Michelson - Morley experiment - Why!

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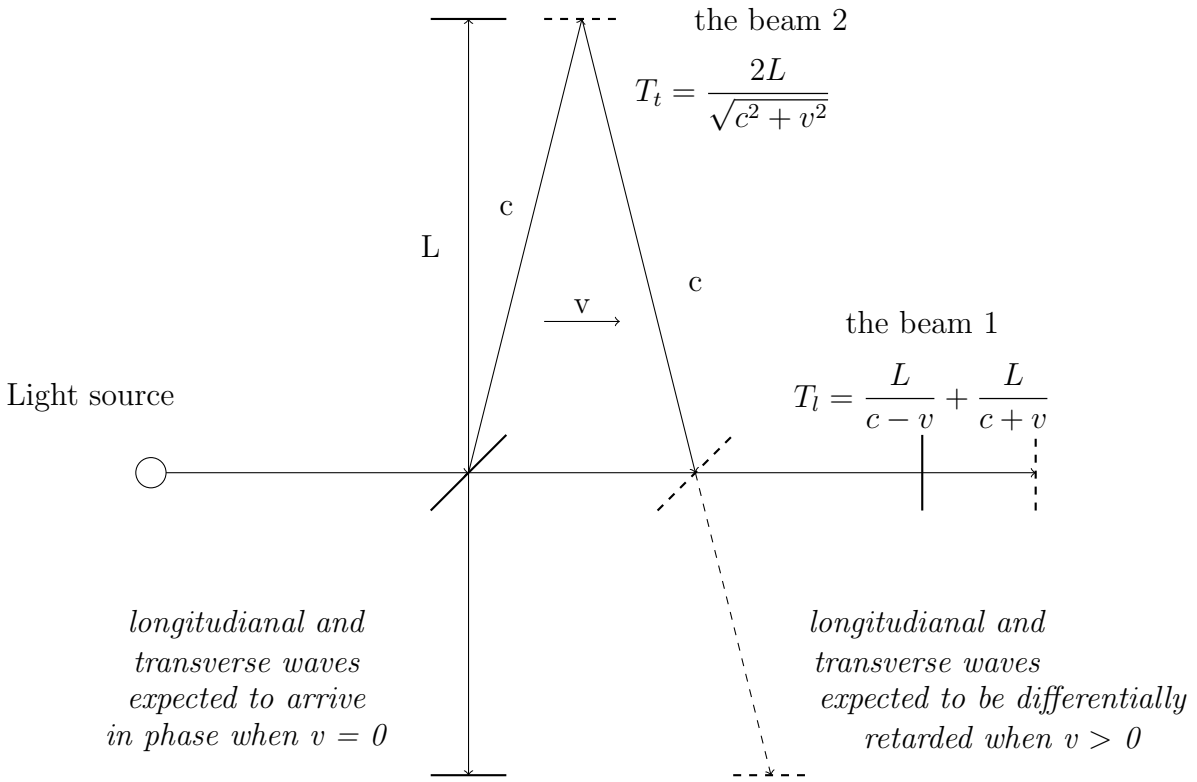
Abstract

Michelson - Morley experiment is the Most famous "failed" experiment [1]. Why the experimental results is negative?

Michelson - Morley experiment

The experiment compared the speed of light in perpendicular direction in an attempt to detect the relative motion of matter through the stationary luminiferous aether ("aether"). The result was negative, in that Michelson and Morley found no significant difference between the speed of light in the direction of movement through the presumed aether, and the speed at right angles.



Expected differential phase shift between light travelling the longitudianal versus the transverse arms of the Michelson- Morley apparatus

The expectation was that the effect would be graphable as a sine wave with two peaks and two troughs per rotation of the device.This result could have been expected because during each full rotation, each arm would be parallel to the wind twice (facing into and away from the wind giving identical readings) and perpendicular to the wind twice. Additionally, due to the Earth's rotation, the wind would be expected to show periodic changes in direction and magnitude during the course of a sidereal day.

Because of the motion of the Earth around the sun, the measured data were also expected to show annual variations.

$$T_l = \frac{L}{c-v} + \frac{L}{c+v} = \frac{2L}{c}\frac{1}{1-\frac{c^2}{v^2}}$$

$$T_t = \frac{2L}{\sqrt{c^2-v^2}} = \frac{2L}{c}\frac{1}{\sqrt{1-\frac{v^2}{c^2}}}$$

The time difference between T_l and T_t is given by

$$T_l - T_t = \frac{2L}{c}\left(\frac{1}{1-\frac{v^2}{c^2}} - \frac{1}{\sqrt{1-\frac{v^2}{c^2}}}\right)$$

To find the path difference, simply multiply by c;

$$\Delta\lambda = 2L\left(\frac{1}{1-\frac{v^2}{c^2}} - \frac{1}{\sqrt{1-\frac{v^2}{c^2}}}\right)$$

One path will be longer than the other, this distance is $\Delta\lambda$.Path difference is denoted by $\Delta\lambda$ because the beams are out of phase by a some number of warelengths (λ).

It can be seen from this derivation that aether wind manifests as a path difference.This derivation is true if the experiment is orientated by any factor of 90^0 with respect to the aether wind.If the path difference is a full number of wavelengths, constructive interference is observed (central fringe will be white).If the path difference is a full number of wavelengths plus one half, deconstructive interference is observed (central fringe will be black).
Of this experiment. Albert Einstein wrote,"If the Michelson - Morley experiment had not brought us into serious embarrassment. no one would have regarded the relativity theory as a (halfway) redemption.

Although the estimated difference between these two time is exceedingly small, Michelson and Morley performed an experiment involving interference in which this difference should have been clearly detectable . But the experiment gave a negative result- a fact very perplexing to physicists...

-Albert Einstein, 1916

The extent to which the null result of the Michelson - Morley experiment influenced Einstein is disputed.

Why did experimental results get negative?
There are many arguments for this results, unfortunately the arguments so far have not provided any solid evidence.

Michelson -Morley type experiment have been repeated many times with steadily increasing sensitivity. Is that necessary if we are to understand the essence of the problem, find a convincing answer.

Michelson -Morley experimental equipment and similar devices did not help achieve the goal. To achieve the experimental purpose mentioned above, physicists need a different type of device.

We will give the argument.

References

[1] Michelson - Morley experiment-Wikipedia

[2] Quang N V, A new solvable quintic equation of the Bring - Jerrard form $x^5 + ax + b = 0$, Vixra: 2108.0060 (AL)

[3] Quang N V, A new solvable quintic equation of the shape $x^5 + a^2x + b = 0$, Vixra: 2104.0008 (AL)

[4] Quang N V, A proof of the four color theorem by induction Vixra: 1601.0247 (CO) , Semanticscholar.org:124682326

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