Exploration on an Alternative Explanation of the Michelson-Morley Experiment

Rajeev Kumar*

Abstract

Einstein assumed that the speed of light is same with respect to all inertial frames of reference and devised his theory of special relativity. In this paper an explanation of the Michelson-Morley experiment has been presented and consequently the redundancy of the Einstein's theory of special relativity has been illustrated.

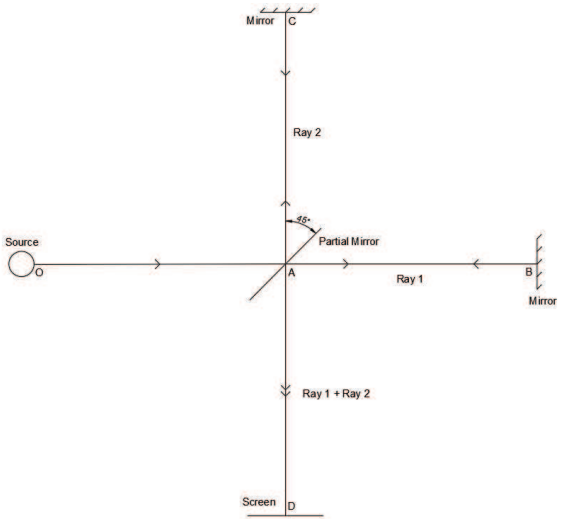
Keyword : Michelson-Morley experiment, Einstein's theory of special relativity.

1 POSTULATES

(i) Law of reflection : Relative speed of approach and relative speed of separation of the ray with respect to the reflecting point of the reflecting surface will be equal along the normal and tangential directions of the reflecting surface at the point of reflection.

(ii) Law of emergence : Velocity of a ray will be the vector sum of velocity of the source and velocity of the ray from the same source at rest, i.e., wavefront will be an expanding sphere or part of an expanding sphere with the centre moving with the velocity of the source.

2 MICHELSON-MORLEY EXPERIMENT



*rajeevkumar620692@gmail.com

Frame of reference : Experimental setup.
Result of the experiment : No fringe shift was detected even after orienting the experimental setup in different directions with respect to the ground.
Explanation : Let the experimental setup is moving with a velocity **v** with respect to an inertial frame of reference, then by the law of emergence, the velocity of incident light ray with respect to the source will remain constant, equal to $\mathbf{c_o}$ (let).
And by the law of reflection, the relative speed (i.e., magnitude of the relative velocity) of the incident light ray with respect to the mirror will be equal to the relative speed of the reflected light ray with respect to the mirror. Therefore the relative speed of both the incident ray and reflected ray will always remain the same and equal to c_o with respect to the experimental setup.
Now the time of relative path travelled is given by

$$t = \sum \frac{\text{relative distance}}{\text{relative speed}}$$

Time of relative path travelled by Ray 1

$$t_1 = \frac{OA}{c_o} + \frac{AB}{c_o} + \frac{BA}{c_o} + \frac{AD}{c_o}$$

let $OA = AB = AD = l$

$$\Rightarrow t_1 = \frac{l}{c_o} + \frac{l}{c_o} + \frac{l}{c_o} + \frac{l}{c_o} = \frac{4l}{c_o} \qquad (\text{i})$$

Time of relative path travelled by Ray 2

$$t_2 = \frac{OA}{c_o} + \frac{AC}{c_o} + \frac{CA}{c_o} + \frac{AD}{c_o}$$

let $AC = l$

$$\Rightarrow t_2 = \frac{l}{c_o} + \frac{l}{c_o} + \frac{l}{c_o} + \frac{l}{c_o} = \frac{4l}{c_o} \qquad (\text{ii})$$

3 CONCLUSION

From (i) and (ii) , we can infer that the time difference

$t_2 - t_1 =$ constant

so the phase difference

$\phi_2 - \phi_1 =$ constant

Since the phase difference between the two rays will always remain constant irrespective of the speed and orientation of the experimental setup, so no fringe shift will be detected. Therefore the concepts of the constancy of the speed of light, length contraction and time dilation are redundant and hence Einstein's theory of special relativity can be discarded once and for all.

References

1. Hugh D. Young, Roger A. Freedman, Albert Lewis Ford, *"Sears' and Zemansky's University Physics with Modern Physics 13th edition."*