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Hypotheses

A NEW EXPERIMENT TO DETERMINE THE GALAXY SPEED OF EARTH IN SPACE

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Abstract

In this article is discussed the question of the speed at which the Earth moves in space. Until now, this speed has not been determined with sufficient accuracy. Many astronomers believe that Earth with the Sun moves, relative to the observed galaxies, near a rate of 600 km/s, but the opinions of scientists fluctuate widely, between 130 km/s and 1000 km/s. This is because until now conducted experiments primarily with satellites Prognoz-9 (USSR) and COBE (USA), besides being expensive are also inaccurate. Discussed is also the possibility to conduct an experiment, on Earth's surface, through which the speed as well as and direction of Earth's movement in space could be more accurately determined. It is noted that this experiment will be thousands times cheaper than experiments with artificial satellites.

Introduction

Along with the annual movement the Earth is involved in the galactic motion of the Solar system. It is therefore pertinent to ask the question: What are the speed and the direction of Earth's movement in space? To give a straightforward answer is difficult. Existing data are contradictory. In 1933 Dayton Miller [1] stated that, their research with Michelson-Morley interferometer yielded the result that the Earth is moving towards constellation Dorado with a speed of 208 km/s. In 1983 the Soviet Union launched satellite "Prognoz-9" to study the so-called "relict radiation". As a result of the observations made, and based on the basic model of the Solar system movement into space, it was reported that it moves at a speed of around 515 km/s in the direction of the constellation Virgo. With the same purpose in 1989 the US launched its satellite COBE. Within the accuracy of monitoring tools it is assumed that the speed of the Earth and the Solar System is about 600 km/s. Although many astronomers now accept that the Earth and the Sun move relatively to the observed galaxies in the vicinity of approximately 600 km/s; the values of this speed vary enormously between 130 km/s and 1000 km/s.

The Fresnel-Einstein Dilemma

In 1818 Fresnel [2] derived the following formula for speed of light propagating in an optical (transparent) medium

(1) $$u = u_0 \pm V\left(1 - \frac{1}{n^2}\right),$$

where $u_0 = c/n$ is the speed of light in an optical medium (presumed to be at rest), c is the speed of light in vacuum, V is the speed of the Earth in space, and n is the refractive index.

The point of view of Fresnel is that formula (1) reflects a real change in the speed of propagation of light in a given optical medium. Contrarily, the point of view of relativists is that formula (1) is wrong because there is no change in the speed of light, based on Einstein postulate that the speed of light is independent of the state of motion, i.e. the speed of light in an optical medium at constant rectilinear motion must equal the speed of light at rest.

The question of the physical meaning of Fresnel formula

To substantiate formula (1) Fresnel assumes that the change in the speed of light is due to change in the ether density. However, this hypothesis is unacceptable and this wrong hypothesis is the reason that the Fresnel formula was rejected and misunderstood by the scientists. But the meaning of formula (1) is quite simple to understand; if for example, one holds a piece of glass or a magnifying glass in his/her hand and move it around, than the speed of light inside the glass medium will change because we are dragging the light by the hand movement. The same argument goes for the Earth and all celestial bodies. As Earth moves across the space, the speed of light propagating in any optical medium residing on Earth (air, water, etc.) should change because of that movement.

There is a way to justify the Fresnel formula if we consider two very important starting points [6]: 1) the principle of Huygens-Fresnel in Optics, and 2) the fact that only atoms and molecules of chemical elements emit light waves.

The principle of Huygens-Fresnel states that when a luminous disturbance reaches a point, each point becomes a source of secondary waves. However, a “point” is nothing more than an abstraction. It is therefore reasonable to ask ourselves: What is the real physical object able to replace the point so that the object can radiate real light waves? The answer to this question is easy. Where Huygens and Fresnel put points we should consider atoms or molecules of the relevant optical medium.

In an earlier article [6] we compared the way of propagation of light to the propagation of radio and television broadcasts by a chain of relay stations. This is one way to reduce energy losses in retransmission. Apparently, nature chose the same more effective way to propagate light waves. Thus, according to the principle of Huygens-Fresnel, the energy of the excited atoms is transmitted first to the closest atoms-repeaters, which in turn transmit it to the next ones, etc. i.e. from one repeater to another until it reaches the recipient atoms. Every atom emitting a light wave with certain frequency must find atoms repeaters tuned to that frequency, so that a large number of spectral lines can be transported simultaneously. Thus, each atom repeater becomes a source of secondary spherical waves, as follows from the principle of Huygens-Fresnel.

The efficient transfer of energy is only one side of the problem. It is not gratuitous as there is some sacrifice in terms of the speed. It is because energy transfer between atoms repeaters is not instantaneous but takes some time. Time losses are of two different kinds: 1) the time taken by the atom repeater to accept and send optical signals; 2) the time it takes for the light signal to reach the next atom repeater. Therefore, the average speed of light depends on the distance between the atoms repeaters and their number in the optical medium. When the mass density of the medium is less, there will be greater average distance between the atoms repeaters and greater speed of propagation of light and vice versa, an optical medium with greater mass density will have less average distance between the atoms repeaters and therefore smaller speed of propagation of light. This is in line with the fact that the greater the number of atoms repeaters, the more time is lost to retransmit signals. The different refractive indices of different optical media can be explained in this way.

Now regarding to the most important question: "How to explain the relation between the movement of the optical medium through the ether and the average distance between atoms repeaters?". When waves travel in a continuous medium, such as air, water, ether, etc., we introduced a particular feature we call [6] delayed/overtaking position, respectively lagging/outpacing potential. It reflects the fact that when the oscillator and the receiver are moving the path of the waves travelling to the moving receiver changes. The conclusion is apparent: If we consider light propagation in a moving optical medium (with reference to the static ether) then the distance the waves travel, between atoms-retranslators, will change. Therefore, the number of intermediate repeaters will change. In addition, that means that the time for signal retransmission will change and in result, so will the speed of propagation of light. In this way, we reach to an explanation of the physical meaning of Fresnel formula.

Proposed experiment

In essence, the proposed experiment is similar to the classical experiments to determine the speed of light. However, while the objective of classic experiments was to determine it quantitatively, here the objective is different, to determine whether this speed undergoes changes, i.e. whether it depends on the movement of the Earth in space. In [4] a test setting, similar to that used in Fizeau experiment in 1849, was described. Here we offer experimental setup similar to the one used by Karolus-Mittstaedt in 1928 [7].

The schematic diagram of the experimental setup is shown in Fig. 1. Light from a laser 1 passes through the optical shutter (modulator) 3 located between two crossed polarizers 2 and 4 and then passes through the elongated optical fiber coil 6 (entry point 5 and exit point 7), then it falls and is reflected by a moving mirror 8. The reflected light returns after passing through a second elongated coil of optical fiber 10 (entry point 9 and exit point 11) and reaches a second optical shutter (modulator) 12, thereafter via polarizer 13 falls on a photo element 14. The resulting output electric signal is amplified by the amplifier 15 and is fed to an oscilloscope or recorder 16.

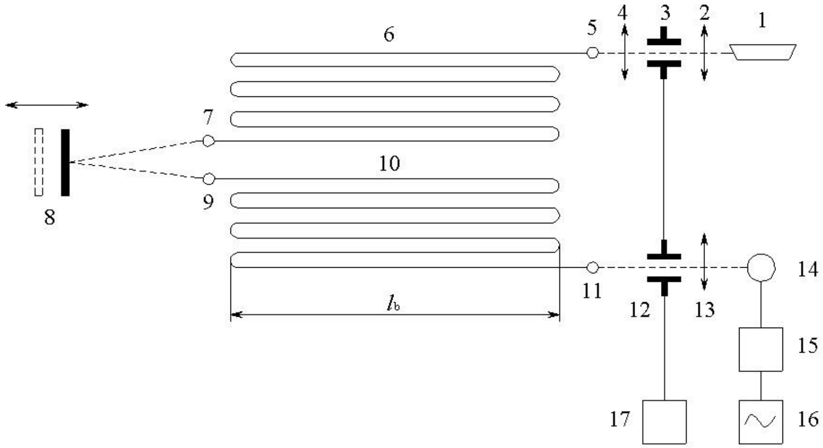

Fig. 1. Scheme of the experimental set-up: 1 - lasers; 2, 4 and 13 - crossed polarizers; 3 and 12 - optical shutter (modulator) of crystal KDP; 6 and 10 - oblong coils (antennas) of the optical fiber; 5 and 7 - inputs and 9 and 11- outputs of the light into the optical fiber; 8 - mobile mirror; 14 - photocell; 15 - amplifyer; 16 - oscilloscope or recorder; 17 - generator. l_b *- length of the double coil of optical fiber*

The experiment runs as follows. The entry optical shutter 3 modulates the light signal and produces a wave sequence (Zug) of duration (opening time)

(2) $$t_\otimes = \frac{1}{2f},$$

where f is the operating frequency of the generator 17.

Since the two optical shutters 3 and 12 operate synchronously, the amount of light reaching the photo element 14 is determined by the ratio

(3) $$\frac{t_P}{t_\otimes},$$

where t_P is the travel time for which the light beam travels the path between optical shutters 3 and 12.

If the ratio (3) between the travel time t_P and the opening time $t_\otimes$ of (2) is an integer number,

(4) $$\frac{t_P}{t_\otimes} = m,$$

where m is an integer, then maximum light will reach the photoelement 14 and maximum electric signal will be registered. In this case, the light signal transmitted by the entry optical shutter 3 will arrive to the exit optical shutter 12 precisely when it is open, so a maximum light will pass. Vice versa, if the ratio (3) is of the kind

(5) $$\frac{t_P}{t_\otimes} = m + \frac{1}{2},$$

then the output electric signal from the photoelement 14 will have a minimum value. In this case, the light signal transmitted by the entry optical shutter 3 will arrive to the exit optical shutter 12 when it is closed and therefore a minimum amount of light will pass.

The time needed for the optical signal to travel between the two optical shutters 3 and 12 is determined as (Appendix A equation (A17))

(6) $$t_P = \frac{2l}{c} n + \frac{2l}{c} n^3 \left(\alpha^2 - 2\alpha\right) \frac{V^2}{c^2},$$

where *2l* is the light path through the elongated optical fiber coils (antennas) 6 and 10, and

(7) $$\alpha = 1 - \frac{1}{n^2}$$

is the so called Fresnel coefficient of ether drag.

Obviously, the travel time (6) depends on the velocity V of the elongated optical fiber coils (antennas) movement through space. When this velocity changes, the speed of propagation of light inside them will change as well. This will affect also the travel time t_P. Therefore, the output electric signal from the photo element 14 will change and the oscilloscope or recorder 16 can register this.

The two points of view

There are two viewpoints as to whether in the above experiment the speed of light will change or not, and whether the output signal from the photo element 14 will change.

a) The point of view of the relativists - According to the principle of relativity of Einstein the speed of light in an optical medium must be constant and does not depend on whether the optical medium is in motion or not. Therefore, the travel time t_{P}, needed for the light to travel the path between the two optical shutters 3 and 12, will be constant ($t_{\mathrm{P}} = const$). In this case the relationship (3) should not change with the time, i.e. under the special theory of relativity we will have

$$\frac{t_{\mathrm{P}}}{t_{\otimes}} = const . \tag{8}$$

Therefore, the output signal from the photo element 14 should not change.

It must be underlined that in the special theory of relativity no object in space can have an absolute speed as there is no absolute inertial system providing a frame of reference to determine the movement of celestial bodies absolutely, i.e. every movement must be determined with reference (in relation) to another object.

b) The point of view of Fresnel - In Fresnel's formula the speed of light in a given optical medium depends on the speed V of movement of this optical medium with reference to the ether. Therefore, the travel time t_{P}, for the light to travel the path between the two optical shutters 3 and 12, will depend on that speed because equation (6) is a function of it.

Obviously in this case the relationship (3) between the travel time t_{P} and the opening time of the optical shutter $t_{\otimes}$ will be

$$\frac{t_{\mathrm{P}}}{t_{\otimes}} = \frac{2l}{t_{\otimes}c} n + \frac{2l}{t_{\otimes}c} n^3 \left(\alpha^2 - 2\alpha\right) \frac{V^2}{c^2} . \tag{9}$$

It is obvious that (9) is a function of the speed V and if this speed changes then the amount of light that passes through the two optical shutters should change. Therefore, the observed output signal from the photoelement 14 should also change.

Calculating the necessary optical path

We need to calculate the necessary length of the optical path in order to fulfill the condition to observe maximum and minimum output signals. To this end, it is necessary that the ratio (9) has values of 1/2, i.e.

(10) $$\frac{\Delta t_{\mathrm{p}}}{t_{\otimes}} = \frac{2l\,n^3}{t_{\otimes} c^3}\left(\alpha^2 - 2\alpha\right)V^2 = \frac{1}{2},$$

where V is the speed of movement of the optical fiber coils 6 and 10. We will take into account only the variable portion, i.e. the second term of equation (9)

If we resolve equation (10) with regard to the optical path l we get

(11) $$l = \frac{c^3}{4n^3(\alpha^2 - 2\alpha)}\frac{t_{\otimes}}{V^2}\ .$$

Now provided that the constants in (11) are as follows:

$c = 3\mathrm{x}10^8\left[\frac{\mathrm{m}}{s}\right]$ is the speed of light;

$n = 1,46$ is refractive index of the optical fiber;

$\alpha = 1 - \frac{1}{n^2} = 0,53$

and we substitute in (11) then the result for the optical path will be the following formula

(12) $$l \approx 2,78\mathrm{x}10^{24}\frac{t_{\otimes}}{V^2}\,[\mathrm{m}].$$

Now, if instead of the opening time $t_{\otimes}$ we substitute its equal from (2), we will get

(13) $$l \approx 1,39\mathrm{x}10^{24}\frac{1}{f\,V^2}\,[\mathrm{m}].$$

Application of experimental setup (Fig. 1) to determine the speed of Earth in space

It must be said that our original idea was to use this experimental setup for verification of the principle of relativity of Einstein [4, 5]. It was planned to place the optical fiber coils 6 and 10 parallel to the Earth parallel, and to relate the change of speed V to the daily and annual movements of the Earth. However, there is a problem connected with the excessive length of the optical path. For example, if we use an optical shutter with an operating frequency f = 0,6 GHz as used in [8] and assumed speed of the setup and the daily motion on the Earth with speed in range between 0 and 200 km/s, then the length of the optical path gets about $l \approx 60\ \mathrm{km}$, i.e. the total optical path that optical signals must travel in both coils must be $2l \approx 120\ \mathrm{km}$.

One possibility to put this result into practice (with significantly reduced optical path length) is to create a cosmic compass [9]. Figure 2 shows a schematic diagram of a hand-operated cosmic compass. It consists of a mast antenna with counterweight 1, rotating platform 2, and base 3. Coils 6 and 10 are wound on the mast antenna 1. In this way it will be possible to establish the direction of Earth motion by detecting the maximum signal on the recording device.

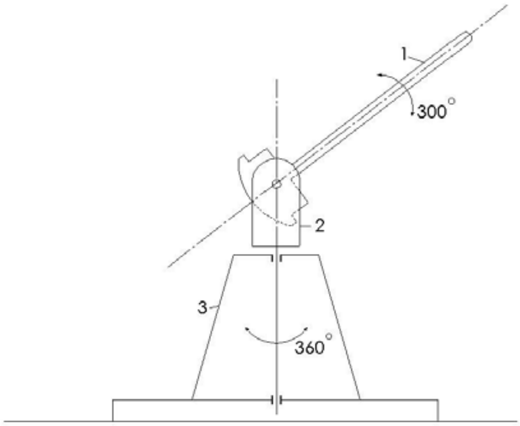

Fig. 2. Scheme of terrestrial cosmic compass

The advantage of this setup is that the full galactic speed of the Earth may be derived from formula (13) instead of its projection with reference to the location of the experimental setup. For example, if we assume that this speed is within the range 400 ÷ 600 km/s, then for the necessary optical path length we receive:

- in optical shutter f = 0,6 GHz and V = 400 km/s

$l \approx 14480$ m and $2l \approx 28960$ m

- in optical shutter f = 0,6 GHz and V = 600 km/s

$l \approx 6435$ m and $2l \approx 12870$ m.

Different options are possible, keeping in mind the varying data for Earth galactic speed.

Experimental method

It is important in the beginning to establish whether the rotation of the antenna affects the output signal or not. If it turns out that the signal does not change, this will mean that the special theory of relativity is correct. In this case, the experiment shall be terminated. Conversely, if the output signal is changed, this will mean that Fresnel is right and the experiment shall continue.

The following important notes have to be made:

1. The cosmic compass should be positioned so that the mast antenna rotates in the plane of earthly meridian.

2. The moving mirror 8 is used for calibration. By moving the mirror we may find respective positions corresponding to maximum or minimum output signal. The distance between two positions with observed maxima of the output signal is:

(14) $$\Delta l = \frac{c}{4f} .$$

For the chosen operating frequency $f = 0,6$ GHz of the optical shutters this distance is $\Delta l = 12,5$ cm. In this case, the movable mirror should be able to be shifted to at least 15 ÷25 cm.

At the beginning of the experiment, by rotating the antenna, two positions with observable maximum and minimum in the output signal, must be found. One of these positions corresponds to a case where the mast-antenna is directed along the direction of motion of the Earth, and in the other position, the mast antenna is perpendicular to that direction. This is the "zero" position of the antenna.

Having established the zero position of the antenna, using the movable mirror two positions with maximum signal should be found and then the mirror should be positioned in the middle. The difference between the maximum and minimum output signal should also be determined. This is actually the calibration of the setup.

Now we can begin the main experiment. In the course of 24 hours periodically, for example once every 15-20 minutes, we must seek the two positions of the antenna showing a maximum and minimum signal and calculate the difference between the maximum and minimum signal $(\Delta \mathrm{I})$. We must seek positions of the antenna where this difference is greatest. It is in this case that there will be complete coincidence of the direction of the antenna with the direction of the Earth. We should take a record of the antenna coordinates in this position and then we will be able to determine the speed of the Earth.

(15) $$V = V_{cb} \frac{\Delta \mathrm{I}}{\Delta \mathrm{I}_{cb}} .$$

It should be noted that in each measurement we determine the summary movement of the Earth, i.e., its orbital speed plus the galactic speed. To determine more precisely the direction of the galactic motion it will be necessary to take measurements for a full year. In this case, the tip of the vector sum of the Earth velocities will delineate an oval curve on the celestial sphere. The center of this oval curve will determine the direction of the galactic speed.

The proposed experiment and contemporary optical technologies

The optical path length depends largely on the operating frequency *f* of the optical shutters (modulators). Research established that there are commercially available electro-optical shutters (modulators) based on $LiNbO_3$ crystal with an operating frequency ≥ 40 GHz [10, 11]. Very suitable for the purpose are the modulators of the company Optilab [11], which have built-in polarizers. When using electro-optical modulators of this type the experimental setup may be significantly simplified (Fig. 3).

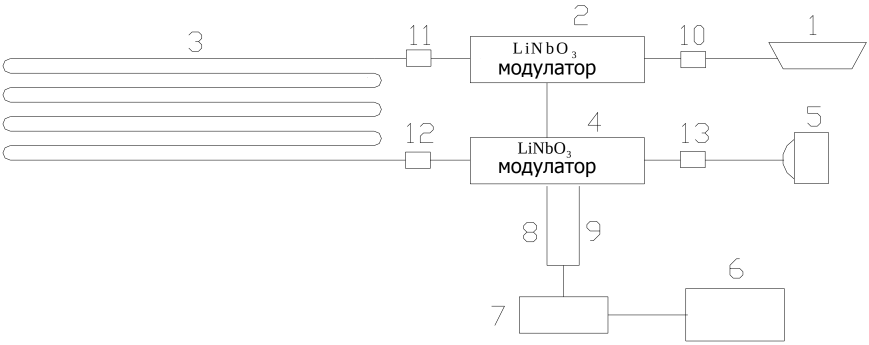

Fig. 3. Experimental set-up with integrated polarizers
1 - lasers; 2 and 4 - incoming and outgoing optical shutter (modulator) of crystal $LiNbO_3$; 3 - oblong coils (antenna) of optical fiber; 5 optical power meter; 6 - signal generator; 7 - driver amplifier; 8 and 9 - RF cables; 10, 11, 12, and 13 - optical connectors.

This experimental installation is no different from the described above in its operating principle. The light from the laser 1 passes through entry 2 and exit 4 electro-optical shutters (modulators) and via elongated coil of optical fiber 3 reaches the optical power meter 5. Since the two electro-optical shutters operate synchronously, the amount of light that will pass through them will depend on the relationship (3) between the travel time t_P and the opening time $t_\otimes$ of the optical shutters, i.e. everything said above here remains in force.

However, there is no movable mirror here. In this case, the calibration may be accomplished by amending the frequency of the signal generator.

Regarding the operating frequency of electro-optical modulators we want to note that would be reasonable to choose operating frequency of $f = 9\ \text{GHz}$. We must keep in mind that a signal generator operating at the same frequency will be needed. Here we also take into account that the elongated coil of optical fiber is single and light travels in both directions ($L = 2l$). In this case, the optical path length will be:

(16) $$L \approx 2,78\text{x}10^{24} \frac{1}{f V^2} \, [\text{m}]$$

- with optical shutter $f = 9$ GHz and $V = 600$ km/s

$$L \approx 858\,\mathrm{m}$$

- with optical shutter $f = 9$ GHz and $V = 400$ km/s

$$L \approx 1930\,\mathrm{m}.$$

Finally, let consider the length of the elongated coil of optical fiber and the respective length of the mast antenna. It depends on the location of the cosmic compass. A length of 5 to 10 m would be sufficient. If needed, the length of the mast antenna may be reduced up to 2-3 m; however, it should be kept in mind that in this case the error in determining the direction of motion of the Earth will increase.

Conclusions

If during rotation of the mast antenna in the plane of the meridian the output signal does not change, it will mean that the truth is on the side of Einstein. This means that the principle of relativity is correct. Conversely, if during a rotation of the antenna in the plane of the meridian the output signal changes, this means that the truth is on the side of Fresnel. In this case, it will be possible to determine the direction and speed at of Earth motion in space.

We are convinced that the truth is on the side of Fresnel!

Appendix A. Calculation of the time which is needed light to travel the optical path between the electro-optical modulators 3 and 12 (Fig. 1)

The classical formula for calculating the time in which light travels a given distance is:

$$time = \frac{\text{distance}}{speed}.$$

However, this classical formula is not applicable here. Here variables are as the distance also and speed. It is a fact that when the light travels a given distance twice once in the direction coincident with the direction in which to move the optical medium and vice versa are appear two important features, namely:

- The first feature is related to the Fresnel's formula (1). When the direction coincides with the direction of movement of the optical medium, the speed of propagation of light must be $u_0 + V\alpha$, and when these directions are opposite, the speed of propagation of light must be $u_0 - V\alpha$ where,

(A1) $$\alpha = 1 - \frac{1}{n^2}$$

is so-called Fresnel's coefficient for partial dragging of the ether, and n is the refractive index.

- A second feature relates to the fact that as a result of so-called delayed / preemptively position, the distance which the light must travel in both directions are different from the actual physical length l of the optical medium, i.e. this distance changed [4]

To make it more clear the above we first define the time, which is needed by light to travel the distance between electro-optical modulators 3 and 12 taking into account the physical length of the optical medium.

1. Determining the time to travel t_{P} when the distance l is physical length of the optical path.

In this case the time for which the light travels twice the path l must be

(A2) $$t_{\mathrm{P}} = \frac{l}{u_0 + V\alpha} + \frac{l}{u_0 - V\alpha}$$

and after bringing (A2) in common denominator

(A3) $$t_{\mathrm{P}} = 2l\frac{u_0}{u_0^2 + (V\alpha)^2} = \frac{2l}{u_0}\frac{1}{1-(V\alpha)^2/u_0^2}$$

and account of the fact that the relationship V^2/u_0^2 is small quantity can be accepted

(A4) $$\frac{1}{1-(V\alpha)^2/u_0^2} \approx 1 + \frac{V^2}{u_0^2}\alpha^2$$

and will obtain

(A5) $$t_{\mathrm{P}} \approx \frac{2l}{u_0}\left(1 + \frac{V^2}{u_0^2}\alpha^2\right).$$

After taking $u_0 = c/n$ into account and replace in (A5) after appropriate conversions we will have

(A6) $$t_{\mathrm{P}} = \frac{2l}{c}n + \frac{l}{c}\frac{V^2}{c^2}2n^3\alpha^2 .$$

However, it should be noted that the time (A6) is only a rough approximation. For a more precise definition of that, time should be taken into account and "increase" or "shortening" of this time as a result of so-called delayed / preemptively position [4].

2. Determining the time to travel t_{P} in the case when taking into account “increasing” or „reducing” of the optical path.

In this case the time for which the light travels twice the path between the two optical modulators will be

(A7) $$t_{\mathrm{P}} = \frac{l+\Delta l_{+}}{u_0 + V\alpha} + \frac{l-\Delta l_{-}}{u_0 - V\alpha},$$

where additives in both the numerator addends in (A7) are "extension" or "reduction" of the optical path.

To determine additives Δl_{+} and Δl_{-} is starting from the following considerations. Time t for which the light beam travels the distance l, movable mirror will move on distance Δl_{+} or Δl_{-}. Therefore, there will be in force proportions:

- for the case where the direction of light coincides with the direction of the Earth

(A9) $$t = \frac{l}{u_0 + V\alpha} = \frac{\Delta l_{+}}{V}$$

- for the case where the direction of light opposes with the direction of the Earth

(A10) $$t = \frac{l}{u_0 - V\alpha} = \frac{\Delta l_{-}}{V}$$

i.e. we will have

$$\Delta l_{+} = l\frac{V}{u_0 + V\alpha}$$

$$\Delta l_{-} = l\frac{V}{u_0 - V\alpha}$$

and substituting in (A7) will be obtained,

(A11) $$t_{\mathrm{P}} = \frac{l+\Delta l_{+}}{u_0 + V\alpha} + \frac{l-\Delta l_{-}}{u_0 - V\alpha} = \frac{l + lV/(u_0+V\alpha)}{u_0 + V\alpha} + \frac{l - lV/(u_0-V\alpha)}{u_0 - V\alpha} =$$

$$= l\left(\frac{1}{u_0+V\alpha} + \frac{1}{u_0-V\alpha}\right) + lV\left[\frac{1}{(u_0+V\alpha)^2} - \frac{1}{(u_0-V\alpha)^2}\right].$$

Now (A11) is brought to a common denominator

(A12) $$t_{\mathrm{P}} = l\frac{2u_0}{u_0^2 - V^2\alpha^2} - l\frac{4u_0V^2\alpha}{(u_0+V\alpha)^2(u_0-V\alpha)^2}\ .$$

But as here the product $(u_0+V\alpha)^2(u_0-V\alpha)^2 = \left(u_0^2 - V^2\alpha^2\right)^2$ the equation (A12) will acquire type

(A13) $$t_P = l\frac{2u_0}{u_0^2 - V^2\alpha^2} - l\frac{4u_0V^2\alpha}{\left(u_0^2 - V^2\alpha^2\right)^2}.$$

Let the common multiplier in (A13) be subtracted before the brackets

(A14) $$t_P = \frac{2lu_0}{u_0^2 - V^2\alpha^2}\left(1 - \frac{2V^2\alpha}{u_0^2 - V^2\alpha^2}\right)$$

Equation (A14) can also be simplified if it is removed before the brackets and u_0^2

(A15) $$t_P = \frac{2l}{u_0}\frac{1}{1 - V^2\alpha^2/u_0^2}\left[1 - 2\alpha\frac{V^2}{u_0^2}\frac{1}{1 - V^2\alpha^2/u_0^2}\right]$$

and taking into account the (A4) we will have

(A16) $$t_P \approx \frac{2l}{u_0}\left(1 + \frac{V^2\alpha^2}{u_0^2}\right)\left(1 - \frac{2V^2\alpha}{u_0^2}\right).$$

Now once you do multiplication and ignore values of the fourth order for the time t_P to get

(A17) $$t_P \approx \frac{2l}{u_0}\left[1 + \frac{V^2}{u_0^2}\left(\alpha^2 - 2\alpha\right)\right].$$

Here in (A17) after substituting $u_0 = c/n$ will give final

(A18) $$t_P = \frac{2l}{c}n + \frac{2l}{c}n^3\left(\alpha^2 - 2\alpha\right)\frac{V^2}{c^2}.$$

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ЕДИН НОВ ЕКСПЕРИМЕНТ ЗА ОПРЕДЕЛЯНЕ ГАЛАКТИЧНАТА СКОРОСТ НА ЗЕМЯТА

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Резюме

Поставя се въпроса за на скоростта, с която Земята се движи в космоса. До сега тази скорост не е определена с достатъчна точност. Много астрономи считат, че Земята заедно със Слънцето се движи спрямо наблюдаваните в близост галактики със скорост 600 km/s, но мненията на учените се колебае в широки граници, между 130 km/s и 1000 km/s. Това се дължи на фактът, че провежданите до сега експерименти преди всичко на изкуствени спътници на Земята *Прогноз 9* (СССР) и *COBE* (САЩ), освен че са скъпи са и неточни. Разглежда се възможността да се проведе експеримент, тук на повърхността на Земята, без да се излиза в космоса, чрез който по-точно да се определи, както скоростта също така и посоката и на движение. Отбелязва се, че този експеримент ще бъде хиляди пъти по-евтин от експериментите с изкуствени спътници.