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Experiment show: Special theory of relativity is invalid

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It is reported that experimental set-ups have been created and experiments have been conducted, the purpose of which is to resolve the age-old dispute whether there is or is not an "Aether wind", i.e. whether the velocity of light propagation in optical media depends on the movement of the Earth in space. Based on the experimental results obtained, it should be assumed that the Special Theory of Relativity (SRT) is invalid. It is noted that the experimental setups are easy to implement and anyone who is interested can do such experiments on their own, even at home, and find out what the truth is.
It is assumed that the Earth, together with the Sun, moves in space at a velocity greater than 3000 km/sec.
Keywords: Aether, Aether wind, Interferometer, Mach-Zender interferometer, Special Relativity.

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I. Introduction

In 1818, in explaining stellar aberration from the perspective of the wave theory of light, Fresnel [1] derived the following formula

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

where the expression in parentheses is the so-called Fresnel drag coefficient, namely

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

It is obvious that according to (1), the velocity u of light propagation in a given optical medium, with refractive index *n*, must depend on the velocity*V* with which the Earth moves in space, i.e. formula (1) predicts that there must be an "Aether wind". Here *c* is the velocity of light in vacuum. In a broader sense, "Aether wind" should be understood as the influence that the Earth's motion has on optical phenomena.

The beginning of experiments to search for an Aether wind was set by Michelson in 1881 [2], subsequently set by himself and other researchers for more than 100 years (Morley and Miller, Kennedy and Thorndike 1926, Essen 1955, Townes and associates 1964, etc.) [3]. All these experiments were interpreted as unsuccessful. Great efforts to discover an Aether wind were made by Miller. He conducted experiments for more than 20 years and claimed that there is an Aether wind, and the Earth moves with an absolute velocity of 208 kilometers per second [4]. To resolve this dispute, an international conference was organized in 1927, which was attended by the most famous scientists of that time [5]. The majority decided in favor of the SRT, i.e. that there is no ether wind. But there are also dissatisfied ones, the dispute continues to this day, for example, in the book by Jean de Climont [6] 9,700 discontented people are announced who are against the SRT.

The aim of the experiments is to resolve this age-old debate. Our first successful experiment, through which an Aether wind was discovered, was carried out in mid-June 2020, and a report on the results was published in [7,8]

II. Fresnel vs. Einstein. The Essence of the "Aether wind" Controversy

Fresnel's formula (1) was experimentally confirmed by Michelson himself [9], as well as by Fizeau [10], Hooke [11], etc. However, Einstein and his followers ignored this formula and claimed that it was a consequence of the Lorentz transformation, while the velocity of light propagation was constant and did not depend on the motion of the Earth.

In fact, if we start from the Lorentz transformations, we arrive at the following formula [12];

$$u = \frac{c}{n} \pm V\left(1 - \frac{1}{n^2}\right) - \frac{V^2}{cn} \quad (3)$$

As can be seen, formulas (1) and (3) are almost identical. The difference lies in the additional additive in (3), which in some cases can be ignored. But there is a significant difference in their interpretation:

- Fresnel's formula (1) predicts that there must be a real change in the velocity of propagation of light when the given optical medium moves in space, i.e., that there must be an Aether wind.

- Einstein and his followers claim that formula (3) has no real physical meaning, i.e. there should be no Aether wind and there should be no real change in the velocity of light propagation.

III. Did Michelson make a mistake in sizing his interferometer?

Perhaps the greatest blame for the emergence of the SRT lies with Michelson. In our opinion, when sizing his interferometer, he made a catastrophic mistake [13]. As is known, the velocity of light propagation in a given optical medium depends on the refractive index *n*. Therefore, when sizing experimental installations for searching for Aether wind, the refractive index must also be present. The individual optical media must be distinguished, i.e. whether the light is propagating in air, water or another optical medium. Michelson's mistake is that this coefficient is missing in his formula for sizing an interferometer.

What Fresnel tells us with equation (1). The Aether wind is directly related to a given optical medium and its refractive index, which is why back in 2015, we called for the Fresnel formula to be used when sizing an interferometer for searching for Aether wind [14,15]. However, our voice was not heard.

IV. How big is Michelson's error?

Here are the formulas for sizing theMichelson interferometer [16]

$$\Delta t^{\bullet}_{\mathrm{M}} = \left(l_1 + l_2\right)\frac{V^2}{c^3},\ \ l_1 + l_2 = \frac{\Delta t^{\bullet} c^3}{V^2} \quad (4)$$

And these are our formulas for sizing a second-order interferometer derived based on Fresnel's formula

[14,15] $\Delta t^{\bullet}_{\mathrm{F}} = 2l\,n^3(2\alpha - \alpha^2)\frac{V^2}{c^3}$,

$$l = \frac{1}{2n^3\,(2\alpha - \alpha^2)}\frac{\Delta t^{\bullet} c^3}{V^2}$$

Let us compare the required optical path calculated using the Michelson formula (4) and Fresnel formula (5), under the same initial conditions (optical medium air, with the refractive index $n = 1{,}000293$, Fresnel coefficient $\alpha = 0{,}0005857$, Earth's orbital velocity 30 km/s and the same light source).

The calculated optical path according to Michelson should be $l_1 + l_2 = 25 + 25 = 50\ \mathrm{m}$, but in fact it was $l_1 + l_2 = 11 + 11 = 22\,\mathrm{m}$. Under the same conditions this path, calculated. taking into account Fresnel's formula should be $l = 10665$ м [13]. The difference is very significant. In our opinion, Michelson's chance of discovering an Aether wind was zero. The same mistake is repeated by his followers.

Our opinion is that experiments whose formulas for sizing the interferometer lack a refractive index should be considered erroneous, and even meaningless. This is the simple reason why the Aether wind was not discovered for more than a hundred years.

V. Sizing the experimental set-up a first-order

In 2015, we proposed to create an experimental setup based on electro-optical modulators [12]. It turned out that this project required significant financial resources, which we, as independent researchers, did not have, so we had to abandon it. But in 2020, we discovered that it is much easier and cheaper to create an experimental setup based on a Mach-Zehnder interferometer built on the basis of optical fibers. The schematic diagram of this set-up is shown in Fig. 1.

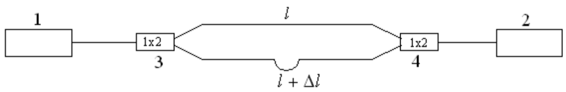

Fig.1. Schematic diagram atMach-Zehnder interferometer

Light source withDFB laser diode1, Optical power meter 2,Incoming optical splitter 3, Outgoing optical splitter 4.

The operation of this experimental set-up is very simple: The signal emitted by the light source 1 is divided by the input splitter 3 approximately equally between two arms of the interferometer. When there is a phase difference between the two arriving signals in the output splitter 4, they recombine. And since they are coherent, they are amplified or attenuated. For example, when the arriving signals are in antiphase, the signal should be minimal, and if there is no phase difference, the light will pass with very little loss and the signal will be maximal. Therefore, the interferometer converts the change in phase into a change in the amplitude of the output signal, which change can be registered by the optical power meter 2.

We have found that for a Mach-Zehnder interferometer to work, there must be a difference Δl between the lengths of its two arms, and it must be properly sized, i.e., it must be calculated how much the difference should be Δl. Below, (Appendix A) it is calculated that for a first-order interferometer, the time for light to travel a certain optical path of length *l* should be (Equation A12);

$$t = \frac{lV}{c^2}\left(1 - \alpha\right)n^2 \quad (6)$$

Equation (4) can be simplified if we take into account the value of the Fresnel constant α according to (2) and we can calculate that $\left(1-\alpha\right)n^2=1$. So, it will turn out that the time for which light travels an optical path must be,

$$t=\frac{lV}{c^2} \qquad (7)$$

The result obtained in this way is quite interesting. It turns out that when sizing a first-order interferometer, if one starts from Fresnel's formula, the time it takes light to travel a given optical path *l* does not depend on the refractive index.

Let's assume that the length of one arm of the interferometer is, and the other is l_2. In such a case l_1, the difference in time between the two beams arriving at the output optical splitter will be;

$$\Delta t^{\bullet}=\frac{(l_2-l_1)V}{c^2}=\frac{\Delta lV}{c^2} \qquad (8)$$

And if equation (8) is solved in terms of Δl we will obtain;

$$\Delta l=\frac{\Delta t^{\bullet}c^2}{V} \qquad (9)$$

In order to observe a maximum change in the measured signal, from the optical power meter, the difference Δl mustbe equal or slightly greater than $\lambda/2$, i.e. the time differencemust be $\Delta t^{\bullet}\geq T/2$, where λ is the working wavelength of the light source.We assume the working wavelength to be $\lambda=1550\,\text{nm}$. Under this condition, it can be calculated that the time $\Delta t^{\bullet}=T/2=\lambda/2\text{c}=2,58.10^{-15}$ sec. And after substituting in (9) we will obtain the formula for determining the required difference between the two arms of the interferometer, namely

$$\Delta l=\frac{232,5}{V}\ \text{м} \qquad (10)$$

Let us solve equation (10) in terms of *V*, we will get

$$V_{max}=\frac{232,5}{\Delta l}\ \text{м/сек} \qquad (11)$$

where V_{max} e is the maximum velocity that the interferometer can measure.

VI. Set-ups whit the Hybrid Mach-Zehnder interferometer base

The first successful experiment, in mid-2020, through which an aAether wind was discovered, was carried out on the basis of the so-called Hybrid Mach-Zehnderinterferometer [7,8]. The schematic diagram of this experimental setup is shown in Fig. 2. On the one hand, it is based on a first-order Mach-Zehnder () interferometer, but it also has elements of a second-order interferometer, for example, nodes 5, where light travels in both the forward and reverse directions.

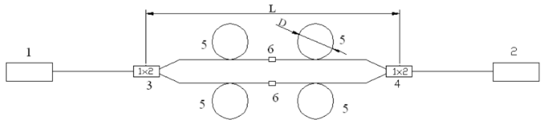

Fig. 2. Schematic diagram at Hybrid Mach Zehnder interferometer.
Light source 1, Optical power meter 2, Input optical splitter 3, Output optical splitter4, Second-order nodes 5 and connectors 6.

This set-up is easy and inexpensive to make. Its components are widely available and can be implemented even at home. For example, the set of Optical Light source (OLS) and Optical power meter (OPM) was purchased on ebay for about $80. According to the technical data, the OLS from this set emits a constant signal with a power of -6.5 dBm, which corresponds to about $224\,\mu\text{W}$, and the OPM can measure signals up to $-70\,\text{dBm}$.

The set of necessary optical elements consists of:

- PCL Splitter 1x2, with SC/APC - 2 pice
- SimplexPath Cord, FC/APC – SC/APC conector, - 2 pice
- Simplex SC/APCadapter- 4pice.

An advantage of this experimental setup, shown in Fig. 3, is that all components are connected directly via connectors, without additional technological operations.

Fig. 3. Set-up based whitHybrid Mach-Zehnder interferometer

VII. Experiments with set-up based on a Hybrid Mach-Zehnder interferometer

When, in mid-2020, we were ready to start experiments with this experimental setup, we were faced with two unknowns. As a novelty, we assumed that instead of observing an interference pattern of dark and light fringes, as had been done in the past, it was much easier to measure the change in the power of the measured signal, using the OPM, but we were not sure what the result would be. We also did not know how to properly size the interferometer, since we did not know exactly what the velocity at which the Earth was moving was. The SRT states that there is no absolute motion and the velocity must be zero, Michelson, when calculating his interferometer, had assumed the orbital velocity of the Earth to be 30 km/s, and Miller in [4] claims that this velocity is probably 208 km/s.Our opinion at that time was that the Earth moves at a much higher velocity, probably 400÷600 km/s [6,14]. In this case, when calculating our interferometer, we assumed an absolute velocityof 600 km/s. Therefore, if we take into account equation (8), we can calculate that for the interferometer to work, the difference in the travel of the two arms must be $\Delta l \leq 0,387$ mm. It was this value Δl that made it possible to use optical splitters connected directly, with connectors, relying on the dispersion of their dimensions in the manufacturing process.

Given the unknowns, we prepared and conducted experiments with 3 different interferometers [7]. We were lucky. When switched on, all our experimental setups started working, in the sense that the measured signal started and changed continuously. It also turned out that when observed, in some cases after a few minutes, and in other cases with a duration of hours, the measured signal oscillates between certain minimum and maximum values. Let us call these oscillations “slow”. Here are the slow, maximum and minimum values that were measured with the different interferometers:

No. 1 (June 30, 2020), min 14 μW - max 70 μW, i.e. in a ratio of 1:5
No. 2 (July 2020), min 16 μW - max 53 μW, i.e. in a ratio of 1:3.5
No. 3 (October 2020), min 20 μW - max 50 μW, i.e. in a ratio of 1:2.5

There were also so-called “fast” (random) oscillations, but within much narrower limits and with a duration of seconds. The reason for these oscillations is, on the one hand, related to the digital indicators, and on the other hand, to the fact that our OPM is a Fabry-Perot laser diode. The width of the spectral lines emitted by it (Linewidth) $\Delta\lambda \geq 1$nm and if a calculation is made, it will turn out that the coherence length (Coherence length) is less than 3 millimeters, i.e. we use OLS with very modest parameters, considering that such sources with coherence lengths of hundreds of meters and even kilometers are sold on the market, but unaffordable for our budget.

When conducting all experiments, the experimental setups were placed and lay in a horizontal plane, for Sofia $42,7^0$ north latitude, and the interferometer was oriented in the north-south direction using a compass.

It should be noted that as part of the Solar System, the Earth's velocity must take into account all its motions, i.e. its galactic velocity (vector sum of its diurnal and orbital motion plus its motion with the Sun). Let us assume that the projection of this total velocity (vector $\vec{V}_G$) onto the plane in which the experimental setup lies is V_G. Let us also assume that angle α is the angle between V_G and the direction of the interferometer. Therefore, when it rotates with the Earth, the velocity along its axis will change according to the law:

$$V(\alpha) = V_G \cos\alpha \qquad (12)$$

Therefore, when the angle α changes, the velocity $V(\alpha)$ will change, and the measured signal will also change.

VIII. Set-ups whit Mach-Zehnder interferometer base

In 2021, we acquired an OLS type S3FC1550 from Thorlabs (Fig. 4), which has a DFB laser diode, has a built-in thermostat and emits light with a spectral linewidth $\Delta\lambda \leq 0,06$ nm, i.e. it has a coherence length of more than 4 cm and although this length is still modest, it is larger compared to the Fabry-Perot light source, but it is sufficient for more stable operation of the interferometer. The price of this light source is more than 3000$.

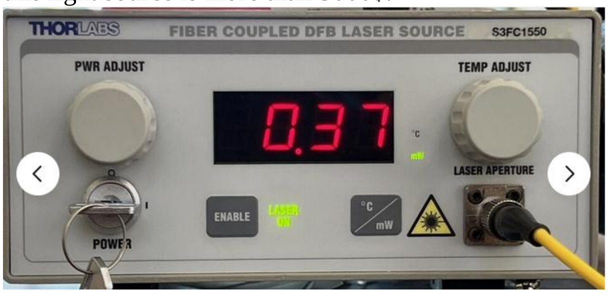

Fig. 4. Thorlabs S3FC1550 light source with DFB laser diode

An experimental set-up based on a Mach-Zehnder interferometer with this new light source is shown in Fig. 5. The same set of optical elements is required for its implementation as in the experimental setups with a hybrid Mach-Zehnder interferometer. The difference is that here the second-order nodes are removed, after some of the double outputs of the PCL splitters are trimmed and connected by splicing so that the distance between them is not more than 50 ÷ 60 cm. In this case, the condition must be observed that the difference Δl in the length of the optical path between the two arms is in accordance with the calculated one according to equation (10).

Fig. 5. Experimental set-up based on Mach-Zehnder interferometer

IX. Experiments with set-up based on Mach-Zehnder interferometer

The experiments with an experimental setup based on a Mach-Zehnder interferometer also proved successful. When the OLS and OPM are turned on, the measured signal starts and continuously changes, alternating maximum and minimum values. So, in this case it is enough to observe precisely the sequential appearance of these maximum and minimum values of the measured signal and the time between their appearance. It turned out that this is very easy since the maximum signals reached values greater than $150\ \mu W$, and the minimum ones reached values less than $2\ \mu W$, i.e. in a ratio of 75:1.

The first experimental setup with a Mach-Zehnder interferometer was created in order to be convenient for demonstrations, i.e. within 15 ÷ 30 minutes to observe several maximum and minimum values of the measured signal. An explanation is needed here. The difference in the time for the appearance of maximum and minimum values depends on what maximum velocity the interferometer is set to measure. When setting a lower velocity, the frequency of the appearance of extreme values increases and vice versa, when setting a higher velocity it decreases. For example, if the interferometer is set to the maximum velocity with which the Earth moves, which is still unknown, it will take 6 hours to observe two consecutive extreme values of the measured signal, so that it rotates through an angle of 90^0. Therefore, assuming that the Earth's velocity is about 600 km/s, the interferometer was set to measure a maximum velocity of about $54\ km/s$ (at $\Delta l = 4,3 mm$). However, it turned out that the frequency of occurrence of extreme values is much greater than expected, i.e. it turned out that the velocity of the Earth is much greater than, as was assumed at the time.

Subsequently, experimental setups were created to measure higher velocitys. For example, at the end of December 2021, an experimental setup was carried out with an interferometer set to measure an Aether windvelocity of about 500 km/s. In this case, the difference in the optical path between the two arms was assumed to be about 0.46 mm. We also found that it is most convenient for the light source to be set to emit a constant signal of 0.52 mW at a temperature of $24,5^0 C$, as recommended by the manufacturer. Thus, in these experiments, maximum signals greater than $150\,\mu W$, and minimum signals smaller than $2\,\mu W$, i.e. already in a ratio of 75:1, were measured.

Fig. 6. Set-up with main interferometer to measure 700 km///sec

In Fig. 6. shows an experimental setup created in 2022. It consists of two interferometers. In the foreground is a main Mach-Zehnder interferometer, set to measure a maximum velocity of about 700 km/s, It role is auxiliary. One of its channels is interrupted and it measures only the noise, i.e. external disturbances (temperature fluctuations, electromagnetic influences, vibrations, etc.) associated with the passage of light between the light source and the measuring device. At the front are the optical power meters (OPM). The right device records the change in optical power in the main interferometer, and the left one measures the noise. At the top, one on top of the other, are the laser light sources (OLS).

How the measured signal of the main interferometer changes is shown in the graph Fig. 7. It is built on the basis of a video [18] recorded on October 15, 2022, at 13:10. This video is 27 minutes long, taking into account the values of the measured signal every 1 minute. A period of time was chosen when the velocity of the Aether wind changes the fastest.It can be seen how over time the measured signal of the main interferometer (OPM on the right) is constantly changing. The readings are initially 24 μW, start to rise and after about 10 minutes increase to 153,2 μW, then decrease to a value of 1,9 μW and increase again. During this time, the left OPM measures an almost constant signal (about 30.5 μW) and moves very little, indicating that the noise is negligible. It is obvious that there can be no doubts about the real existence of an Aether wind here. On the one hand, the OLS of the main interferometer emits a constant signal of $0,52\,mW$, and at the output it is constantly changing. The only objective reason and driving force for the change in the measured signal is obviously the change in the velocity of the Aether wind when the direction of the interferometer changes due to the rotation of the Earth according to equation (12).

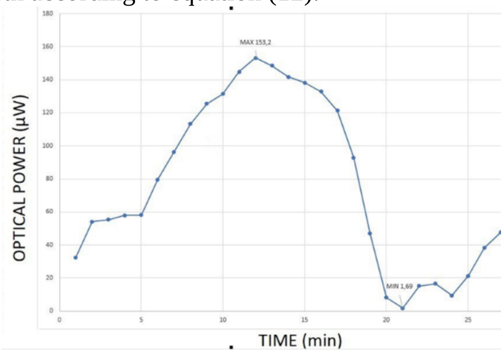

Fig 7. Graph of change in the measured signal for a time period of 27 minutes

X. What is the velocity and direction in which the Earth is moving?

In addition to the main task, to resolve the age-old dispute whether there is or is not an Aether wind, as an additional task, it was also planned to determine the velocity and direction with which the Earth moves. It turned out that this additional task cannot be solved on the basis of the Mach-Zehnder interferometer. The reason is that after connecting the two arms of the interferometer, by splicing, it is not possible to measure how much difference there is in the length Δl of the optical path between them, i.e. it cannot be set to measure an exactly specified velocity. But there is another reason and it is related to the Doppler effect factor. How it affects the change in the measured signal is shown in the graph Fig.8. This graph is built on the basis of a video recorded on June 23, 2024, at 14:52, for a period of time of 24 hours, for a complete rotation of the Earth around its axis. Here, the values of the measured signal every 1 minute are also taken into account.

Our expectations were that at an Earth velocity of 600 km/s the relative weight of the Doppler effect would be only 0.3% and it could be neglected. That is why we expected there to be a clearly expressed symmetry in some sections of the diagram, given how the function should change according to equation (12) and so by the appearance of this graph to determine the direction of Earth's motion. It turned out that there is no such symmetry. Rather, the symmetry turned out to be an asymmetry, for example, the difference between sections marked A and B. It can be seen that section A has a duration of about 110 minutes, and section B has a duration. The difference is almost 2 times. And this means that the relative weight of the Doppler effect is much greater.

In our opinion, based on the type of diagram in Fig. 8 and the large number of extreme values of the measured data, it should be assumed that the velocity of the Earth is much greater than 600 km/sec. Perhaps it is greater than 3000 km/sec.

But there is a possibility to overcome the difficulties mentioned above and to solve the problem of determining the velocity and direction of the Earth's movement. This can be done by means of an experimental setup based on electro-optical modulators, as proposed in [15]. The main advantage of such an experimental setup is that the Doppler effect will be avoided. We have such a project ready. But the costs of creating such an experimental setup are currently beyond our budget.

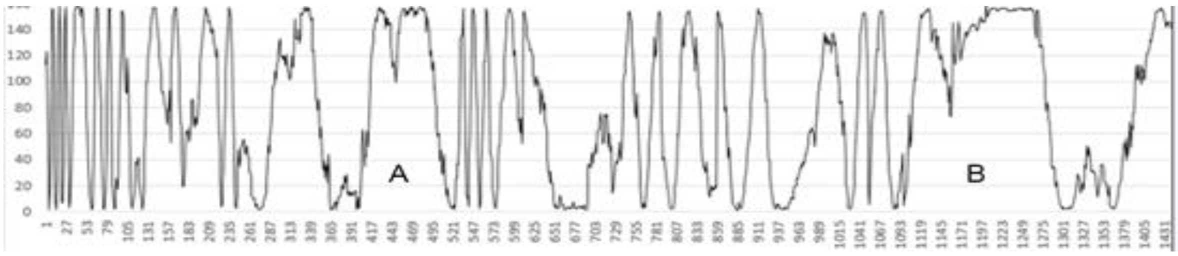
Fig.8. Graph of change in the measured signal over a period of 24 hours

XI. Conclusion

From the experiments conducted so far, it has been established with a high degree of certainty that the velocity of propagation of light in optical media depends on the movements of the Earth, as predicted by Fresnel's formula. Therefore, there is an "Aether wind" and it has already been discovered. Einstein himself stated that if an "Aether wind" is discovered, it must be admitted that the Special Theory of Relativity will be invalid:

"My opinion about Miller's experiments is the following. ... Should the positive result be confirmed, then the special theory of relativity and with it the general theory of relativity, in its current form, would be invalid. Experimentum summus judex. Only the equivalence of inertia and gravitation would remain, however, they would have to lead to a significantly different theory." — Albert Einstein, in a letter to Edwin E. Slosson, 8 July 1925 (from copy in Hebrew University Archive, Jerusalem.) See citations below for Silberstein 1925 and Einstein 1926.

It is assumed that the velocity of the Earth together with the Sun is more than 3000 km/sec.

The authors are ready to show their experiments to a competent committee. The experimental setup is easy to implement and anyone who is interested can do such experiments themselves, even at home, and find out what the truth is.

XII. Appendix A. Sizing of a first-order interferometer

When sizing a first-order interferometer, it is characteristic that we have two different cases, when the direction of motion of the optical medium coincides with the direction of light propagation and vice versa, these directions being opposite. In the first case, if we take into account the Fresnel formula, the velocity of light propagation should be $u_0 + V\alpha$, and in the second case it should be $u_0 - V\alpha$, where is $u_0 = c/n$ the velocity of light propagation in the given medium, *c* is the velocity of light in vacuum, *V* is the velocity of the Earth in space, *n* is the refractive index, and a α is the so-called Fresnel coefficient according to equation (2).

Case 1: Calculation of the time t_p^+ when the direction of motion of the optical medium coincides with the direction of propagation of light. In this case, the time for light to travel an optical path of length *l* should be

$$t_p^+ = \frac{l + \Delta l_+}{u_0 + V\alpha} \quad \text{(A1)}$$

Case 2: Calculate the time t_p^- when the direction of motion of the optical medium and the direction of propagation of light are opposite. In this case, the time for light to travel a certain optical path of length *l* should be

$$t_p^- = \frac{l - \Delta l_-}{u_0 - V\alpha} \quad \text{(A2)}$$

where the additions Δl_+ and Δl_-, i.e. the "lengthening" and "shortening" of the optical path have meanings, just as in the sizing of a second-order interferometer [15], namely

$$\Delta l_+ = l\frac{V}{u_0 + V\alpha}, \quad \text{and} \quad \Delta l_- = l\frac{V}{u_0 - V\alpha} \quad \text{(A3)}$$

Let us first calculate the time t_p^+ according to (1), taking into account the meaning of Δl_+

$$t_p^+ = \frac{l}{u_0 + V\alpha} + \frac{lV}{(u_0 + V\alpha)^2} \quad \text{(A4)}$$

Equation (A4) can be represented in the form

$$t_p^+ = \frac{l(u_0 + V\alpha) + lV}{(u_0 + V\alpha)^2} = \frac{l(u_0 + V + V\alpha)}{(u_0 + V\alpha)^2} = \frac{l}{u_0^2}\frac{(u_0 + V + V\alpha)}{(1 + V\alpha/u_0)^2}$$
(A5)

and if we take into account that the ratio $V\alpha/u_0$ is a small value, we can assume

$$\frac{1}{1 - V\alpha/u_0} \approx 1 - 2V\alpha/u_0 \quad \text{(A6)}$$

It will to be

$$t_p^+ \approx \frac{l}{u_0^2}\left(u_0 + V + V\alpha\right)\left(1 - 2V\alpha/u_0\right)$$

(A7)Now, after doing the multiplication and ignoring the higher order quantities, we get

$$t_p^+ \approx \frac{l}{u_0} + \frac{lV}{u_0^2}\left(1-\alpha\right) \qquad \text{(A8)}$$

and after it is replaced $u_0 = c/n$ it will be obtained definitively

$$t_p^+ \approx \frac{l\,n}{c} + \frac{lV}{c^2}\left(1-\alpha\right)n^2 \qquad \text{(A9)}$$

Calculating the time t_p^- (case 2) when the direction of motion of the optical medium is opposite to the direction of light propagation is similar to calculating the time t_p^+ (case 1), and the result will be;

$$t_p^- \approx \frac{l\,n}{c} - \frac{lV}{c^2}\left(1-\alpha\right)n^2 \qquad \text{(A10)}$$

т.е. разлика ще има само в знаците, така, че уравнения (А9) и (А10) могат да се запишат заедно по следния начин
i.e. the only difference will be in the signs, so equations (A9) and (A10) can be written together as follows

$$t_P \approx \frac{l\,n}{c} \pm \frac{lV}{c^2}\left(1-\alpha\right)n^2 \qquad \text{(A11)}$$

where the sign "+" refers to the case when the direction of motion of the optical medium coincides with the direction of the velocity of light propagation, and the sign "-" refers to the case when these directions are opposite.

The result thus obtained is very interesting. It turns out that the time for which light travels a given distance does not depend on whether the direction of propagation of light and the direction of movement of the optical medium are the same or opposite. Moreover, the first term of equation (A11) is actually a free constant and its value can be assumed to be equal to zero. Therefore, this equation can be simplified;

$$t = \frac{lV}{c^2}\left(1-\alpha\right)n^2 \qquad \text{(A12)}$$

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