THE VELOCITY OF LIGHT IS DIRECTION DEPENDENT*)

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Performing the so-called by us "coupled-mirrors" experiment, we have established that velocity of light measured along a given track on the earth's surface is different during the different hours of the day.

In the last decades the Einstein postulate about the constancy of light velocity along all directions in any inertial frame of reference has gained such a large popularity that for a great part of the physicists this problem is closed as, say, the problem about the impossibility to construct a perpetuum mobile. However, until now an experimental proof of this Einstein postulate within first order accuracy in v/c does not exist. The historical Michelson experiment, favouring the constant light velocity dogma, gives an accuracy of second order in v/c, but the effects of first order, as a matter of fact, are there unobservable. And we must emphasize that the null effects of second order (which, according to us, are connected with the Einstein-Lorentz time dilation, considered by our theory as an absolute phenomenon [1]) cannot be treated as a decisive proof of the "first-order-constancy" of light velocity. On the other hand, the historical Harress-Sagnac-Pogany experiment has shown that velocity of light in a non-inertially moving frame of reference is direction dependent and this dependence is of first order in v/c.

Recently we have performed an experiment which offers the possibility to establish whether the velocity of light is direction dependent also in an inertial frame of reference. This so-called by us "coupled-mirrors" experiment, although too crude in its first performance, can be considered, according to our firm opinion based on the absolute space-time theory elaborated by us in the last years [2], as the first experimental disproof of the Einstein constant light velocity dogma and of his principle of relativity.

In [3] the opinion is defended that until now a first-order in v/c experiment for the establishment of the light velocity direction dependence in an inertial frame of reference is neither proposed nor it is shown that such an experiment cannot be invented at all. In this report we show that a first-order in v/c experiment can be not only theoretically proposed, but such an experiment was performed and it has favoured the anti-relativistic dogma for the direction dependence of light velocity.

For the sake of simplicity and better visualization, we shall perform the necessary calculation for the adjustment presented in fig. 1.

*) Editorial note: The idea of the experiment seems to be of some interest, notwithstanding the author's experimental results are too crude to be convincing.

Let us have two disks driven always exactly with the same phase difference (imagine the wheels of a bicycle). On each disk two antipodal facets are cut and the one is made a mirror, while the other and the rest of the disk's rim are not light reflecting. The distance between both disks, called further rotating mirrors RM_1 and RM_2, is d. Intensive light from the source S_1 (respectively, S_2) is reflected by the semi-transparent mirror M_1 (resp., M_2) and, after passing through the semi-transparent mirror N_1 (resp., N_2), is incident on the mirror facet of RM_1 (resp., RM_2).

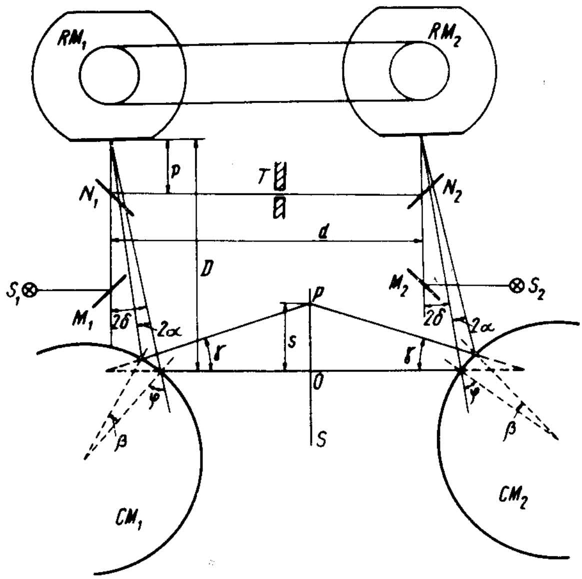

Fig. 1. The "coupled-mirrors" experiment.

The light beam reflected further by the semi-transparent mirrors N_1 and N_2 (resp., N_2 and N_1), whose distance from the rotating mirrors is p, is incident on the mirror facet of RM_2 (resp., RM_1). If the rotating mirrors are at rest, the light beam reflected further by the cylindrical mirror CM_2 (resp., CM_1) will illuminate screen S from the right (from the left) at an arbitrary point. The light path from the rotating mirrors to the cylindrical mirrors is D and from the cylindrical mirrors to the screen is $d/2$.

If the rotating mirrors are put in motion, then, because of the slit T, only the light which is reflected by RM_1 (resp., by RM_2) when the latter is perpendicular to the incident beam will reach RM_2 (resp., RM_1). However, for the time spent by light to cover distance $d + 2p$, the facet of RM_2 (resp., RM_1) which is parallel (an exact parallelism is not necessary!) to the corresponding facet of RM_1 (resp., RM_2) will rotate by a certain angle $\delta = 1/c\,(d + 2p)\,\Omega$, where Ω is the angular velocity of the rotating mirrors.

Let us now suppose that light velocity along the direction from RM_1 to RM_2 (which we shall call "direct") is $c - v$ and along the direction from RM_2 to RM_1 (which we shall call "opposite") is $c + v$. In such a case during the time in which the light pulse reflected by RM_1 will reach RM_2 the latter will rotate to an angle $\delta + \alpha$, while during the time in which the light pulse reflected by RM_2 will reach RM_1 the latter will rotate to an angle $\delta - \alpha$, and we shall have

$$(1) \qquad \delta \pm \alpha = \left(\frac{d}{c \mp v} + \frac{2p}{c}\right) \Omega ,$$

from where (assuming $v \ll c$) we get $\alpha = \Omega dv/c^2$.

Our apparatus takes part in the diurnal rotation of the earth and in 24 hours it will make all possible angles with the component of the absolute earth's velocity in the plane determined by the different positions of the apparatus durnig the day; this component we shall call further absolute earth's velocity and designate by v.

Let us suppose that the "ether" conception (defended by our absolute space-time theory) is valid and let us denote the unit vector along the "direct" direction by $\boldsymbol{n}$.

Let us first suppose that $\boldsymbol{n}$ is perpendicular to $\boldsymbol{v}$ and let us adjust so the cylindrical mirrors that the chopped light beams will illuminate the same point O on the screen S. Now, if $\boldsymbol{n}$ will become parallel to $\boldsymbol{v}$, both light beams will illuminate point P and for the distance s between O and P we shall have (suppose $\varphi \cong \pi/4$)

$$(2) \qquad s = \gamma \frac{d}{2} + 2\alpha D ,$$

where $\gamma = 2(\alpha + \beta)$ and $\beta = 2\alpha(D/R) \sec \varphi$; angles β, γ and φ are shown in the figure and R is the radius of the cylindrical mirrors. Thus we should have

$$(3) \qquad s = \frac{\Omega}{c^2} d^2 v \left[1 + 2D\left(\frac{1}{d} + \frac{\sec \varphi}{R}\right)\right].$$

If we take $\Omega = 900$ rad/sec $\cong 143$ rev/sec, $d = 10$ m, $v = 100$ km/sec, $D = 5$ m, $\varphi = \pi/4$, and $R = \sqrt{2}/0{\cdot}098 \cong 14$ cm, we obtain $s = 0{\cdot}01$ mm.

The establishment of velocity v is to be performed as follows: In regular intervals of time during a whole day we maintain such a rotational velocity Ω that the chopped light beam from the left would illuminate always point O. Then the light beam from the right will illuminate point O when $\boldsymbol{n} \perp \boldsymbol{v}$; it will be displaced over a distance $2s$ upwards when $\boldsymbol{n} \uparrow\uparrow \boldsymbol{v}$ and over the same distance downwards when $\boldsymbol{n} \uparrow\downarrow \boldsymbol{v}$.

In our factual adjustment both rotating disks were fixed on a common shaft because the most important requirement of the "coupled-mirrors" experiment is the ensuring of equal phase difference between both rotating mirrors during the earth's rotation. As light sources two He–Ne lasers were used. We used three cylindrical mirrors for any beam and such a combination of cylindrical mirrors which encreases enormously the "arm" of a light beam is called by us the "cylindrical mirrors indicator". The cylindrical mirrors indicator has shown its effectiveness because of the use of light beams generated by lasers. The light spots were observed over two different screens because in our factual experiment both rotating mirrors lie in two different parallel planes. According to the calculation for our real adjustment it must be $s = 0{\cdot}62$ mm for $v = 100$ km/sec. This displacement is large enough to be reliably registered. However the nonconstancy of the cylindrical mirrors radii and the trembling of the images were too considerable and our experiment could not lead to an accurate quantitative measurement of v. The observed displacement was maximum 3 ± 2 hours after midnight and after noon and corresponded to a velocity $v = 130 \pm 100$ km/sec, the "direct" direction being that one after midnight. The distance between both rotating mirrors was $d = 7{\cdot}2$ m, the radius of the cylindrical mirrors was $R = 8$ cm, and the velocity of rotation of the shaft taken from an old torpedo-boat was $\Omega/(2\pi) = 80$ rev/sec. The azimuth of the apparatus was 84^0 and the observations were performed in July – August in Sofia.

The error of ± 100 km/sec was established in the following manner: An observer maintains during $2-3$ minutes one of the light spots in a given position adjusting by hand a corresponding tension of a dc electromotor which drives the shaft. Another observer registers the diapason of trembling of the other light spot which was normally $2-3$ mm. If this diapason is $\Delta s = 2{\cdot}48$ mm, then (see fig. 1) the fluctuation error is ± 100 km/sec.

As a matter of fact we observed over the screen not a light spot but only a boundary line between a more bright and a more dark fields. This boundary line was the image of one end of the slit T. Because of the diffraction the boundary line between the dark and bright fields was not enough sharp. This was the reason that even when there is not a trembling of the light spot (the rotating mirrors are at rest) one registers the position of this boundary line with an uncertainty of about 1 mm.

The room was not temperature-controlled. However it is easy to see that the temperature changes of the w h o l e r o o m have not influence on the result, because the appearing effects (a change of the shaft's length, a change of the diameters of the cylindrical mirrors, a change of the refractive index of the semi-transparent mirrors) lead ot results which compensate each other. It is worth to note here that the temperature change of the diameters of the cylindrical mirrors CM_1 and CM_2 in fig. 1 leads to shifts of both light spots over the screen S which cannot be compensated changing the rotational velocity, while one easily concludes that in our real adjustment (where the symmetry over the corresponding cylindrical mirrors is complete!) also the results of this temperature effect are compensated with a change of the rotational velocity. Of course it is clear that if there will be a temperature change only for one part of the apparatus, this can be neither eliminated nor established.

We cannot give an estimation of the non-constancy of the cylindrical mirrors radii and the irregularity of the mirrors' surfaces which can lead to considerable errors. To elliminate this sort of errors we have performed the measurement choosing in the different days different position O which is to be illuminated on the screen steadily by the one of the light beams. In the time from 25-th July to 23-rd August we have performed 17 whole-day measurements (with interruption of 3 – 4 hours for a sleep) but during the greater deal of time the author operated alone on both screens that has diminished the accuracy.

We must declare that the technique used in our experiment is far beneath the possibilities of the contemporaneous technology and we appeal to the interested scientists to repeat this experiment on a higher technical level. The play is worth the candles. If other experimentalists should establish that no positive effect can be seen, then the "coupled-mirrors" experiment will represent the first experiment in the history of physics by whose help the Einstein constant light velocity dogma is being proved involving first-order in v/c effects. Our firm conviction, however, is that this time the theory of relativity should not be granted with an experimental support coming from the hands of an absolutist, as it was the case so many times in the last 70 years.

If one puts the "coupled-mirrors" apparatus on a rotating platform, then one has not to await for the earth's rotation and the measurement can be performed in a couple of minutes. If such a platform has three degrees of freedom, one can measure all three components of the absolute earth's velocity.

Obviously, the result of the "coupled-mirrors" experiment will agitate the whole physical world. This experiment will require an urgent correction of the official (generally called "relativistic") space-time conceptions. As a matter of fact, after its performance by several scientists who should claim a positive effect, nobody would further doubt that theoretical physics has to return to the old and simple Newtonian conceptions about absolute space and time, introducing there only our absolute time dilation dogma [1].

However we have to emphasize that the "coupled-mirrors" experiment could have been performed even by Foucault in the midst of the XIX-th century. As a matter of fact, it represents only a modification of his method for the measurement of light velocity with the help of the "rotating mirror". And we must add that with the help of the "coupled-mirrors" experiment one can establish the absolute earth's velocity with an absolute accuracy higher than the accuracy which the Foucault's experiment offers, because in our experiment the displacement of the light spot is proportional to v, while in the Foucault's experiment this displacement is proportional to c, and c is about thousand times larger than v. Thus we are surprised, indeed, that Michelson, the king of the exactitude, has not performed the "coupled-mirrors" experiment and has overseen its magnificent first-order in v/c possibilities.

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