

Experiments of Light in Inertial and Non-Inertial Frames

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Abstract: The experiments with light give attention to the longitudinal component of light. This study brings together two possible experiments with light in which the transversal component of light is under examination with the purpose to clarify if the velocity of light does or does not depend on the velocity of its source. One of the experiments is in an inertial frame, and the other is in a non-inertial frame. The predicted result of the experiment in the inertial frame is based on the well-accepted conclusion that experiments with light in Earth's inertial frame cannot put in evidence the motion of the inertial frame. The result of the experiment in a non-inertial frame indicates if the velocity of light does or does not depend on the velocity of its source. The possible results of the experiments were analyzed, and we concluded that the velocity of light depends on the velocity of its source.

1 Introduction

We need to approach the study of physics regarding the light and its propagation with some specific rules. Two rules are as follows:

The first rule is unacceptance of any irrational claims as fact. Irrational claims introduce errors in mathematical calculations that in turn produce a distorted reality. An irrational claim leaves room to interpretation, and science that accepts irrational claims may become a belief, a religion, a philosophy, or a political platform.

In physics, an example of an irrational claim is in special relativity. The constancy of the velocity of light may have some support, but the claim that the velocity of light is the same for any observer is an irrational claim. Even if we observe that the velocity of light in Earth's inertial frame is a constant, we do not have to ignore the detail that the source of light belongs to Earth; or perhaps, we do not entirely understand the interference of light within interferometers. It is better to say 'We do not know yet' instead of guiding a science toward a dead end. For this reason, and not only for this reason, the Lorentz transformations and special relativity are unacceptable.

F. Dambi [1, 2] confirms that the special relativity based on the Lorentz transformations is not sustainable and cannot be acceptable. Many other papers, not listed here because of their large number, confirm the same result.

The second rule is the credibility priority given to the results of the experiments. The first priority is given to experiments performed on Earth, such as the Michelson-Morley experiment, others like it, and the experiments analyzed in this paper. These kind of experiments are under our direct control and observation, and their number is larger than the ones of second priority. The second priority is given to the experiments or observations performed in macrocosmos and microcosmos. For macrocosmos observations, we allude to the astronomers' observations [3] that the velocity of light is independent of the motion of

its source. For microcosmos experiments, we allude to the experiment performed at CERN, Geneva, in 1964 [4]. Nevertheless, it is essential that the experiments of the first and second priority to support each other, and they do when our understanding of them is correct.

It is helpful, at least for the time being, when there are contradictions between experiments according to our understanding, to follow the rules like these.

The following sections bring together two possible experiments with light in which the transversal component of light is under examination. Section 2 presents the experiment in an inertial frame, and section 3 presents the experiment in a non-inertial frame. In conclusions, we discuss the possible outcomes of both experiments.

2 Experiment in the inertial frame of the Earth

Figure 1 illustrates the Earth that is moving around the Sun with the velocity of $v = 3E + 04 \text{ m/s}$. We use the rotational motion of the Earth around its axis, but we ignore its velocity in this study.

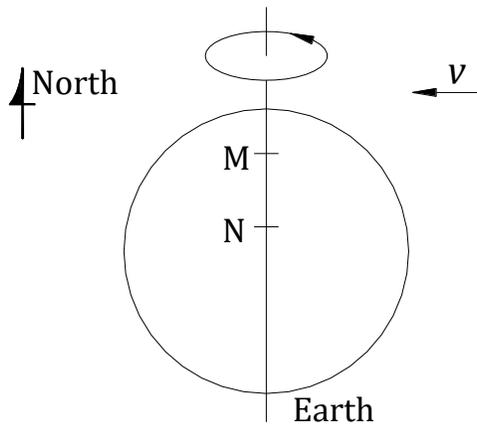


Figure 1. The geographical setting of the experiment.

A source of light at point M sends a ray of light from North to South, to point N that is on a screen perpendicular to the direction of light ray propagation. The distance from M to N is equal to L . Figure 1 depicts the front view of Earth with points M and N at midday.

Figure 2 depicts four front views from outside of Earth: the view at midday, the view at 6 PM, the view at midnight, and the view at 6 AM when the velocity of light is considered independent of the velocity of its source.

Because of velocity v , the light ray from point M to point N should arrive on the screen at points A, B, C , and D located to the right, in front, to the left, and behind of point N at the distance d , as shown in figure 2.

The velocity of light along the distance L is $c' = \sqrt{c^2 - v^2} \cong c$. In the same time t , the light from point M travels to one of the points A, B, C , or D with the speed c , the light from point M travels to point N with the velocity c' , and the Earth travels the distance d . Thus, $t = L/c' = d/v \Rightarrow d \cong Lv/c$.

If the velocity of light is independent of the velocity of the motion of its source and the Earth revolves around the Sun, the expected result of this experiment is that the light ray

from M to N shifts on a circle for a complete rotation of the Earth that includes points A, B, C, and D.

The speed of light from a stationary source in a fixed frame is $c = 3E + 08 \text{ m/s}$. Thus, the shift in twenty-four hours rotates on a circle with the diameter $D = 2d = 2Lv/c$. For $L = 100 \text{ m}$ the shift diameter is $D = 20 \text{ mm}$. This calculation is presented to offer an idea of the theoretical result of the experiment.

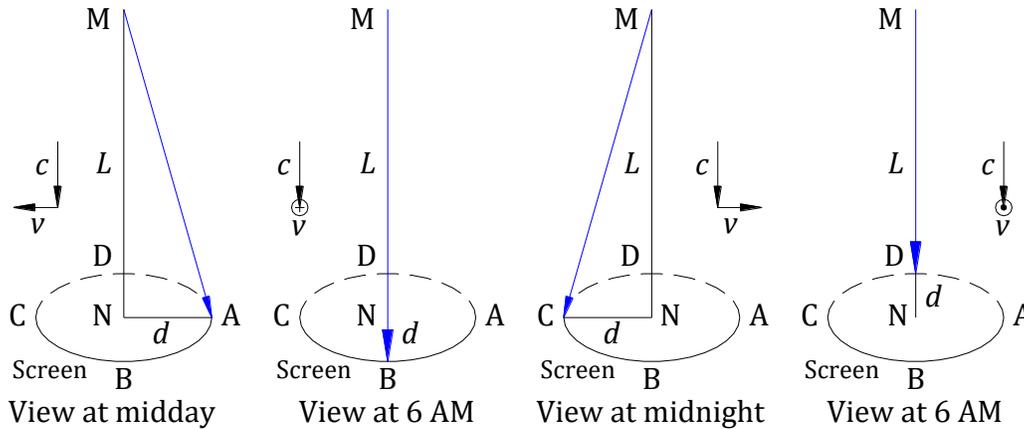


Figure 2. Position observations of the shift of the ray of light.

According to the accepted understanding that no experiment with light can put in evidence the motion of the Earth around the Sun, the predicted results of this experiment is that there is no shift. Therefore, we can conclude that:

- If the velocity of light is independent of the motion of its source, then the Earth does not revolve around the Sun.
- If the velocity of light depends on the motion of its source, then the Earth may or may not revolve around the Sun.

3 Experiment in non-inertial frame

The experimental device presented in Figure 3, in the front view and right view, is positioned at point M, and the screen at point N of figure 1.

A disk of radius R, with a source of light inserted in it, is rotated around its axis in both directions, clockwise and counterclockwise. In front of the rotating disk, there is an opaque wall with a collimator introduced in it that allows the light to travel through it and to reach the screen at point N. The distance from the source of light to the screen is L. This experimental setting can also be employed for the first experiment when the disk is fixed with the laser in the front of the collimator.

If the velocity of light is independent of the velocity of its source, when the disk is rotated in either direction, the light ray is expected to reach the screen at point N.

If the velocity of light depends on the velocity of the light source, when the disk is rotated clockwise as seen in the front view, the light ray reaches the screen at point A located at the right of point N at the distant d. When the disk is rotated counterclockwise, the light ray reaches the screen at point B located at the left of point N at the same distant d.

The velocity v of the light source is $v = \omega R$, where ω is the angular velocity of the disk. If the motor rotates the disk with a frequency $f = 100000 \text{ rpm}$ and the disk $R = 1 \text{ m}$, then $v = \omega R = (2\pi f/60)R = 10472 \text{ m/s}$.

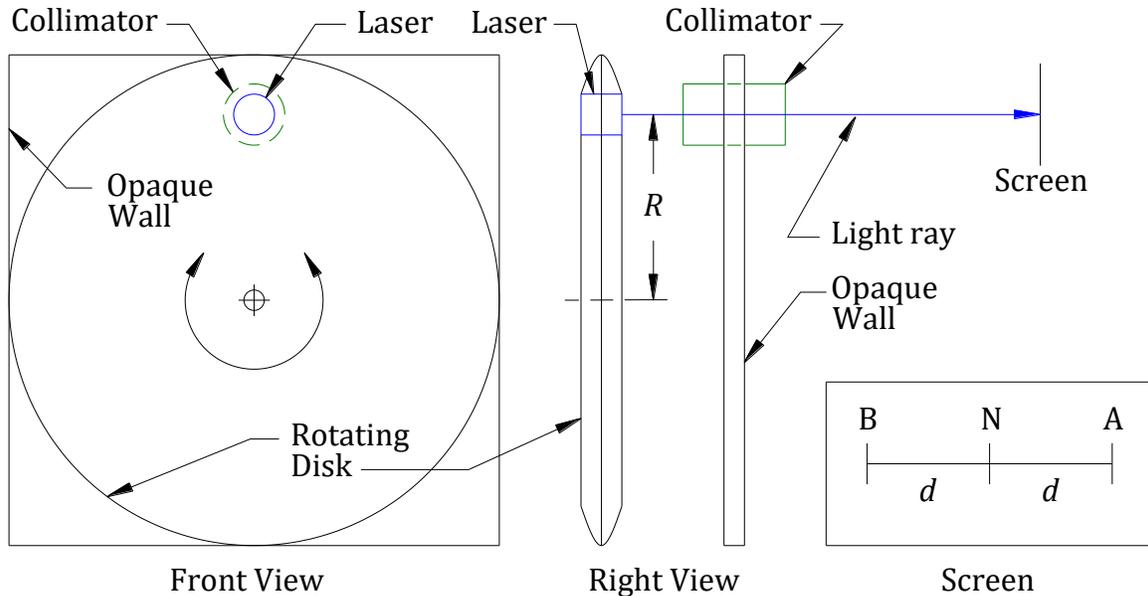


Figure 3. Experimental device for non-inertial frame.

The distance d is $d \cong Lv/c$. The shift from clockwise to counterclockwise is $D = 2d = 2Lv/c \cong 7 \text{ mm}$.

If the shift does not appear, then the velocity of light is independent of the motion of its source. If the shift appears, then the velocity of light depends on the motion of its source. The result of the experiment is independent of the motion of the Earth's inertial frame.

4 Conclusions

The first experiment offers the conclusions that if the velocity of light is independent of the motion of its source, then the Earth does not revolve around the Sun, and if the velocity of light depends on the motion of its source, then the Earth may or may not revolve around the Sun.

The second experiment yields the truth if the velocity of light is independent of the motion of its source, or if the velocity of light depends on the motion of its source. The result of the experiment, whatever it would be, is independent of the motion of the Earth's inertial frame. Therefore, the result of the experiment cannot indicate if the Earth does or does not revolve around the Sun.

If the second experiment shows no shift, then the velocity of light is independent of the motion of its source, and according to the first experiment, the Earth does not revolve around the Sun. This conclusion agrees with the astronomers' observations and the experiment performed at CERN, Geneva, in 1964.

If the second experiment shows shift, then the velocity of light depends on the motion of its source, and according to the first experiment the Earth may or may not revolve around the Sun.

Therefore, if the velocity of light depends on the velocity of its source, it does not prove that the Earth revolves around the Sun, but if the Earth revolves around the Sun, then the light depends on the velocity of its source.

Without to accomplish the non-inertial frame experiment, if we consider that the Earth is moving around the Sun, then the velocity of light depends on the velocity of its source. It is not possible to accomplish an experiment of light in Earth's inertial frame to prove that the Earth does or does not revolve around the Sun. In this case, we have to rely on experiments and observations of the second credibility priority, as described in section 2 by the rule of the credibility priority. The reasoning is similar to mechanical phenomena.

The experiments presented here take us over one hundred years ago and request us to reconsider our knowledge about light. Different from the experiments in which the longitudinal component of light is under study through the interference of light, the experiments in which the transversal component of the light is under study do not leave room to interpretation. Nevertheless, the experiment in the non-inertial frame can give us the independent truth if the velocity of light does or does not depend on the velocity of its source, which is the primary purpose of this study, without any interpretation and the confirmation or support from other experiments.

References:

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