A Test in the Outer Space For the Constancy of the Velocity of Light

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The scheme of an experiment is presented in order to test the constancy of the velocity of light. Herewith are explained the reasons that justify carrying out the experiment in the outer space, along with the ideas that support the convenience to continue doing this type of experiments nowadays, despite a century of Relativity's assent.

Keywords: Special Relativity, 2nd Postulate, Prof. J.G. Fox, Electronic Reemission of Light

Introduction

I am presenting here the schematic assembly of an experiment that could prove the existence of two light beams with different propagation speeds, i.e, a test for the 2nd postulate of the Special Theory of Relativity (STR).

As it is known, this postulate establishes the velocity of light as a universal constant, for any state of motion between the luminous source and the observer: that is, does not support what we intend to verify: the existence of two light beams at different rates.

We know that there have been many laboratory experiments carried out to this end, most of them providing null results, and that those with positive results were subsequently questioned for misinterpretations or for systematic mistakes.

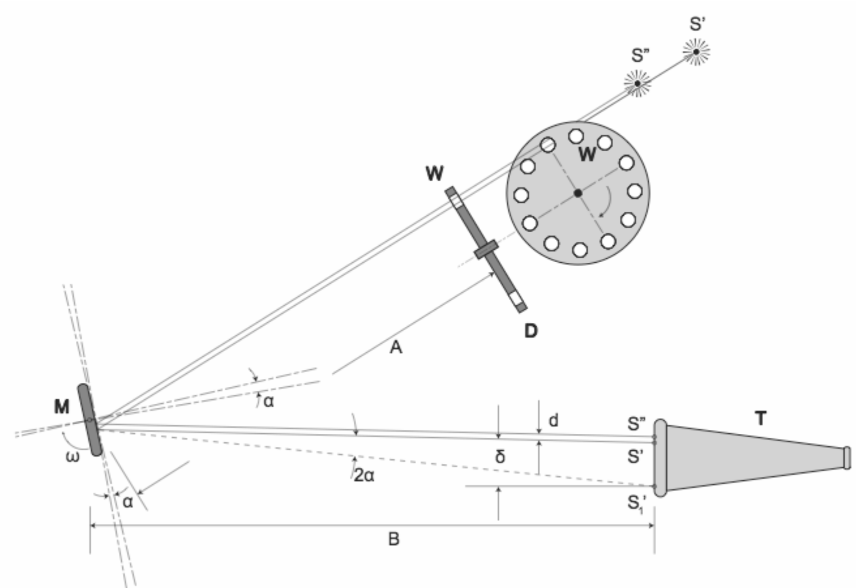
However, there is a fundamental reason for these null results -aside from the possible validity of the 2nd postulate in issue-, and it is because of the **electronic reemission of light**. This factor causes that whenever a light beam passes through -or is reflected by- a dielectric, the emergent light does it with speed c, regardless of the speed c' having the incident beam. The conservation of its energy despite this shift of velocity is manifested in the change of its frequency and its wavelength, that is, the Doppler Effect appears to us, and their formulas allow us calculate these changes.

This fact was thoroughly described by Prof. J.G. Fox in his papers of the 1960's decade in the American Journal of Physics, "Experimental Evidence for the Second Postulate of Special Relativity" [1] and "Evidence Against Emission Theories" [2], with profusion of references, among which I point out "Principles of Optics" of M. Born & E. Wolf [3] and "Theory of Electrons" of L. Rosenfeld [4]. Surprisingly, having passed almost half a century since its publication, the scientific community does not seem to have picked it up or digested it completely, since it keep on quoting experiments that include this distorting phenomenon in its development as proves of validity for the 2nd postulate.

In order to avoid this inconvenience -since the air also acts as a dielectric material for light- it is that I present this experiment to be performed at a space laboratory, that is, deprived of air.

The Test

The figure sketches the following:



Let us choose two celestial bodies S' and S" as two possible sources of luminous beams at velocities c' and c''. These bodies must be visually close enough in order to be simultaneously focused by the telescope T through the rotating mirror M and the window W. In addition, the selected celestial bodies must have quite different radial velocities R' and R", in order to maximize the sought-after result.

D is a rotating disc with round-peripheral-windows W that will let the light from the celestial bodies S' and S", pass intermittently.

This test intends to evidence that $c'=c+$R' and $c''=c+$R" or, at least, that $c'\neq c''$.

For this purpose we set up a rotating mirror M to a distance A from the disc D.

The times that it will take for the beams to cover the distance A will be t'=A/*c'* and t"=A/*c"*.

If *c"*>*c'*, there will be a delay in the arrival of the light from S' to M with respect to the one belonging to S", equal to t'-t", that will cause the mirror turn the angle α when the reflection of S' is produced.

Measuring the angles in radians, and being the angular speed of M ω turns per second, we will have:

$$\alpha = 2\pi\omega(t'-t'') = 2\pi\omega\left(\frac{A}{c'} - \frac{A}{c''}\right) = \frac{2\pi\omega A(c''-c')}{c'c''} \tag{1}$$

The test begins, with the disc D and the mirror M at rest, focusing on the celestial bodies S' and S" with the telescope T through the window W and the reflection in M, and measuring the apparent separation of S' and S", d, on a perpendicular plane to the axle of M (S"S').

Setting to turn D (speeding as fast as possible) and M to the angular speed ω which allows focusing the celestial bodies in T, the emerging beams from M, with velocity *c*, will be separated by an angle 2α, that, provided that for little angles, tgα≅α, they will impact in the objective of the telescope T, placed to a distance B from M, with a separation δ=2αB ($S'S'_1$ in the figure) in addition to the one previously measured with the system at rest. Replacing α for its expression in (1):

$$\delta = 2\alpha B = \frac{4\pi\omega AB(c''-c')}{c'c''} \cong \frac{4\pi\omega AB(c''-c')}{c^2} = \frac{4\pi\omega AB(R''-R')}{c^2}$$

That is,

$$\delta = \frac{4\pi\omega AB(R''-R')}{c^2} \tag{2}$$

Let us operate the equation (2) with credible values in its parameters in order to appreciate the sensibility of this test.

At this end we shall take the same example of two celestial bodies with radial velocities R'=-60km/sec and R"=+300km/sec, from my 2005 publication, of a test based in the stellar aberration [5].

For ω let us use 1000/sec, the same level of rotation that Foucault used in his famous determination of the velocity of light, and we will make A=B=10m.

This example turns out that $\delta \cong$5mm, a value that is easy to register.

Conclusion

The test is presented as a sketch, and, consequently, it does not include any constructive detail. Nevertheless, its conception is simple, and its complexity -certainly big- lays in the so exclusive environment for its realization: the outer space, at an orbital laboratory or in our natural satellite, the Moon.

Seeing equation (2) it is easy to decide the adequate size of their parameters depending on the technology available and the place where the test is to be performed, like for example reducing the distances A and B but increasing the rotating speed ω of the mirror M, and/or choosing another pair of stars S' and S" so that it be possible to enlarge the difference (R'-R").

We might wonder whether it wouldn't be easier to make a vacuum in a laboratory on land instead of sending the presented assembly to the outer space. The point is that by doing so, we would still have the problem with the chosen luminous sources, as its rays would match their speeds when passing through the Earth's atmosphere -even when they previously had different ones.

In the author's opinion, this great difficulty to do a reliable experiment with light beams of possible different velocities, due to the light's reemission, or dispersion, by the electrons of a dielectric mean, joined to the enormous difference between the velocities of light and the luminous sources (that makes it so difficult to detect any influence of the last ones upon the others), made possible the STR's so extensive assent, without still existing any conclusive proof of its second postulate's validity. The reader may find in my publication of reference [5] the reasons I expound for this assertion.

The other big reason for this assent is, of course, the great quantitative predictability achieved with its formulas.

But the so deep change that the Relativity has produced in the physical -and even philosophical- conception of the universe, and in the epistemology in general, justifies the whole effort aimed at reconciling someday this theory with the experimental verification of its principles.

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