he receives the frequency $\nu = \nu_0(1+V/C)$.

When the light source moves with speed V away from the immovable observer, in accordance with formula (4-8) the observer receives the frequency $\nu = \nu_0(1-V/C)$.

When the observer and the light source move with identical speed V along the line "source-observer" the observer receives the frequency

$$\nu = \nu_0(1+V/C)(1-V/C) = \nu_0(1-\frac{V^2}{C^2}) = \nu_0(1-\beta^2),$$ **(4-9)**

that is the frequency ν becomes less than the frequency ν_0.

When the observer and the light source move with identical speed the frequency decreases because of an influence of the medium on the speed of light. If the observer and the light source were moving with identical speed in absolute vacuum the frequency would not change and the observer would receive the frequency ν_0.

The decrease of the frequency, when the observer and the light source move with identical speed, takes place because of the influence of the medium on the speed of light. If the observer and the source with identical speed would move in absolute vacuum, the frequency would not change and the observer would receive the frequency ν_0.

On Fig.4.6 the light source and the observer move with identical speed V relative to the medium. The source radiates the photons with frequency ν_0. At the moment of emission the photons move relative to the source with initial speed C and with the wavelength $\lambda_0 = C/\nu_0$. Because the source moves with speed V, in the direction of the observer the photons move with initial velocity $(C-V)$ relative to the frame connected with the medium and have the wavelength λ_0.

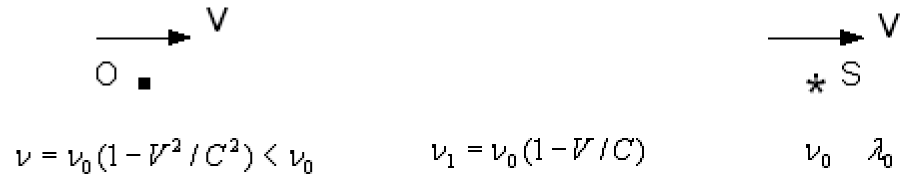


Fig.4.6

In the case if between the source and the observer there were no medium, the observer immovable relative to this frame would receive the frequency $\nu_1 = (C-V)/\lambda_0 = \nu_0(1-V/C)$ and the observer moving with the speed V would receive the frequency ν_0.

In the case when the light goes from the source to the observer in the medium, the photons meet the atoms of medium with the speed $(C-V)$, are reradiated by these atoms and go in the medium with the frequency $\nu_1 = \nu_0(1-V/C)$. The speed of light in the medium is equal to C/n_{cp} but from atom to atom of the medium the photons move with speed C. Therefore the observer which moves toward them with the speed V meet the photons with the speed (C+V) and sees the frequency $\nu = (C+V)/\lambda_1 = \nu_0(1+V/C)(1-V/C) = \nu_0(1-\beta^2)$ which is less than ν_0.

In accordance with the special theory of relativity the frequency of light has not to change when the observer and the light source move with identical speed. The decrease of the frequency determined by formula (4-9) can be detected nowadays in laser experiment with the movement of the re-radiator in the earth atmosphere at speed above 150-200 mph or in the orbital interference experiment (see 5.2.3).

4.6. The transverse Doppler-effect.

In the case when the source of light moves perpendicular to the line "source-observer" the light comes to the observer with decreased frequency that is so-called transverse Doppler effect arises. This effect cannot be explained by the wave theory. The relativity explains this effect as result of time dilation in the moving frames. In 1938 Ives and Stilwell detected the transverse effect but they were disagree with relativistic explanation of that effect and tried to explain the result of their experiment without relativity. The Ives-Stilwell's experiment is considered as one of important proofs of the time dilation.

In reality the transverse effect is simply explained without hypothesis of the time dilation and therefore the Ives-Stilwell's experiment cannot be considered as a proof of the time dilation. The decrease of the frequency of the light which goes perpendicular to the movement of the source is explained only by the kinematical cause.

Well known and experimentally proved formula for the transverse Doppler effect with a movement of the source is simply derived from expression (4-7) if to put $\varphi = 90^\circ$:

$$\nu = \nu_0\sqrt{1-\beta^2}$$ **(4-10)**

The expression (4-10) shows that in the direction perpendicular to the movement of the source the light goes with the frequency $\nu < \nu_0$.

The decrease of the frequency is explained not by a time dilation. It is explained by the fact that the observer sees only the photons radiated by the source at some angle back. The photons which the source radiates with the speed C at the angle $\varphi = 90^\circ$ (that is in the direction D_1 on the Fig.4.5) does not come to the observer because their initial velocity is equal to vector sum of the velocities C and V and therefore does not coincide with the direction D_1. These photons move relative to the observer at the angle which is less than $\varphi = 90^\circ$ and therefore they cannot come from the point S to the point D_1 where the observer is.

As you can see, from the moving source S only the photons radiated by the source at some angle back can go at angle $\varphi = 90^\circ$ in the direction D_1. These photons are radiated with the speed C in the direction of the point A_1 but to the speed C the speed V is added (as the triangle SA_1B_1 shows) and the photons go in the direction D_1 with initial speed $\overline{C}_2 = \overline{C} + \overline{V}$ till they are reradiates by the atoms of the medium. The speed C_2 is less than C and therefore because of the Doppler effect the frequency $\nu = \nu_0\sqrt{1-\beta^2}$ is less than ν_0. And only that is proved by the Ives-Stilwell's experiment.

It is generally assumed that the transverse Doppler effect confirms the conclusion of the relativity about the time dilation in moving frames. In accordance with special relativity, in moving at speed V source the time delays in $\sqrt{1-\beta^2}$ times and therefore the immovable observer sees the frequency which is less in $\sqrt{1-\beta^2}$ times.

But let us image other situation. Let the light source is immovable and the observer moves at speed V in the direction perpendicular to the line "source-observer". What frequency will the observer receive if the source radiates the light with frequency ν_0 ? Because in the relativity the movement of the observer is equivalent to the movement of the light source the moving observer has to see the frequency which is less in $\sqrt{1-\beta^2}$ times.

But in reality the moving observer in this case will see not decreased frequency but, on the contrary, the frequency which is increased in $\sqrt{1+\beta^2}$ times.

The expression (4-5) $\nu = \nu_0\sqrt{1+2\beta Cos\alpha+\beta^2}$ determines the Doppler effect for the case when the observer at speed V moves at angle α to the direction of the light source. If the source S on Fig.4.4,a is located in the position the S_2, the observer moves perpendicular to the light beam and the angle α is equal to 90°. For the angle $\alpha = 90^\circ$ expression (4-5) gives the formula for the transverse Doppler effect with a movement of the observer:

$$\nu = \nu_0\sqrt{1+\beta^2}$$ **(4-11)**

Obviously, the increase of the light frequency in the transverse Doppler effect with a movement of the observer does not connect with any change of the time and is explained only by a kinematical cause. The phenomenon of the transverse Doppler effect with the movement of the observer contradicts to the special relativity and nowadays can be detected in the orbital laser experiment (see 5.2.4).

4.7. The stellar aberration.

The well-known phenomenon of the stellar aberration cannot be explained by the special relativity and evidently contradicts this theory. The problem is that the aberration takes place when the observer moves but there is no aberration when the source moves. The stellar aberration unquestionably proves that the movement of the observer is not equivalent to the movement of the light source that is it proves the falsity of the postulate of invariability.

The phenomenon of the stellar aberration is known from 1727 when James Bradley has discovered that the apparent locations of the stars shift in the direction of the orbital Earth’s movement. The apparent locations of the stars which are located just in the direction perpendicular to the orbital speed of the Earth shift on 20.5 angle seconds. Moving with the orbital Earth’s speed, the observer sees the light signals external to the Earth frame of reference. As else Galilei had noted in his example with moving ship, in accordance with principle of relativity only the experiments and the observations carried out inside the inertial frame of reference do not allow to detect the movement of this reference but the observation of the signals external to the inertial frame allows to detect the movement of the frame. Extending the principle of relativity on the optical phenomena, the special relativity claims that none of the experiments or the observations, including the optical ones, can detect the movement of the inertial frame. The phenomenon of the stellar aberration evidently proves that the observation of the light going from the stars allows detect that in reality the inertial frame of the Earth moves relative to the stars.

The stellar aberration takes place only in the case when the observer moves but this phenomenon absents when the source moves.. The absence of the aberration in the case when the source moves is proved by the observations of the binary stars.

If the binary system is located so that the orbital plane of the stars is perpendicular to line "binary system- Earth", each of the binary stars moves perpendicular to this line that is two light sources with known distance between them move in the opposite directions perpendicular to the line "source-observer". If, in accordance with special relativity, the movement of the light source is equivalent to the movement of the observer, the aberration has to be observed and in the case when the source moves. In binary systems the stars move in the opposite directions and therefore the apparent locations of the stars have to shift in the opposite directions too. If to take into account that the speed of the movement of the stars is more than the orbital speed of the Earth, the apparent sizes of the binary orbits have to increase on hundreds of the angle seconds. However the apparent locations of the binary stars do not shift because of movement of the stars that is there is no aberration when the stars move. The observations of the natural satellites of the primary planets prove the absence of the aberration when the light source moves.

In order to understand why the aberration takes place when the observer moves but absents when the source moves, let us more strictly define a concept "the aberration" and consider how the aberration arises when the observer moves.

Let us imagine two stars A and B immovable relative to the interstellar medium (Fig.4.7).

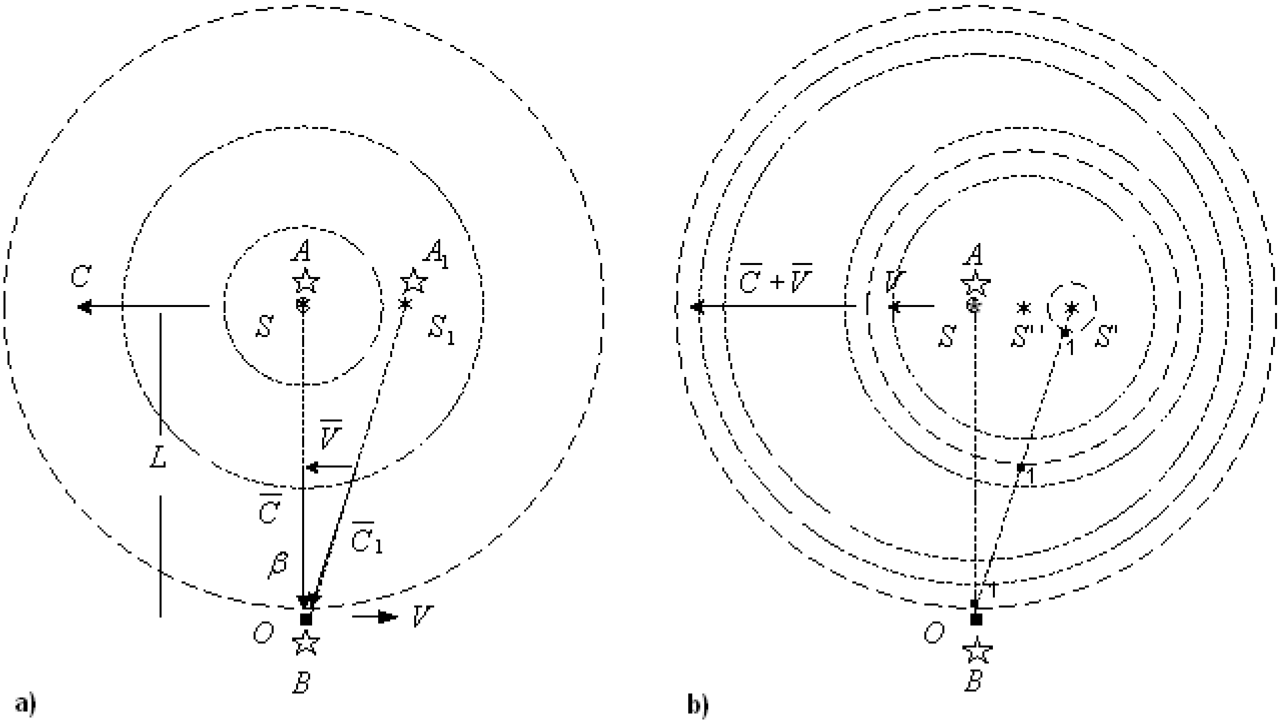


Fig.4.7

Near the star A there is the light source S and near the star B there is the observer O. Let us consider the propagation of the light in the cases when only the observer O or only the source S moves relative to the frame of reference of these stars. If the observer and the light source are immovable, the observer sees the source in the point A.

When the observer moves at speed V perpendicular to the line AB, he sees the source S and the star A in shifted positions S_1 and A_1 that is the aberration takes place and the apparent location of the sources shifts on the angle of aberration $\beta = V/C$.

Let us imagine first that the light from source S goes to the observer in absolute vacuum. Relative to the source and the frame of the stars A and B, the photons move in all directions with identical speed C (Fig.4.7,a). The observer crosses the light beam with speed V and in this case the photons enter his telescope with speed $\overline{C}_1$ which is vector sum of the speed $\overline{C}$ and the speed $\overline{V}$. Therefore the observer sees the light source and the star in the shifted on angle β positions S_1 и A_1. The aberration arises because the observer moves perpendicular to the light beam and crosses it. The aberration arises at the moment when the photons enter the moving object lens of the telescope that is the aberration arises in that point of the space where the moving observer meets the photons. If the observer suddenly stops in the point B he immediately sees that the aberration disappeared and the light source and the star are in the positions S and A.

In reality the photons go from the source to the observer not in the absolute vacuum but in the interstellar gaseous medium and the moving observer and his telescope are surrounded by the Earth's atmosphere. In interstellar medium the photons move with speed C/n_{CP} which is very close to C and enter the moving at speed V atmosphere with speed $\overline{C}_1 = \overline{C} + \overline{V}$ relative to the atmosphere at the angle of aberration $\beta = V/C$ to line AB. In the atmosphere the photons are reradiated by the atoms of the air and move relative to the atmosphere with speed C/n_B. Thus, in real situation the aberration arises already at the moment when the photons enter the atmosphere of the moving Earth. With speed C/n_B and at angle β, the light of the source S and the star A enter the telescope and the observer sees the source and the star in the shifted positions S_1 и A_1.

Thus, the aberration is characterized by next definitive distinctions:

1. The aberration arises only in the case when the moving observer crosses the light beam.

2. The aberration arises for the reason that the photons entering the moving together with an observer medium (the glass of the objective or the Earth’s atmosphere) change the direction of their movement and go relative to this medium at the angle of the aberration β .

3. The angle of the aberration changes immediately if the speed of the observer’s movement changes.

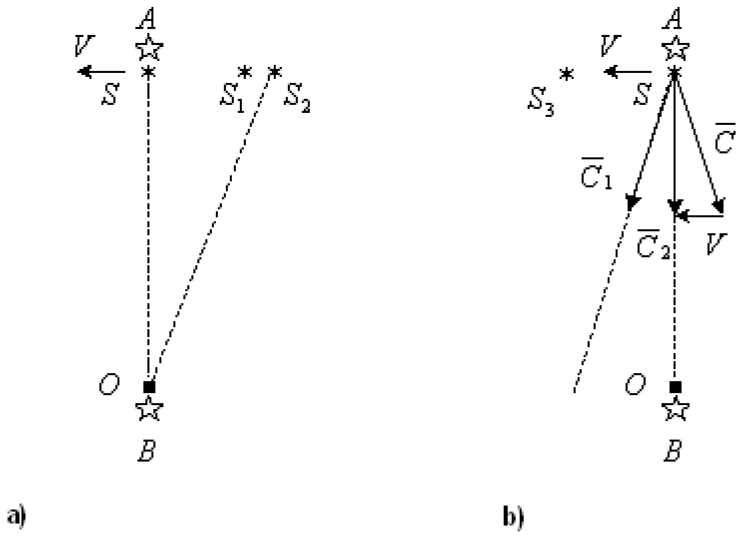
4. The moving observer sees the light emitted by the source a time $T_0 = L/C$ ago. If the source stops to emit the light, the light continues to go to the observer during the time T_0 and therefore during the time T_0 the moving observer crosses the light beam and sees the light source in shifted position.

Now let us consider the situation when the observer is immovable but the source moves with the speed V.

Let us again imagine first that the light from the source go to the observer in absolute vacuum. In this case each photon emitted by the moving source receives additional speed V. Relative to the source the photons move in all directions with identical speed C but relative to the immovable stars A and B they move in all directions with different speeds $\overline{C} + \overline{V}$ (Fig.4.7,b). When the source is already in the point A the observer sees the photons which the source has emitted the time $T_0 = L/C$ ago when it was else in the point S'.These photons labeled on Fig.4.7,b as 1 move in absolute vacuum with speed $\overline{C}_1 = \overline{C} + \overline{V}$ at angle β to the line AB and therefore the observer sees the source S not beside the star A where the source is at this moment but in the point S' that is he sees the source in a shifted position. But this shift is not connected with the aberration. The observer really sees the source in the position from which the source has emitted the photons the time $T_0 = L/C$ ago. The photons really go in the space at angle β to the line AB and do not change the direction of their movement when they enter the objective of the telescope how it happens in the case of aberration. In addition, if in this case the source suddenly stops, its apparent location does not change immediately and the observer will see this change only after the time T_0.

In reality the light from moving stars go not in absolute vacuum but in the interstellar gaseous medium in which the light can propagate only with speed C/n_{CP} very close to C. Therefore the photons emitted by the moving source move in all directions with different speeds until they are reradiated by an atoms of the immovable interstellar medium and then they go in all directions wit identical speed $C/n_{CP} \cong C$. However the presence of the interstellar medium practically does not influence on the direction from which the photons come to the observer.

Let the source S moves with speed V during the time more than $T_0 = L/C$ and at the moment of the observation is beside the point A (Fig.4.8,a).



a) b)

Fig.4.8

The moving source is already in the point A but at this moment the observer cannot see it in the position A because the light from point A will come to the observer only after the duration T_0. The observer sees the source S in the position S_2 which is shifted relative to the immovable star A but this shift is not connected with the aberration. He sees the source in the position from which the light was radiated the time $T_0 = L/C$ ago. At the moment when the source is already in the point A the observer will see it in the position S_2 even if the source stops to emit the light after it passes the point S_2. The shift SS_2 is a little more than the aberration shift SS_1 because the shift SS_1 is determined by the vector $\overline{C}_1 = \overline{C} + \overline{V}$ and the speed $\overline{C}_1$ is more than C whereas the shift SS_2 is determined by the speed C with which the light goes from the point S_2 to the observer in the interstellar medium.

If the source S during the time more then $T_0 = L/C$ was immovable in the point A and at the moment of the observation begun with speed V to move, the observer during the time T_0 sees it in the point A and only after the duration T_0 he will see that the source began to move Fig.4.8,b).

The most interesting situation is when the source moves at speed V without emission of the light and momentarily radiates the light at the moment when he is beside the point A (Fig.4.8,b). The light radiated by the source in the point A will come to the observer only after the duration $T_0 = L/C$ when the source already comes in the point S_3. Does the aberration take place in this case?

The observer sees the momentary flash in the point A that is the light from the moving source comes to him without any aberration. At the moment of the emission each photon receives the additional speed V. Therefore the photons emitted in the point A in the direction to the observer go with initial speed $\overline{C}_1 = \overline{C} + \overline{V}$ at angle $\beta = V/C$ to the line AB and do not come to the observer (Fig.4.8,b). Only the photons which the source radiates in the point A at some angle back to the line AB come to the observer. These photons go along the line AB with initial speed $\overline{C}_2 = \overline{C} + \overline{V}$. After the reradiating by the atoms of a medium they change their speed and with the speed close to C go along the line AB to the observer. The observer sees that the photons come to him from the point A without any aberration. Because the speed $\overline{C}_2$ is less than C these photons have the frequency $\nu_2 = \nu_0 \sqrt{1 - V^2/C^2}$ less than ν_0 (see the chapter 4.6). When the source moves the Doppler shift takes place only but there is no aberration.

Obviously, if in the point A the moving source S will stop or change the speed of its movement, the observer will see it in the same point A during the time $T_0 = L/C$ that is he will see during this time no any change.

Thus, the aberration takes place when the moving observer crosses the light beam. Any change of the speed of observer's movement leads to change of the angle of aberration.

There is no aberration when the source moves perpendicular to the line "observer-source". The observer can see any change of the speed of its movement only after the time T_0.

In the binary star system the observer simultaneously sees without any aberration two light sources which move in opposite directions and which are on known distance from each other. The absence of the aberration in the binary star systems proves the falsity of the main thesis of the relativity about the equivalence of the movements of the source and the observer.

4.8. About the "consequences" of the special relativity.

The main postulate of the special relativity states that the speed of the light depends neither on the movement of the source nor on the movement of the observer measuring this speed. If this statement is true, three next effects or three so-called "consequences" have to take place: the time has to dilate, the longitudinal length of the bodies has to decrease and their longitudinal mass has to increase when the speed increases. The experiments and the observations which prove the "consequences" are usually considered as the confirmation of the special theory of relativity.

In our opinion all known phenomena and experiments confirming these "consequences" have no concern with special relativity and can be explained without this theory.

The time dilation is proved by the observations for the mu-mesons that bear by the cosmic rays in the Earth atmosphere. If the mu-mesons move at speed C, they can pass the distance 600 metres during their lifetime 2.2 microsecond and then they decay. But the mu-mesons pass the distances 20-30 km from the upper atmosphere and reach the Earth surface. The special theory of relativity explains this fact by the time dilation in the frame of reference of the moving mu-mesons: in their frame the time goes slower and therefore the mu-mesons moving at the speed very close to C pass such great distances. But, maybe, the mu-mesons which born in the nuclear reactions move - in spite of relativistic prohibition - at speed which is much more than C? In this case they can during their lifetime reach the Earth surface.

In accordance with relativity theory, in the modern particle accelerators the increase of the mass does not allow to accelerate any particle to the speed more than C. When the particle moves at speed close to C its longitudinal mass becomes so great that no force can increase its speed in the direction of the movement. At the same time the mass in the transverse direction does not change that is an external force can change the speed of the particle in the transverse direction but cannot change its speed in the direction of the movement. However it is clear and without theory of relativity that the modern accelerator cannot accelerate any particle to the speed more than C with the help of the accelerating electromagnetic field which itself moves relative to the accelerator at speed C. When the particle moves in the accelerator at speed close to C the interaction of the accelerating field with the moving particle decreases likewise it takes place in an asynchronous electromotor when the speed of the rotation of the rotor approaches to the speed of the rotation of the stator field.

The contraction of the longitudinal length of the moving objects is usually considered as the first "consequence" of the special relativity. In accordance with STR the length of any object contracts in the direction of its movement. The principle of the invariance of the light speed leads of necessity to the conclusion that the length of the moving body contracts and any ruler having the length L_0 has the length $L = L_0\sqrt{1 - V^2 / C^2}$ when it moves at speed V. The length contraction predicted by the special relativity has no one experimental confirmation.

However, nowadays the experimental verification of this "consequence" is easy and practicable.

The possibility of such verification arose more than 30 years ago when Mishel A. Duguau had photographed the short light impulse in the water. In the chapter 5.2.2 we suggest the experiment with moving "light rod" which will prove, as we expect, that there is no contraction in the moving objects.

The length contraction, the increase of the mass and the time dilation are the phantom arising as result of the wrong interpretation of optical experiments and observations carried by Arago, Fizeau, Michelson, De Sitter and so on. Trying to explain these experiments, Larmor, Fitzgerald, Lorentz and Poincare used the mathematical abstracts about the length contraction, the increase of the mass and the time dilation. Einstein converted the mathematical abstracts in the physical categories after he proposed his strange postulate of invariability of the speed of light.

4.9. The cosmological red shift without the invariance of the light speed.

In 1929 Edwin Hubble has discovered that the more the distances to the galaxies the more the red shifts in the galactic spectrums. In accordance with special theory of relativity the frequency of the light cannot change if the source is immovable relative to the observer. The frequency of the light, because of the Doppler-effect, decreases the less the faster the source recedes from the observer. Therefore the cosmological red shift was explained with the recession of galaxies: the more the distance from the Earth the faster the galaxy recedes from the Earth. The attempts to explain the cosmological red shift with other reasons failed. The most popular hypothesis was the hypothesis "The ageing of light quanta". In accordance with that hypothesis there is no recession of galaxies but the cosmological red shift arises because the light quanta passing the great distances lose the energy and therefore decrease its frequency. But the hypothesis "The ageing of light quanta" was rejected when it was discovered that the red shifts were proportional to the wavelengths but it did not accord with the prediction of that hypothesis.

In our opinion many problems of modern astrophysics and cosmology arise because of Doppler interpretation of the cosmological red shift.

The cosmological red shift can be explained without the hypothesis of the recession of galaxies if to refuse from the postulate of invariability and to take into account next conditions:

- the light is the stream of the photons,
- each photon has own frequency,
- the photons are re-radiated by the atoms of the medium and move relative to the re-radiating atoms at speed C,
- relative to the interstellar medium the light goes at speed $\frac{C}{n_M}$ which is practically equal to C,
- on its long way from galaxies to the Earth the photons repeatedly meet a moving gaseous accumulations.

If the source radiating the light of frequency ν_0, the observer and the medium in which the light spreads are immovable relative to some inertial frame, the observer receives the same frequency ν_0. But the photons change their frequency if they meet the moving re-radiator on their way to the observer. Let us consider two situations – when the re-radiator moves at speed V on the line source-observer toward the source and when the re-radiator at the same speed V moves in the opposite direction.

On Fig.4.9 the monochromatic source S and the observer O are immovable relative to the medium. The light goes with the frequency ν_0 and the wavelength λ_0 and on the way from the source to the observer meets the glass plate P moving towards the source. The photons enter the glass at speed $(C+V)$. Therefore their period decreases to $T_1 = \frac{\lambda_0}{C+V}$ and the photons go in the glass with the frequency $\nu_1 = \frac{1}{T_1} = \nu_0(1+\frac{V}{C})$ more than ν_0.

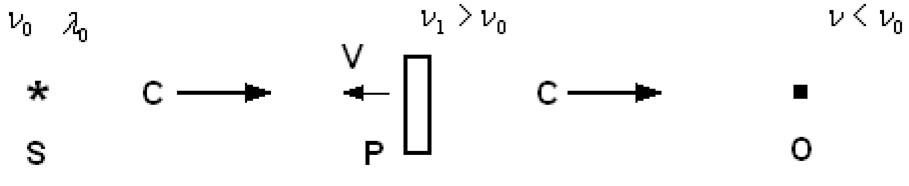


Fig.4.9

From the glass plate P the photons go out with the frequency $\nu_1 > \nu_0$. They move relative to the glass with initial speed C and have the wavelength $\lambda_1 = \frac{C}{\nu_1} = \frac{C}{\nu_0(1+\frac{V}{C})}$. Before re-radiating by the atoms of the medium the photons move relative to the medium and to the observer at speed $(C - V)$ and therefore the observer sees the frequency

$$\nu = \frac{C - V}{\lambda_1} = \frac{\nu_0 (1 + \frac{V}{C})(C - V)}{C} = \nu_0 (1 + \frac{V}{C})(1 - \frac{V}{C}) = \nu_0 (1 - \frac{V^2}{C^2})$$

.

After the re-radiating by the atoms of the medium the light changes its speed and goes to the observer with the speed $\frac{C}{n_M}$ and with the frequency $\nu = \nu_0 (1 - \frac{V^2}{C^2})$. As a result of the interaction with the re-radiator moving toward the light source the frequency decreases that is the light receives the red shift.

If the re-radiator at speed V recedes from the source (Fig.4.10) the photons enter the glass plate P at speed $(C - V)$ and their period increases to $T_2 = \frac{\lambda_0}{C - V}$. In the glass plate the light goes with the frequency $\nu_2 = \frac{1}{T_2} = \nu_0 (1 - \frac{V}{C})$ less than ν_0. From the glass plate the photons go out with the frequency $\nu_2 < \nu_0$. They move relative to the glass with initial speed C and have the wavelength $\lambda_2 = \frac{C}{\nu_2} = \frac{C}{\nu_0 (1 - \frac{V}{C})}$. Before re-radiating by the atoms of the medium the photons move

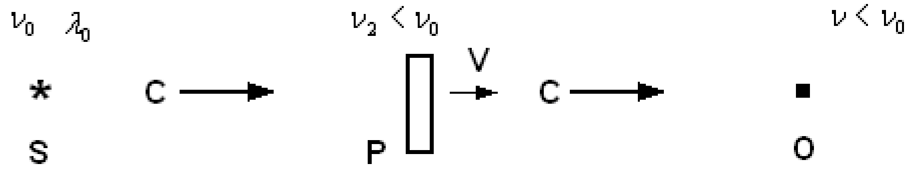


Fig.4.10

relative to the medium and to the observer at speed $(C + V)$ and therefore the observer sees the frequency

$$\nu = \frac{C + V}{\lambda_2} = \frac{\nu_0 (1 - \frac{V}{C})(C + V)}{C} = \nu_0 (1 - \frac{V}{C})(1 + \frac{V}{C}) = \nu_0 (1 - \frac{V^2}{C^2})$$

After the re-radiating by the atoms of the medium the light changes its speed and goes to the observer with the speed $\frac{C}{n_M}$ and with the frequency $\nu = \nu_0 (1 - \frac{V^2}{C^2})$. As a result of the interaction with the re-radiator receding from the light source the frequency decreases. That is, and in this case the light receives the red shift.

Thus, in both cases – when the re-radiator approaches to the source and when it recedes from the source – the frequency of the light decreases from ν_0 to $\nu < \nu_0$:

$$\nu = \nu_0 (1 - \frac{V^2}{C^2}), \quad \textbf{(4-12)}$$

that is in both cases the red shift arises. The red shift arises because of the Doppler effect but this red shift does not connected with the movement of the light source or the observer. The red shift arises as result of the interaction of the light with the moving re-radiator though the light source and the observer are immovable relative to the medium in which the light spreads.

In real interstellar space the moving gaseous accumulations are the re-radiators. On their long way from the stars and galaxies the photons repeatedly meet such moving accumulations and every time their frequency becomes a little less.

The expression $\nu = \nu_0 (1 - \frac{V^2}{C^2})$ does not contradict to the observations because the observing cosmological red shifts are proportional to the frequencies. This expression does not allow determine the value of the red shift in each specific case because the amount of the moving re-radiators is unknown and this amount can be very different from galaxy to galaxy. The expression (4-12) explains only how the cosmological red shift arises.

The Fizeau's experiment proves that the frequency change when the light interacts with a moving re-radiator. If not two but only one interfering beam passes through the moving water the interference fringes continuously move because the frequency of the beam passing the moving water in accordance with the expression (4-12) is less than the frequency of second beam.

The explanation of the cosmological red shift by the re-radiation of the photons allows reject the hypothesis of the recession of galaxies and to reconsider the cosmological scale of the distances, to solve the problem of quasars and many other problems of modern cosmology.

5. How the postulate of invariability of the light speed can be disproved experimentally.

The postulate of invariability affirms that the speed of light depends neither on the movement of the source nor on the movement of the observer. Because in the special theory of relativity the movement of the light source is equivalent to the movement of the observer, the experiments with the movement of the source are considered as the proof of the postulate of invariability. But in reality the independence of the speed of light from the movement of the source is explained in all situations only by the influence of the medium. If to take into account the influence of the medium, the movement of the observer cannot be equivalent to the movement of the source. Therefore any experiments with the movement of the source cannot disprove the postulate of invariability. The falsity of the postulate of invariability can be proved only by the experiment with the movement of the observer.

The moving observer can discover the influence of his own movement on the speed with which the light enters his metering equipment only under the following two conditions:

- the observer has to move with all speed relative to the medium in which the light spreads,
- before the light enters the metering equipment, it has not to interact with any glasses, mirrors or other re-radiators moving together with the observer because these re-radiators can change the actual speed of the light relative to the observer.

In the Earth atmosphere the light spreads with the speed C_A which is less than C on 55 miles per second. Obviously, the observer cannot move in the atmosphere with such speed V so as the speed of light $(C_A + V)$ relative to him could exceed C. The experiment with the movement of the observer can be carried out only on the orbit of the Earth satellite where the light goes relative to the rare atmosphere at speed very close to C and the observer with metering equipment moves at speed 5-6 miles per second. In this case the experiment can prove that the speed of light relative to the observer depends on the movement of the observer and can be more than C.

5.1. Orbital experiment with the moving interferometer.

The experiment with moving interferometer is basic experiment that we propose for the proof of the main postulate of the special relativity.

The purpose of this experiment is to prove that the speed of the light relative to the observer depends on the movement of the observer and that this speed can exceed the speed C. We developed the special interferometer (Fig.5.1) which allows compare the speed with which the light goes relative to the observer with the speed C.

The interferometer is located on the space station orbiting the Earth and works with a coherent light of the laser. The interferometer works thus.

In the interferometer the coherent laser beam divides into three parts. The beam B1 passes the base length L without an interaction with any re-radiators and then the prism 1 sends it to the screen SC where the beam B1 interferes with the beam 2. The beams B2 and B3 enter first into the glass plate P and then go inside the interferometer to the translucent mirrors 2 and 3. Two interference patterns are created on the screen SC – the main pattern and the additional pattern. Main fringes are created in the center of the screen by the beams B1 and B2 with the help the prism 1 and the translucent mirror 2.

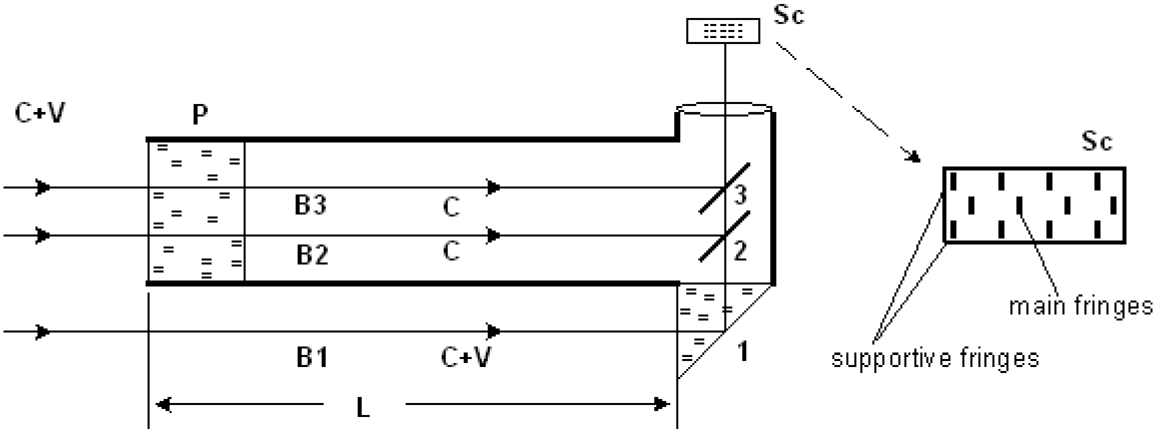


Fig.5.1

The additional supportive fringes are created by the beams B2 and B3 with the help the translucent mirrors 2 and 3. The supportive pattern allows exclude the influence of an inaccuracy in the orientation of the interferometer on the laser beam. The main pattern and the supportive pattern are separated with a darkening of the corresponding parts of the prism 1 and the glass plate P. The thickness of the plate P is equal to the distance which the beam B1 passes in the prism 1.

If the interferometer is immovable relative to the rare gaseous medium in which the laser beam spreads at speed practically equal to C, all three beams go relative to the interferometer with identical speed C. In this case the main fringes are relative to the supportive fringes in some initial position (for example, coincide with them).

If the interferometer moves at speed V towards the light beam, the beam relative to the interferometer moves at speed $(C+V)$ that is the beam B1 passes the distance L with speed $(C+V)$. But the beams B2 and B3 entering the glass plate P with speed $(C+V)$ change their speeds and go in the glass with speed $\frac{C}{n_G}$. Because the rare gaseous medium inside the interferometer is immovable relative to the interferometer, the beams B2 and B3 pass the distance L inside the interferometer with the same speed C as they do it in the immovable interferometer. Because the beam B1 passes the distance L with speed $(C+V)$ but the beams B2 and B3 go with the speed C, the main fringes shift relative to the supportive fringes as it is shown on Fig.5-1. The fringe shift is proportional to the speed V. In effect, this interferometer is the measurer of the speed of the movement relative to the rare gaseous medium. For the orbital speed V= 4.9 miles per second the main pattern has to shift on one fringe in the interferometer with L = 3 cm.

In this experiment the interferometer has to move with the orbital speed relative to the rare gaseous medium relative to which the light spreads with the speed very close to C. The laser can be placed on the second satellite moving on the same orbit ahead of the space station on the distance some hundred meters and the interferometer has to be placed outside the space station and be forehand it.

Perhaps the laser (or the mirror reflecting the laser beam in the direction of the interferometer) can be placed on a long pole in forehand of the space station as it is shown on Fig. 5.2. The interferometer has to be placed outside the space station as far from the laser as it possible. Essential condition of this experiment is the absence of some protective glasses before the interferometer. For the observation of the interference pattern can be used the TV camera transmitting the image into the space station. In this experiment the fringe shift has to change if the space station changes the orientation relative to the direction of its movement. The fringes shift in opposite direction if the orientation of the space station changes on 180^o.

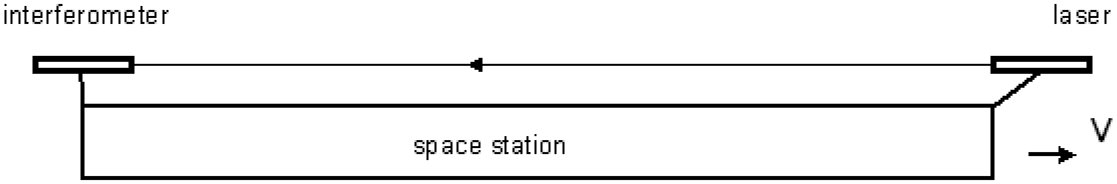


Fig.5.2

The interferometer Fig.5.1 can work with light of some bright star. In this case the interferometer located outside the space station has to be constantly directed on the star. During the orbital movement the main interference pattern will periodically shift according to the change of the speed of the star light relative to the moving interferometer.

5.20. The other possible experiments.

The experiment with the moving interferometer allows direct compare the real speed with which the light beam moves relative to the observer with the speed C that is this experiment will allow direct verify the postulate of invariability. In addition some other experiments can prove the falsity of the main statements of the special theory of relativity.

5.2.1. The experiments with change of the angle of refraction.

In his experiments with the prism and telescope D.Arago supposed that the angle of refraction depends on the speed with which the light enters the glass. This supposition is logical for the wave theory of light. If this supposition is true, the Arago’s idea can be realize in the orbital experiment shown on Fig.5.3. The observer with the telescope is on the space station orbiting the Earth (Fig.5.3,a).

The telescope is constantly directed on the some bright star located in the orbital plane of the space station. When the space station moves at speed V, the object glass of the telescope meets the light of the star with the speed which periodically changes from $(C+V)$ to $(C-V)$. If the angle of refraction depends on the speed with which the light enters the object glass, the noticeable periodical change of the focal distance in the telescope has to take place. In this case this experiment would be the simplest experiment we offer. The obligatory condition in this experiment is the absence of some protection glasses in front of the object glass of the telescope.

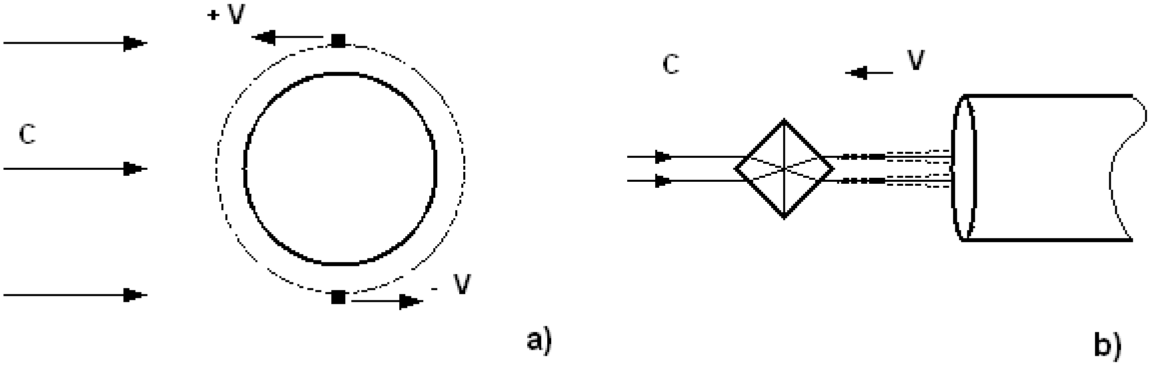


Fig.5.3

The experiment with change of the angles of refraction, which is analogous to the Arago’s experiment with the prism, can be carried on the space station. Two prisms form the cube and this cube is placed in front of the object glass of the telescope (Fig.5.3b). The light of the star enters two facets of the cube at the angle 45^o and goes to the object glass of the telescope from other facets so as to form in the telescope two images of the star. When the telescope moves on the orbit, the speed of the light changes relative to the glass cube from $(C+V)$ to $(C-V)$. As result, the angles of refraction in the glass cube will change and the distances between the images in the telescope will periodically change too. The change of the distances between the images of the star will prove that the speed of light changes relative to the telescope moving with different speed.

5.2.2. The experiment with the "light rod" moving in the air.

The purpose of this experiment is to prove the falsity of the assertion of the special relativity about the contraction of the longitudinal length of the moving objects. The possibility to test the length contraction arose more than 30 years ago when M.Duguay had photographed the short light packet moving in the water at speed 137 500 miles per second

(see: Light Photographed in Flight. Michel A. Duguay. American Scientist 59, 550 (1971), http://scinl.chem.wisc.edu/everitt/docs/duguay_paper/index.html).

M.Duguay had considered some relativistic effects but he did not pay attention on the effect of the length contraction although the length of the light packet had to contract in his experiment more than double.

The short laser impulse creates the beam which has the short length (the light packet). The length of this packet is determined by the duration of the laser impulse and depends on the index of refraction of the medium through which the beam passes. The short laser beam can be considered as a moving "light rod" which can move with great speed and which, as M.Duguay showed, can be photographed. The picture of this "light rod" will allow whether the length of moving rod differs from the actual length or not.

This experiment can be carried out not in the water where the light packet moves at speed 137500 miles per second but in the air where it moves at speed about 0.9997C. In according to the special relativity the length of the "light rod" has to decrease 40 times that can be easily tested experimentally. So as to be seeable from aside, the light packet has to move through a smoky air. If the length contraction takes place, the light packet 30 centimeter in length has to be less than 1 centimeter on the picture. In our opinion this experiment will prove that there is no length contraction that is that "consequence" of the special relativity is wrong.

5.2.3. The change of the light frequency by the moving re-radiator.

In accordance with the special relativity, the frequency of the light does not change if the observer does not move relative to the source. Above, in the chapters 4.5.3 and 4.9, we showed that the frequency decreases if the light interacts with some moving re-radiator. If the observer does not move relative to the source but on the way from the source to the observer the light interacts with the moving at speed V re-radiator, in accordance with expression (4-12) the observer receives the frequency $\nu = \nu_0 (1 - \frac{V^2}{C^2})$ instead of the frequency ν_0. The expression (4-12) obviously contradicts to the special theory of relativity but this expression can be verified in the next simple experiment (Fig.5.4).

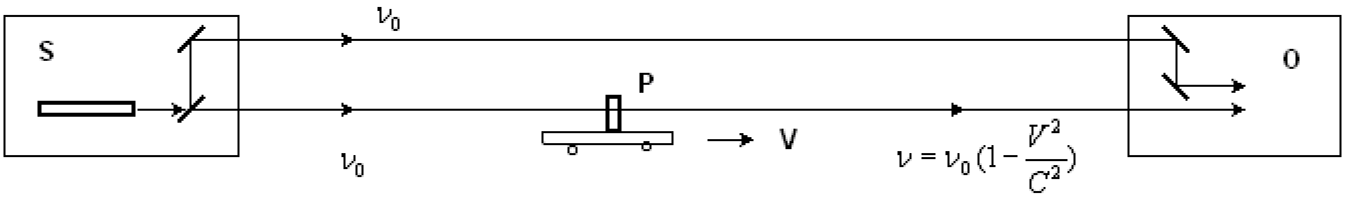


Fig.5.4

The observer O is immovable and is some miles out from the laser source S. Two monochromatic beams go from the source to the observer. One beam passes through the glass plate P which is located on the vehicle and moves at speed 100-150 miles per hour. The beam passing through the moving glass plate comes to the observer with the frequency $\nu < \nu_0$. The observer compares the frequencies of the beams and sees that, in accordance with expression (4-12), the laser beam decreases its frequency after the interaction with the moving re-radiator both in the case when the re-radiator moves toward the observer and in the case when it moves in opposite direction.

The expression (4-12) can be proved in the orbital interference experiment (Fig.5.5). The interferometer is located outside of the satellite so as the beam 1 was parallel to the satellite speed V.

The satellite moves at speed V relative to the rare atmosphere of the Earth. Therefore the rare gaseous medium moves at the same speed V relative to the interferometer. This experiment is alike to the experiments with the dragging of the light by moving medium but in this case the moving medium acts not on both interfering beams but only on the beam 1. The beam 2 comes to the screen Sc with the frequency ν_0 but the beam 1 changes its frequency because of the interaction with the moving medium and comes to the screen with the reduced frequency $\nu = \nu_0(1 - \frac{V^2}{C^2})$. The beam 1 comes to the screen with the same frequency $\nu = \nu_0(1 - \frac{V^2}{C^2})$ and in the case when the medium moves relative to the interferometer in the opposite direction. In both cases the interference fringes constantly move in the same direction and it proves that in accordance with the expression (4-12) the light decreases its frequency when it interacts with the moving medium.

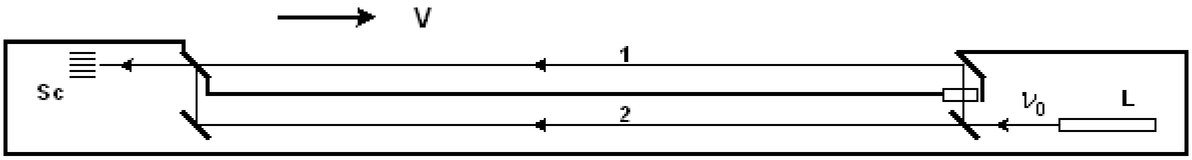


Fig.5.5

5.2.4. The transverse Doppler-effect.

If the source radiates the frequency ν_0 and moves at speed V in the direction perpendicular to the line "the source-the observer", the light comes to the observer with the frequency $\nu = \nu_0\sqrt{1 - \beta^2}$ which is less than ν_0 that is the known transverse Doppler-effect takes place. As it is shown above (the chapter 4.6), the decrease of the frequency when the source moves has the simple kinematical explanation. The special theory of relativity explains that decrease with the time dilation in a moving frame of reference. In accordance with special relativity the same decrease of the frequency has to take place and in the case when the source is immovable but the observer moves at speed V.

However, as we showed in the chapter 4.6, the frequency has to increase but not to decrease if the observer moves. That is and in this case the transverse Doppler-effect takes place but in accordance with the expression (4-11) the observer receives not the frequency $\nu = \nu_0\sqrt{1 - \beta^2}$ but the frequency $\nu = \nu_0\sqrt{1 + \beta^2}$ which is more than ν_0.

The increase of the frequency when the observer moves in the direction perpendicular to the line "the source-the observer" obviously contradicts to the special relativity but this increase of the frequency can be proved in the next experiment (Fig.5.6).

The observer O1 receives the light signal from the laser source S2 which is on the satellite and moves at speed V. The second observer O2 (or only the receiver of light) is on the satellite and receives the light signal from the second laser source S1 which is on the Earth's surface near the observer O1. Both sources radiate the identical frequency ν_0. The line pp on Fig.5.6,a goes through the observer O1 and is perpendicular to the satellite speed V.

The source S2 moves perpendicular to the line "the source-the observer" at the moment when the satellite crosses the line pp in the point O. The observer O1 compares the frequency ν_0 with the frequency of light radiated by source S2 at moment when the source S2 passes the point O and sees that this frequency $\nu_1 = \nu_0\sqrt{1 - \beta^2}$ is less than ν_0. The observer O1 sees the reduced frequency because the transverse Doppler-effect takes place. The light comes to the observer with the reduced frequency $\nu_1 = \nu_0\sqrt{1 - \beta^2}$ because in the direction to the observer the photons go with the initial speed $\overline{C_1} = \overline{C} + \overline{V}$ which is less than C (Fig.5.6,b). Only the photons radiated in the point O by the

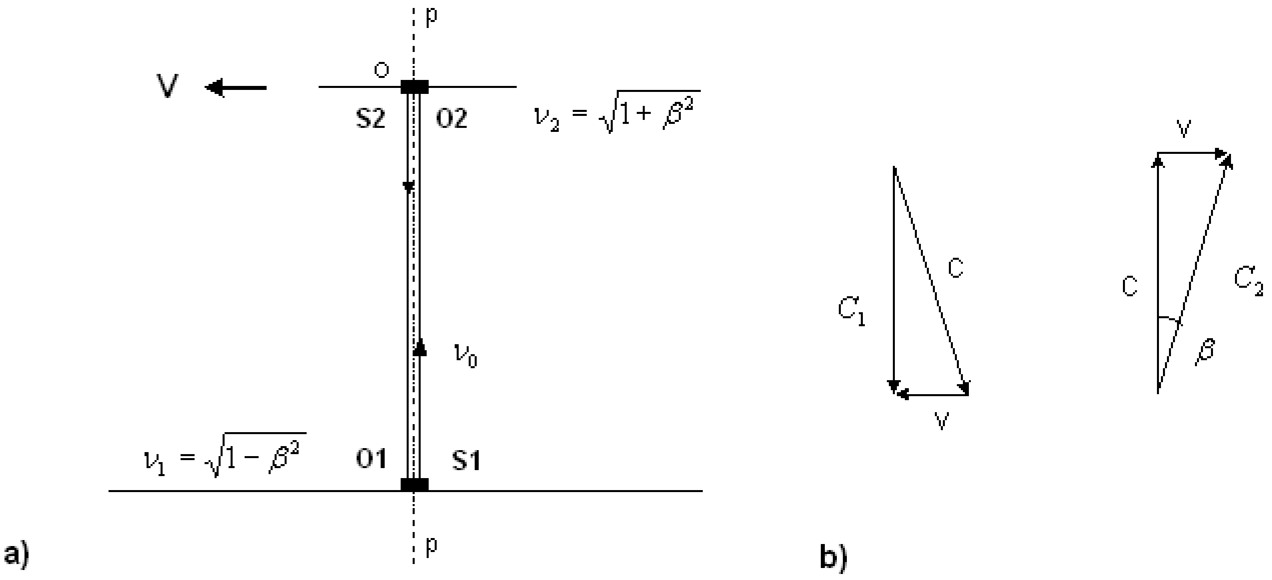


Fig.5.6

moving source S2 at some angle back come to the observer O1. After the summation the speed C with the speed V these photons go along the line pp with initial speed $\overline{C_1} = \overline{C} + \overline{V}$. Then the photons are reradiated by the atoms of the atmosphere and go with speed $\frac{C}{n_A}$ along the line pp to the observer O1. It is important to notice that the light with the frequency $\nu_1 = \nu_0\sqrt{1-\beta^2}$ comes to the observer O1 not at moment when the satellite crosses the line pp but it comes later for the time $\frac{h}{c}$ during which the light passes the distance h from the satellite to the observer.

When the satellite crosses the line pp and is in the point O the observer O2 moves perpendicular to the light beam of the source S1. When the observer moves relative to the light beam the transverse Doppler-effect takes place too. But in this case the observer receives not the frequency $\nu_1 = \nu_0\sqrt{1-\beta^2}$ but the frequency $\nu_2 = \nu_0\sqrt{1+\beta^2}$ which is more than ν_0.

The frequency increases because the speed C is added with the speed V (Fig.5.6,b) and therefore the observer O2 meets the light with the speed C_2 which is more than C. From the point O the moving observer O2 sees the source S1 at the aberration angle β.

The purpose of this experiment is to compare the frequency of light which the moving observer O2 receives with the frequency ν_0 exactly at the moment when the satellite passes the source S1 that is at the moment when it crosses the line pp and is in the point O within the accuracy of some metres. In our opinion now such accuracy is attainable. The fact that near the point O the observer O2 on the satellite will receive the frequency $\nu_2 = \nu_0\sqrt{1+\beta^2}$ more than ν_0 will prove that the transverse Doppler-effect contradicts to the special theory of relativity.

CONCLUSION

The situation in the modern physics is alike to the situation in the ancient astronomy when they thought that the Earth is in the centre of the Universe and all primary planets and all stars revolve round the Earth. The Ptolemey's geocentric theory could describe the movements of the celestial bodies but explained the reason of such complicated movements wrong.

The special theory of relativity describes most of the optical phenomena but explains them wrong in principle.

The underlying postulate of the special theory of relativity states that the speed of light depends neither on the movement of the source nor on the movement of the observer measuring this speed. This postulate necessarily leads to the strange inferences about the time dilation, the increase of the mass and the length contraction in the moving frames of reference. In accordance with this postulate all known phenomena and experiments (Fizeau, Arago, Michelson and so on) are explained wrong and the new experiments are not carry out if they contradict to this postulate.

However the postulate of the invariability of the light speed is not proved experimentally. The independence of the speed of light from the movement of the source is proved convincingly. But no one experiment on the proof of the dependence of the light speed from the movement of the observer, except the wrong Arago's experiment, was carried out. Besides, well known phenomenon of the star aberration cannot be explained by the special theory of relativity and obviously contradicts this theory.

The theory of relativity had a great influence on the physics of 20th century and determined the directions of the development of modern cosmology. The wrong explanation by this theory of the cosmological red shift made to receive the hypothesis of the Big Bang. Many problems of modern cosmology (quasars, black holes and so on) are caused by the wrong evaluation of the cosmological distances according to the cosmological red shift.

Almost 100 years ago the postulate of invariability of the light speed was accepted. The special theory of relativity is based on the postulate which asserts that the speed of light does not depend on the movement of the observer. The new experiments proposed in this article will prove that the speed of light depends on the movement of the observer and that the light goes relative to the observer with more speed if the observer moves toward the light beam.

The necessity of the realization of these experiments is evident because both positive result and negative result of these experiments are very important. The negative result could become the first real proof of the independence of the speed of light from a movement of the observer. The positive result of these experiments will prove that the special theory of relativity is wrong in principle.