The Correct Formulas of the Experiment of Michelson-Morley

Louiz Akram
The Higher Institute for Maritime Studies, Morocco – Naval engineering. Casablanca
louiz.akram@gmail.com

Abstract:
When the light photons bounce off a moving mirror, they react with its atoms to be reflected, consequently, the photons change their velocity vector after each impact depending on the velocity vector of the mirror and thus of the atom. The Michelson-Morley experiment was the event that changed the modern science about "the light" by leading to Lorentz and Einstein's theories about time.
I made the formulas of the Michelson-Morley experiment by considering the effects of the reflection on the light and The rate (percentage) of fringe shift calculated by the formulas which I demonstrated is perfectly null.
As a result not all physics must be wrong ,but only a principle that Einstein and Lorentz stated by fixing the light speed for all observers, which makes us study light in a very difficult way. The formulas demonstrated in this work allow us to study the light as a normal wave and to understand easily all the other light effects without being obliged to use any relativity of the time.
Keywords: Michelson ,Morley, light photon, interferometre, mirror, reflection, absorption, emission, null result, reference frame, speed of light, relativity.

Introduction:

The speed of light has been calculated by maxwell after fixing the electric and magnetic of the source and of the empty space [1]. However, the special relativity considers that the speed of light can only be constant for all observers thanks to the Michelson-Morley experiment [2]. It is a theory that has been tested by Kenned-Thorndike experiment, Ives-Stilwell experiment and many others. This theory is also used when dealing with moving light clocks [3]. However, the steps explained in this work when dealing with the light reflection give correct answers and should help to avoid the complicated relativity of time especially in Michelson interferometre.
In this work, we will prove formulas that predict the nearly null result of Michelson-Morley experiment.
Since we are verifying the experiment results of Michelson-Morley, we are free to change the light velocity vector when it is reflected .
We consider that T_1 and T_2 are the two times needed by the two half beams to reach the captor starting from the source, and that the splitter doesn't influence the light when it passes through it without any deviation, otherwise we will have to use compensating plates to correct that.
When a light photon bounces off a moving mirror, it reacts with one of the mirror's atoms to be reflected by the absorption then the emission. Consequently, the photon gets also an additional velocity vector. It is the velocity vector of the atom during the emission and thus of the mirror.
This phenomenon is similar to a ping pong ball bouncing without friction inside a box that is moving sidewards. In this case the ping pong ball gets the box velocity as a sidewards component of its velocity vector after it bounces and thus the ball seems to accompany the box in its movement.
$\vec{V}$ is the velocity vector of the mirrors and C_1 is the speed of the light directly after the source. We can consider that: $C_1 = C$ if the source of the light is fixed during the experiment, where C is the famous speed constant of the light. And we can consider that: $C_1 = C + V$ if the source of the light moves during the experiment with the velocity V. And the detector (interferometry) is considered always fixed during the experiment.

The proposed approach:

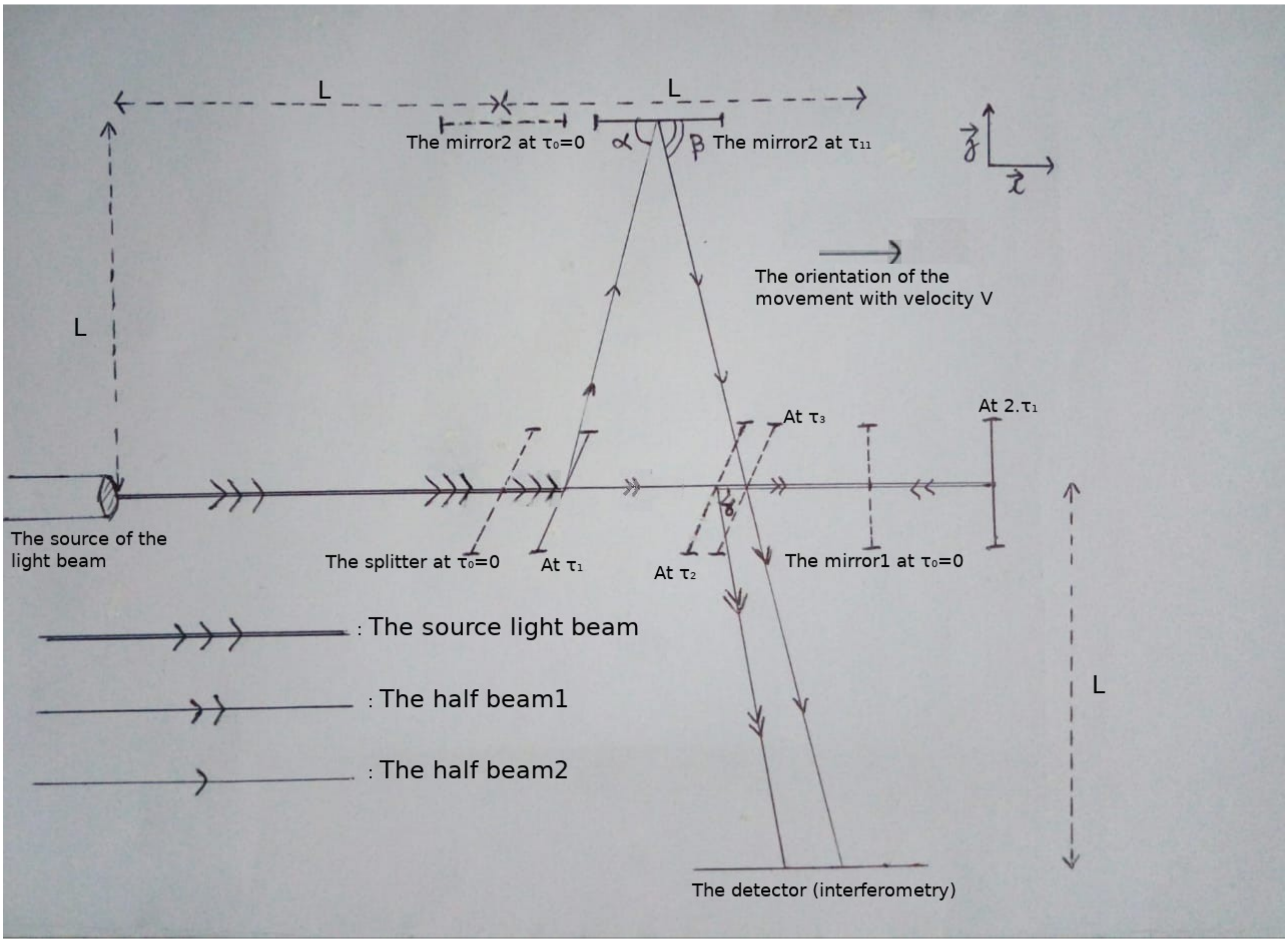

Fig 1. The apparatus of Michelson-Morley experiment.

The figure 1 describes the paths takesn by the light beams in Michelson-Morley experiment. In this figure we considered arbitrarily that α = ß but γ different. Also τ_2 and τ_3 are arbitrarily considered different until this work makes the investigation.

The half beam1 is the one reflected from the mirror1 and the half beam2 is the one reflected from the mirror2.

For half beam1:

We can prove that:

$$T_1 = 2\times\left(\frac{L}{C_1}+\frac{V\times t_1}{C_1}\right)+\frac{L}{C_2}-\frac{V\times t_2}{C_2}+\frac{L}{C_3\times|\sin(\gamma)|} \quad (1)$$

(each term is explained down)

By considering that:

$$C_1\times t_1 = L+V\times t_1 \Rightarrow t_1=\frac{L}{C_1-V} \quad (2)$$

where $t_1=\tau_1$.

C_2 is the speed of the light returning after being reflected from the mirror1.

During the reflection operation of the light, the speed of the light photon absorption by the reacting atom of the mirror is C_1-V . Consequently, the photon will be emitted with the same speed (same energy at the absorption) relatively to the reacting atom along the same axis $\vec{i}$. However, since the atom is moving during the emission with a speed $V\times\vec{i}$ then: $C_2=C_1-2\times V$ (3)

By considering also that:

$$C_2\times t_2 = L - V\times t_2 \quad \text{hence:} \quad t_2 = \frac{L}{C_2+V} = \frac{L}{C_1-V} \tag{4}$$

where: $t_2 = \tau_2 - 2\times\tau_1$

And that: C_3 is the speed of light after being reflected from the splitter and before reaching the detector.

The speed of the light photon absorption by the reacting atom of the splitter is: $C_2+V = C_1-V$.

Consequently, the photon will be emitted perpendicularly along the axis $\vec{j}$ with the same speed (same energy at the absorption) relatively to the reacting atom. However, since the reacting atom moves during the emission along the axis $\vec{i}$ with the speed V, then $V\times\vec{i}$ will be in this case a component of the emitted photon velocity vector. In the end, the velocity vector will become:

$$\vec{C_3} = V\times\vec{i} - (C_1-V)\times\vec{j} \tag{5}$$

Hence: $C_3 = \sqrt{(C_1-V)^2+V^2}$ (6)

and $\cos(\gamma) = \frac{V}{\sqrt{(C_1-V)^2+V^2}}$ (7)

and $\sin(\gamma) = \frac{-(C_1-V)}{\sqrt{(C_1-V)^2+V^2}}$ (8)

And by considering that t_3 is the time needed by the light to reach the detector after being reflected from the splitter, we have: $|\sin(\gamma)| = \frac{L}{C_3\times t_3} \Rightarrow t_3 = \frac{L}{C_3\times|\sin(\gamma)|} = \frac{L}{C_1-V}$ (9)

We deduce that:

$$T_1 = 2\times\left(\frac{L}{C_1} + \frac{V\times L}{C_1\times(C_1-V)}\right) + \frac{L}{C_1-2\times V} - \frac{V\times L}{(C_1-2\times V)\times(C_1-V)} + \frac{L}{C_1-V} = \frac{L}{C_1-V}\times\left(1+\frac{2\times V}{C_1} - \frac{V}{C_1-2\times V}\right) + \frac{L}{C_1-2\times V} + \frac{2\times L}{C_1} \tag{10}$$

For half beam2:

By following the same steps, we can prove that:

$$T_2 = \frac{L}{C_1} + \frac{V\times t_1}{C_1} + \frac{L}{C'_2\times|\sin(\alpha)|} + \frac{2\times L}{C'_3\times|\sin(\beta)|} \tag{11}$$

(each term is explained down)

By considering that:

C'_2 is the speed of the light after being reflected from the splitter and before reaching the mirror2. Consequently: $\vec{C'_2} = V\times\vec{i} + (C_1-V)\times\vec{j}$ (12)

(similar to the case of C_3 with half beam1)

Hence $C'_2 = \sqrt{(C_1-V)^2+V^2}$ (13)

and $\sin(\alpha) = \frac{C_1-V}{\sqrt{(C_1-V)^2+V^2}}$ (14)

and $\cos(\alpha) = \frac{V}{\sqrt{(C_1-V)^2+V^2}}$ (15)

And also by considering that:

C'_3 is the speed of the light after being reflected from the mirror2 and before reaching the captor. The speed of the light photon at the absorption is $\vec{C'_2} - V\times\vec{i} = (C_1-V)\times\vec{j}$. Consequently, the photon will be emitted with the same speed (same energy at the absorption) relatively to the reacting atom. However, since the reacting atom moves during the emission along the axis $\vec{i}$ with the speed V, then: $\vec{C'_3} = V\times\vec{i} - (C_1-V)\times\vec{j}$. (16)

Hence $C'_3 = \sqrt{(C_1-V)^2+V^2}$ (17)

and $\sin(\beta)=\frac{-(C_1-V)}{\sqrt{(C_1-V)^2+V^2}}$ (18)

and $\cos(\beta)=\frac{V}{\sqrt{(C_1-V)^2+V^2}}$ (19)

we deduce that:

$$T_2=\frac{L}{C_1}+\frac{V\times L}{C_1\times(C_1-V)}+\frac{L}{C_1-V}+\frac{2\times L}{C_1-V}=\frac{L}{C_1-V}\times(3+\frac{V}{C_1})+\frac{L}{C_1} \quad (20)$$

Finally:

$$T_2-T_1=\frac{L}{C_1-V}\times(2-\frac{V}{C_1}+\frac{V}{C_1-2\times V})-\frac{L}{C_1}-\frac{L}{C_1-2\times V}=0 \quad (21)$$

Remarks:

We proved above that: $|\alpha| = |\beta|$ (22)

and thus the half beam2 hits the mirror2 at: $\tau_{11} = \frac{\tau_3-\tau_1}{2}+\tau_1$ (23)

We proved also that: $|\gamma| = |\alpha|$ (24)

and thus the two half beams hit the splitter at the same time $\tau_3 = \tau_2$ (25)

Hence they become parallel before reaching the detector at exactly the same time.

Conclusion

The result is made by considering that the speed of light changes by the changing reference frames since this work tests the results of Michelson-Morley experiment and doesn’t consider that Einstein’s conclusion about the luminiferous aether is correct.

The rate (percentage) of fringe shift by the formulas demonstrated above is null and thus it confirms theoretically that the result of Michelson-Morley experiment is perfectly null. However, we can’t conclude that the luminiferous aether doesn’t exist like Einstein said or that the speed of the light doesn’t change by a changing reference frame.

References:

[1] Longair, M. S. (2008). Maxwell and the science of colour. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, *366*(1871), 1685-1696.

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