Special Relativity Predicts a Fringe Shift – a Disproof of Special Relativity and an Alternative Model of the Speed of Light

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Abstract

This paper refutes Special relativity theory (SRT) on its own terms. Special Relativity predicts a null fringe shift for the Michelson-Morley experiment. However, this author discovered that SRT predicts a fringe shift for some arbitrary variations of interferometers. This is a self-contradiction in SRT. This evidence shows that SRT was invented to explain the Michelson-Morley experiment and that relativity theory should be abandoned. An alternative model of the speed of light, Apparent Source Theory (AST), is proposed that can be stated in a few words: *the speed of light is constant relative to the apparent source.* What is the effect of slightly changing the position of the source in the Michelson-Morley experiment ? The answer is that this would result in a small, insignificant fringe shift. The effect of absolute motion of the Michelson-Morley apparatus is to create an apparent change in the position of the source relative to the detector. Apparent change of source position will not result in a (significant) fringe shift for the same reason that a real/physical change of source position will not result in a significant fringe shift. This is the subtle trick of nature that has eluded physicists for a hundred years.

Introduction

Ether theory and emission theory were the two competing theories of the speed of light before the Michelson-Morley experiment. The null result of the Michelson-Morley experiment gave birth to the Lorentz transformation, which eventually led to Einstein's Special Relativity Theory (SRT), and abolished the ether hypothesis. The emission theory was also abandoned gradually due to moving source experiments and astronomical observations.

Despite the failure of the Michelson-Morley experiment, many experimental evidences of absolute motion have been discovered . This include the Sagnac effect, the Miller experiments, the Michelson-Gale experiment, the Marinov experiment, the Silvertooth experiment, the CMBR anisotropy experiment and the Roland De Witte experiment. However, the mainstream physics community simply chose to ignore these facts.

Despite the accumulation of experimental and logical counter evidences, relativity theory still persists as the mainstream science. Some of the main factors for the persistence of relativity theory are:

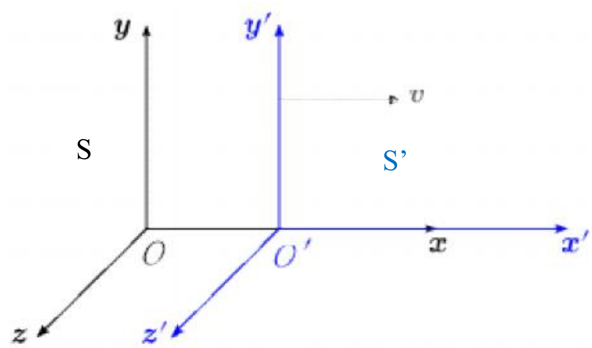
1. The null result of Michelson-Morley experiments
2. Einstein's compelling, beautiful thought experiment: " chasing a beam of light"
3. The inability to comprehend absolute motion vs the 'beauty' of the principle of relativity
4. The success of SRT in predicting and explaining unconventional experiments such as the Ives-Stilwell experiment, the relativistic mass increase of the electron, limiting light speed experiments, muon time-dilation.

5. The lack of an alternative, competing theory to explain the experimental facts of the speed of light

In this paper the experimental basis SRT will be refuted. Despite Einstein's 1905 paper which does not mention the Michelson-Morley experiment, all introductions of SRT start with analysis of the Michelson-Morley experiment. It will be shown that SRT predicts null result for the Michelson-Morley experiment, but predicts a fringe shift for other arbitrary kinds of interferometers. Hence, this will expose the failure of Special Relativity by disproving the assumption on which it is based: no experiment exists that can detect absolute motion. This will further lead to questioning the other experimental evidences of SRT, such as the Ives-Stilwell experiment, hence opening a possibility for alternative explanations. Finally, an alternative explanation of the Michelson-Morley experiment is proposed[1,2].

Lorentz Transformation [3]

Consider two reference frames S and S' . S' moves relative to S in the +x direction. An event observed in S' has coordinates (x', y', z', t') . The same event observed in S has coordinates (x, y, z, t).



Then the Lorentz transformation specifies that these coordinates are related in the following way:

$$t' = \gamma \left(t - \frac{vx}{c^2} \right)$$

$$x' = \gamma (x - vt)$$

$$y' = y$$

$$z' = z$$

where

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

Writing the Lorentz transformation and its inverse in terms of coordinate differences, where for instance one event has coordinates (x_1, t_1) and (x'_1, t'_1), another event has coordinates (x_2, t_2) and (x'_2, t'_2), and the differences are defined as

$$\Delta x' = x'_2 - x'_1 \ , \quad \Delta x = x_2 - x_1$$

$$\Delta t' = t'_2 - t'_1 \ , \quad \Delta t = t_2 - t_1$$

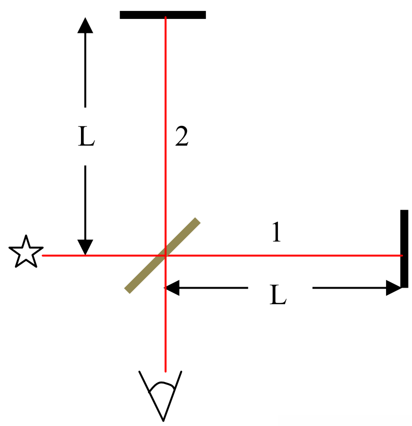
we get

$$\Delta x' = \gamma\,(\Delta x - v\,\Delta t) \ , \quad \Delta x = \gamma\,(\Delta x' + v\,\Delta t')$$

$$\Delta t' = \gamma\,(\Delta t - \frac{v\Delta x}{c^2}) \ , \quad \Delta t = \gamma\,(\Delta t' + \frac{v\Delta x'}{c^2})$$

Explanation of the Michelson-Morley experiment by the Special Relativity Theory

Consider the Michelson-Morley experiment in the reference frame in which it is at rest.



The time delay of beam 1 will be:

$$T1' = \frac{2L}{c}$$

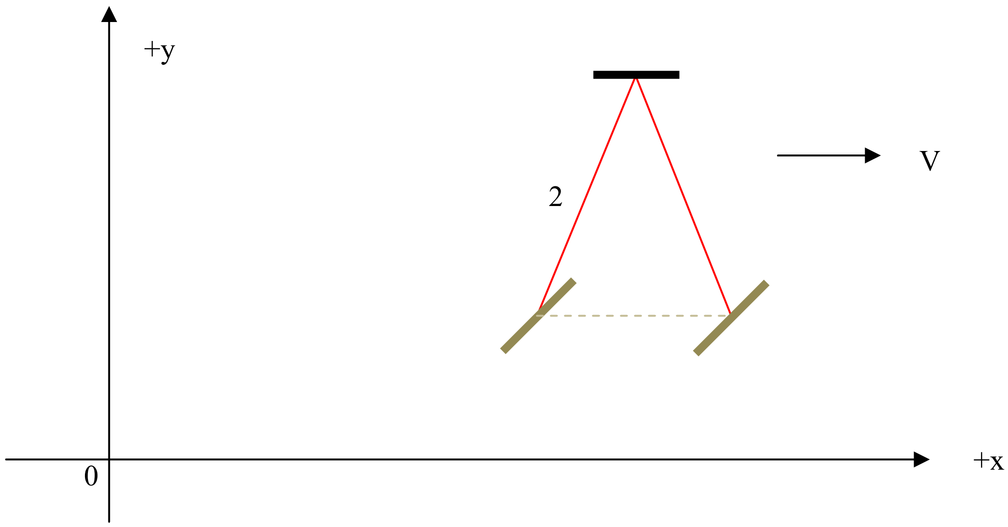
The time delay of beam 2 will be:

$$T2' = \frac{2L}{c}$$

The difference in the delay times of beam1 and beam 2 will be zero.

$$\Delta T' = \frac{2L}{c} - \frac{2L}{c} = 0$$

Now consider the Michelson-Morley interferometer in the reference frame in which it is moving with velocity V in the +x direction. The following diagram shows the path of the lateral beam, beam 2.



Round trip time of beam 2

Now we need to determine the round trip time delay of beam 2 , in the reference frame S.

Forward flight time

Let us first determine the time delay of the beam to go from the beam splitter to the mirror (forward time).

$$\Delta t = \gamma \left(\Delta t' + \frac{v \Delta x'}{c^2} \right)$$

$$\Delta x = \gamma \left(\Delta x' + v \Delta t' \right)$$

Δt' is the forward time delay of beam 2 (from beam splitter to mirror) in its own rest frame, i.e. in the S' frame.

$$\Delta t' = \frac{L}{c}$$

and

$$\Delta x' = 0$$

Therefore

$$\Delta t = \gamma \left(\Delta t' + \frac{v \Delta x'}{c^2} \right) = \gamma \left(\frac{L}{c} + \frac{v * 0}{c^2} \right) = \gamma \frac{L}{c}$$

Therefore the time needed for beam 2 to move from the beam splitter to the mirror , as observed in reference frame S is

$$\Delta t = \gamma \frac{L}{c}$$

Backward flight time

Next we determine the time delay between reflection from mirror and arrival at the beam splitter.

Δt' is the backward time delay of beam 2 (from mirror to beam splitter) in its own rest frame, i.e. in the S' frame.

$$\Delta t' = \frac{L}{c}$$

and

$$\Delta x' = 0$$

Therefore

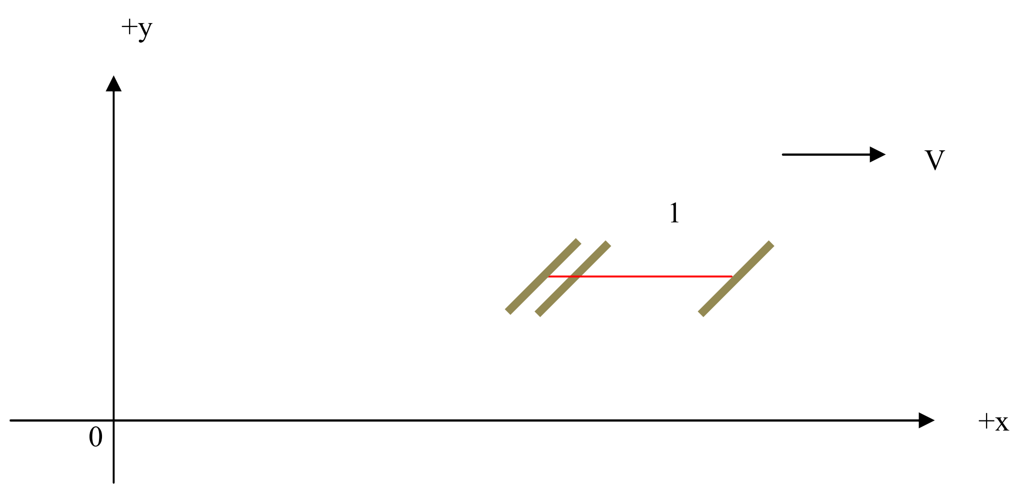
$$\Delta t = \gamma \left(\Delta t' + \frac{v \Delta x'}{c^2} \right) = \gamma \left(\frac{L}{c} + \frac{v * 0}{c^2} \right) = \gamma \frac{L}{c}$$

The total time delay of beam 2 will be the sum of the forward and backward times.

$$T2 = \gamma \frac{L}{c} + \gamma \frac{L}{c} = \gamma \frac{2L}{c}$$

Round trip time of beam 1

Next we determine the round trip time of light beam 1, in the S frame.



Forward flight time

Let us first determine the forward flight time (from beam splitter to mirror).

Δt' is the forward time of beam 2 in the S' frame.

$$\Delta t' = \frac{L}{c}$$

and

$$\Delta x' = L$$

Therefore

$$\Delta t = \gamma\left(\Delta t' + \frac{v\Delta x'}{c^2}\right) = \gamma\left(\frac{L}{c} + \frac{vL}{c^2}\right) = \gamma\,\frac{L}{c}\,(1 + \frac{V}{c})$$

Backward flight time

Next we determine the backward time of beam 1 (from mirror to beam splitter)

Δt' is the backward flight time of beam 2 in the S' frame.

$$\Delta t' = \frac{L}{c}$$

and

$$\Delta x' = -L$$

The negative sign in the above equation is because the x-coordinate of the second event (arrival at beam splitter) is less than the x-coordinate of the first event (reflection at mirror).

Therefore

$$\Delta t = \gamma\left(\Delta t' + \frac{v\Delta x'}{c^2}\right) = \gamma\left(\frac{L}{c} + \frac{-vL}{c^2}\right) = \gamma\,\frac{L}{c}\,(1 - \frac{V}{c})$$

The round trip time of beam 1 , as observed from the reference frame S will be the sum of the forward and the backward time delays.

$$T1 = \gamma\,\frac{L}{c}\left(1 + \frac{V}{c}\right) + \gamma\,\frac{L}{c}\left(1 - \frac{V}{c}\right)$$

$$= \gamma\,\frac{L}{c}\left(1 + \frac{V}{c} + 1 - \frac{V}{c}\right) = \gamma\,\frac{2L}{c}$$

The difference between time delay T1 and T2 will be zero.

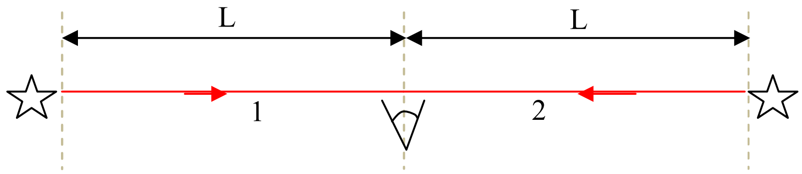
$$T1 - T2 = \gamma \frac{2L}{c} - \gamma \frac{2L}{c} = 0$$

This agrees with the difference in the time delays as observed from the reference frame S' , hence the NULL fringe shift of the Michelson-Morley experiment is explained.

Failure of Lorentz transformation and Special Relativity

We have seen that the Lorentz-Fitzgerald transformations correctly explain the Michelson-Morley experiment. In this section the failure of Lorentz-Fitzgerald transformation, which has been hidden for one hundred years, will be exposed.

Consider the following experiment.



First we analyze the experiment in the reference frame in which the experimental apparatus is at rest, i.e. in reference frame S'.

The time delay of light beam 1 will be:

$$T1' = \frac{L}{c}$$

The time delay of light beam 2 will be:

$$T2' = \frac{L}{c}$$

The difference between the time delay of beam 1 and the time delay of beam 2 is zero.

$$T1' - T2' = \frac{L}{c} - \frac{L}{c} = 0$$

Now consider the experiment in the reference frame in which the experimental apparatus is moving with velocity V in the + x direction, i.e. in S. According to Special Relativity theory, we expect the same time difference of zero, when the experiment is observed in the reference frame S. Let us see if this is the case.

Beam 1

Δt' is the time delay of light beam 1 in the S' frame.

$$\Delta t' = \frac{L}{c}$$

and Δx’ is the difference in the x coordinates of the two events, emission of light at source and detection at detector, in the S’ frame.

$$\Delta x' = L$$

Therefore,

$$\Delta t = \gamma\left(\Delta t' + \frac{v\Delta x'}{c^2}\right) = \gamma\left(\frac{L}{c} + \frac{vL}{c^2}\right) = \gamma\,\frac{L}{c}\,(1 + \frac{v}{c})$$

Therefore, the time delay of beam 1 as observed in the S reference frame is

$$T1 = \gamma\,\frac{L}{c}\,(1 + \frac{v}{c})$$

<u>Beam 2</u>

Now we consider the time delay of beam 2 , in the S frame.

Δt’ is the time delay of light beam 2 in the S’ frame.

$$\Delta t' = \frac{L}{c}$$

and Δx’ is the difference in the x coordinates of the two events, i.e. emission of light at source and detection at detector, in the S’ frame.

$$\Delta x' = -L$$

Note the negative sign in the above equation again.

Therefore

$$\Delta t = \gamma\left(\Delta t' + \frac{v\Delta x'}{c^2}\right) = \gamma\left(\frac{L}{c} + \frac{-vL}{c^2}\right) = \gamma\,\frac{L}{c}\,(1 - \frac{v}{c})$$

Therefore, the time delay of beam 2 as observed in the S frame is

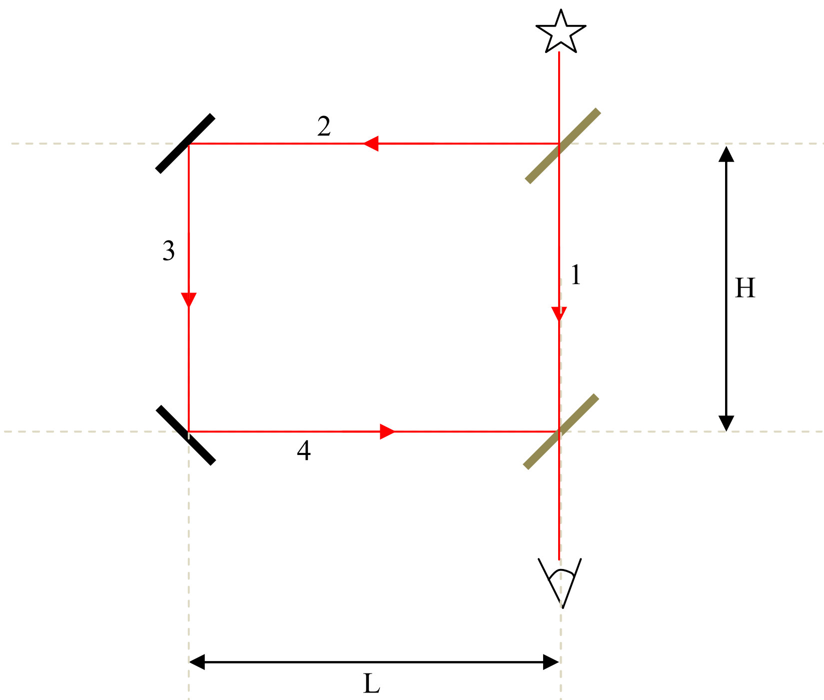
$$T2 = \gamma\,\frac{L}{c}\,(1 - \frac{v}{c})$$

The difference in the time delays of the two beams, as observed in S will be:

$$T1 - T2 = \gamma\,\frac{L}{c}\left(1 + \frac{v}{c}\right) - \gamma\,\frac{L}{c}\left(1 - \frac{v}{c}\right) = \gamma\,\frac{L}{c}\left(1 + \frac{v}{c} - 1 + \frac{v}{c}\right) = \gamma\,\frac{2Lv}{c^2}$$

which is not zero !

Consider another experiment, an interferometer shown below.



We first analyze the experiment in the reference frame in which it is at rest, i.e. in S' .

Beam 1

Time delay of beam 1 will be:

$$T1' = \frac{H}{c}$$

Beam 2

Time delay of beam 2 will be:

$$T2' = \frac{L}{c}$$

Beam 3

Time delay of beam 3will be:

$$T3' = \frac{H}{c}$$

Beam 4

Time delay of beam 4 will be:

$$T4' = \frac{L}{c}$$

The total time delay of beam 234 will be:

$$T234' = \frac{L}{c} + \frac{H}{c} + \frac{L}{c} = \frac{2L + H}{c}$$

The difference between time delay of beam 1 and time delay of beam 234 will be:

$$T234' - T1' = \frac{2L + H}{c} - \frac{H}{c} = \frac{2L}{c}$$

Now we calculate the difference in time delays of light beam 1 and light beam 234 in the S reference frame. According to Special Relativity the time difference of the two beams should be $\frac{2L}{c}$.

<u>Beam 1</u>

$$\Delta t' = \frac{H}{c} \quad and \quad \Delta x' = 0$$

Therefore

$$\Delta t = \gamma \left(\Delta t' + \frac{v\Delta x'}{c^2} \right) = \gamma \left(\frac{H}{c} + \frac{v * 0}{c^2} \right) = \gamma \ \frac{H}{c}$$

Therefore, the time delay of beam 1 in the S reference frame is

$$T1 = \gamma \ \frac{H}{c}$$

<u>Beam 2</u>

$$\Delta t' = \frac{L}{c} \quad and \quad \Delta x' = -L$$

Therefore,

$$\Delta t = \gamma \left(\Delta t' + \frac{v\Delta x'}{c^2} \right) = \gamma \left(\frac{L}{c} + \frac{-vL}{c^2} \right) = \gamma \ \frac{L}{c} \ (1 - \frac{v}{c})$$

<u>Beam 3</u>

$$\Delta t' = \frac{H}{c} \quad and \quad \Delta x' = 0$$

$$\Delta t = \gamma \left(\Delta t' + \frac{v \Delta x'}{c^2} \right) = \gamma \left(\frac{H}{c} + \frac{v * 0}{c^2} \right) = \gamma \frac{H}{c}$$

Beam 4

$$\Delta t' = \frac{L}{c} \qquad and \quad \Delta x' = L$$

$$\Delta t = \gamma \left(\Delta t' + \frac{v \Delta x'}{c^2} \right) = \gamma \left(\frac{L}{c} + \frac{vL}{c^2} \right) = \gamma \frac{L}{c} \left(1 + \frac{v}{c} \right)$$

The total time delay of beam 234 will be:

$$T234 = \gamma \frac{L}{c} \left(1 - \frac{v}{c} \right) + \gamma \frac{H}{c} + \gamma \frac{L}{c} \left(1 + \frac{v}{c} \right) = \frac{\gamma}{c} \left(2L + H \right)$$

The difference in time delays of beam 1 and beam 234 , as observed in S will be

$$T234 - T1 = \frac{\gamma}{c} \left(2L + H \right) - \gamma \frac{H}{c} = \gamma \frac{2L}{c}$$

The time difference of the two light beams is $\frac{2L}{c}$ in S' , but it is $\gamma \frac{2L}{c}$ in S ! The differences in the time delays of the two beams are not equal again, predicting a fringe shift !

This clearly disproves Special Relativity.

An alternative model of the speed of light

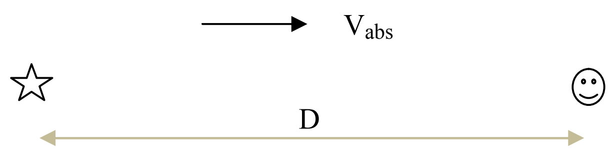
Despite the failure of the Michelson-Morley experiment to detect absolute motion, absolute motion has been detected by other kinds of experiments, such as the Sagnac effect, the Miller experiment, the Silvertooth, the Marinov and the Roland De Witte experiments and also CMBR anisotropy. This shows some problem in the interpretation of absolute motion. Absolute motion was presumed to be motion relative to the ether, but the ether was disproved by the MM experiment.

A new interpretation of absolute motion and the speed of light is proposed in this paper. In this paper we will prove the existence of absolute motion; we won't discuss the 'relative to what question' .

In an effort to explain the Michelson-Morley and the Sagnac experiments, I came across the seed of idea which can reconcile these apparently contradicting experiments, which developed into Apparent Source Theory (AST)after years of effort and confusions. There is no theory of the speed of light to this date that truly explains both these experiments with the same treatment.

Apparent Source Theory (AST)

Consider a light source and an observer absolutely co-moving as shown below.

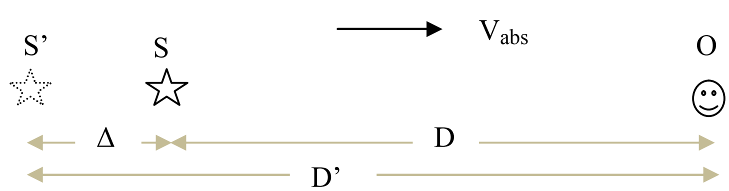


If the source and observer are at absolute rest ($V_{abs} = 0$), the time delay between emission of a light pulse and its detection at the observer will be:

$$T = \frac{D}{c}$$

However, if $V_{abs} \neq 0$, the time delay will be different, i.e. $T \neq \frac{D}{c}$. We may *postulate* that the effect of absolute motion is to create a change in the time delay T. At this point we make a careful interpretation. Why does time delay T vary with absolute velocity? Is it because the speed of light is variable relative to the observer, as for a sound wave? No, because this would imply a medium for light transmission which was disproved by the Michelson-Morley experiment. For co-moving source and observer, the speed of light is always equal to *c*. How then does T vary with absolute velocity if c is constant, as physical distance D is also constant ?

This puzzle is solved as follows: time delay T varies with absolute velocity because the source observer distance *apparently* changes with absolute velocity. For absolutely co-moving source and observer, light behaves *as if* the distance between source and observer is different from the actual, physical distance D. In other words, the position of the source apparently changes relative to the observer, for absolutely co-moving source and observer. Relative to the observer, the source appears to be farther than its physical distance D, in the case of an observer in front of the source with reference to the direction of motion.



The source appears to have shifted away from the observer by distance Δ. The observer O measuring the time delay T between emission and detection of the light pulse will be able to make correct explanation and prediction only by assuming that the light pulse started from S' and not from S, and by assuming that the speed of light is equal to c relative to the apparent source S'.

The amount by which the source apparently shifts position is determined as follows. The time elapsed for the light pulse to go from apparent source position S' to the observer is equal to the time elapsed for the source to move from position S' to S. i.e.

$$\frac{D'}{c} = \frac{\Delta}{V_{abs}}$$

But

$$D' = D + \Delta$$

From the above two equations

$$D' = D\frac{c}{c - V_{abs}} \quad \text{and} \quad \Delta = D\frac{V_{abs}}{c - V_{abs}}$$

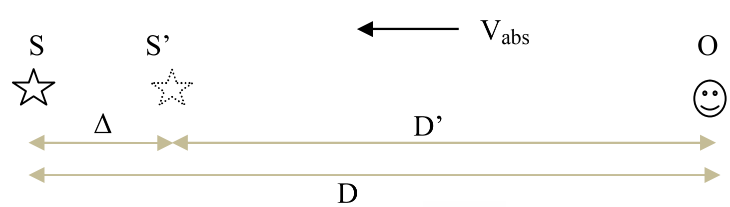
The time delay T will be:

$$T = \frac{D'}{c} = \frac{D}{c - V_{abs}}$$

In the above *interpretation*, each apparent source position S' applies only to a single point relative to the source. This means that the apparent source position is different for observers at different positions relative to the source. Each observer sees their own apparent source. This is because the apparent source distance D' depends on the physical source distance D and on absolute velocity V_{abs}.

Thus the effect of absolute motion is just to create an apparent change in position (distance and direction) of the source relative to the observer. To analyze an experiment involving absolutely co-moving source and observer, therefore, we just replace the real source with an apparent source. Then we analyze the experiment by assuming the speed of light to be constant *relative to the apparent source*. ***The speed of light is always constant relative to the apparent source.***

Similar analysis applies for an observer behind the light source, i.e. an observer 'chasing' a light source. In this case, the source *appears* to have shifted towards the observer by an amount Δ.



$$\frac{D'}{c} = \frac{\Delta}{V_{abs}}$$

But

$$D' = D - \Delta$$

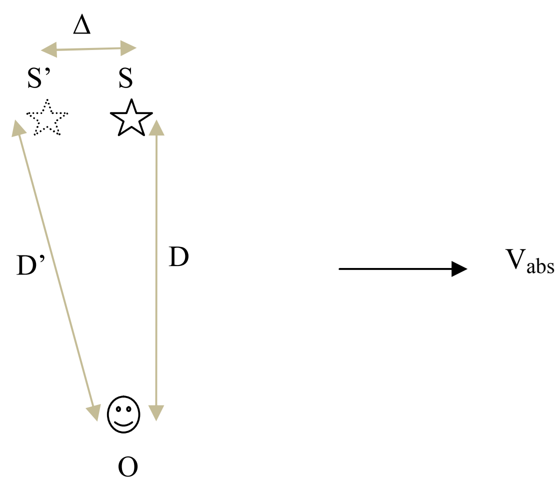
From the above two equations

$$D' = D\frac{c}{c + V_{abs}} \quad \text{and} \quad \Delta = D\frac{V_{abs}}{c + V_{abs}}$$

The time delay T will be:

$$T = \frac{D'}{c} = \frac{D}{c + V_{abs}}$$

Next imagine a light source S and an observer O absolutely co-moving as shown below, with the relative position of S and O orthogonal to the direction of their common absolute velocity.



During the time interval that the light pulse goes from S' to O, the source goes from S' to S.

$$\frac{D'}{c} = \frac{\Delta}{V_{abs}}$$

But,

$$D^2 + \Delta^2 = D'^2$$

From the above two equations

$$D' = D\frac{c}{\sqrt{c^2 - V_{abs}{}^2}}$$

Therefore, the time delay *T* between emission and detection of the light pulse in this case will be:

$$T = \frac{D'}{c} = \frac{D}{\sqrt{c^2 - V_{abs}{}^2}}$$

From the above interpretation, we can work out the procedure to analyze any light speed experiment as follows:

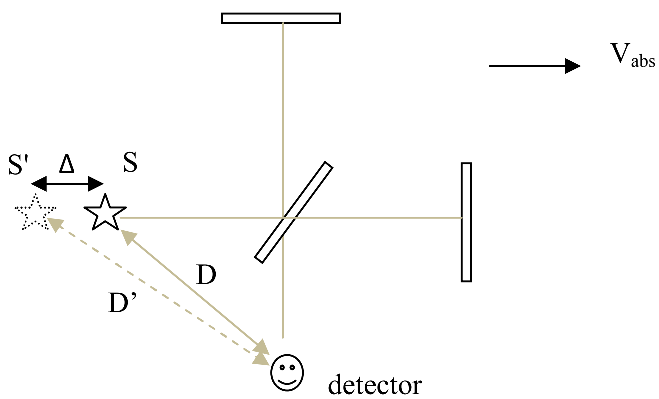
1. Replace the real source with an apparent source
2. Analyze the experiment by assuming that the speed of light is constant relative to the apparent source.

This means that we replace the real source with an apparent source to account for absolute motion. Once we put the apparent source at the apparent source position, we assume space to be Galilean, and analyze the experiment by assuming the speed of light to be constant c relative to the apparent source. This is analogous with conventional emission theory in which the speed of light is constant relative to the source.

The distance D we use to determine apparent source position D' in the above analyses is always the *direct* source observer distance, even if no light comes directly from the source to the observer, but through mirrors as in the Michelson-Morley experiment.

Michelson-Morley experiment

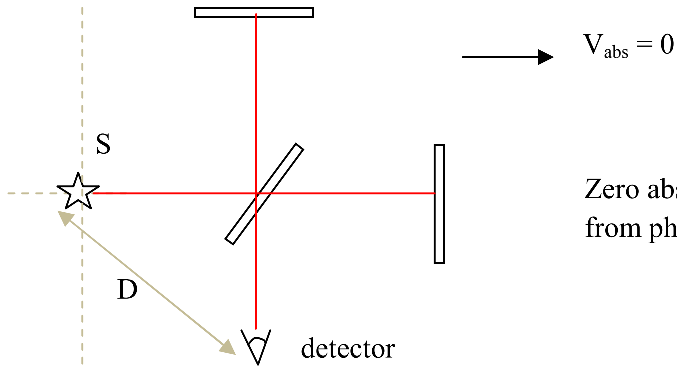
Now let us apply Apparent Source Theory (AST) to the Michelson-Morley experiment.



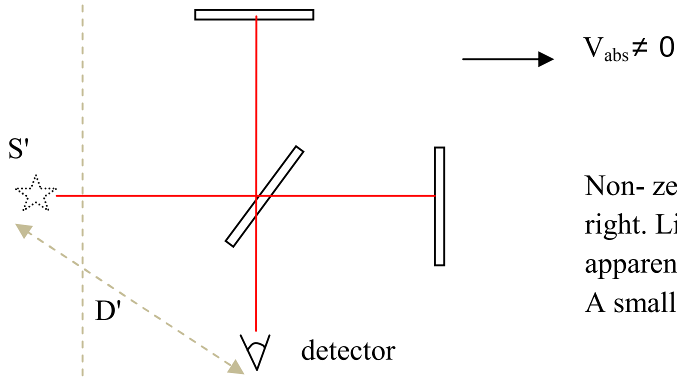
In the above diagram of Michelson-Morley experiment, the real source S has been replaced by an apparent source S'. Once we replace S with S', we assume the speed of light to be constant relative to S'. We may think of this as applying conventional emission theory to S'.

To understand the above analysis, one only needs to ask: assuming the device is at absolute rest, will actually/ physically moving the source from position S to position S' create any fringe shift? The obvious answer is there is NO significant fringe shift will be observed because both the lateral and longitudinal beams would be affected equally. However, it can be shown that a small fringe shift will occur. This may be the small fringe shifts observed in the different experiments such as the Miller experiments.

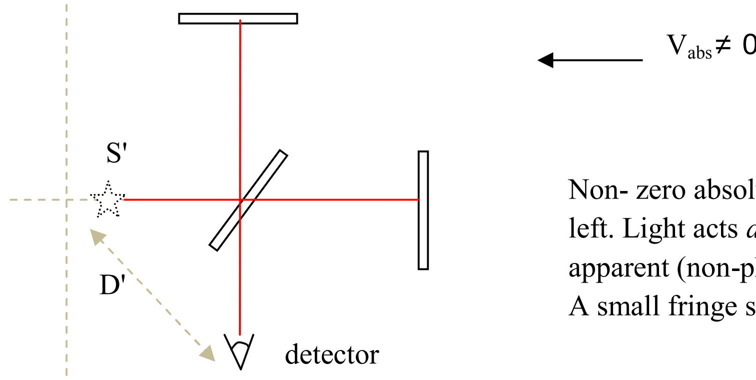
The above diagram is redrawn below to show cases of zero absolute velocity and non zero absolute velocities. No (significant) fringe shift will be expected simply because the source position has changed. Note that *physically* light always starts from the real source S, but light acts *as if* it started from apparent source S'.



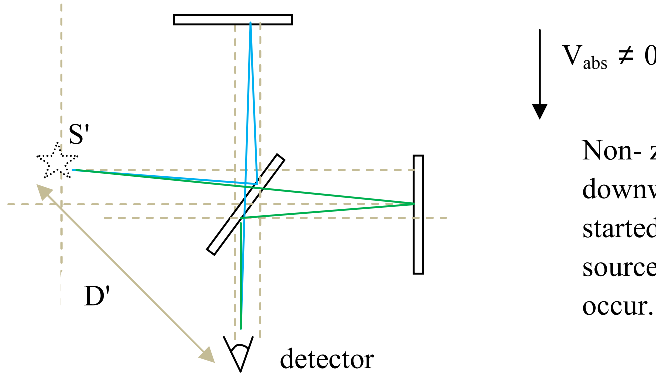
Zero absolute velocity. Light starts from physical source S.



Non- zero absolute velocity to the right. Light acts *as if* it started from apparent (non-physical) source S'. A small fringe shift will occur.



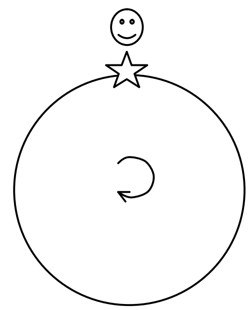
Non- zero absolute velocity to the left. Light acts *as if* it started from apparent (non-physical) source S'. A small fringe shift will occur.



Non- zero absolute velocity downwards. Light acts *as if* it started from apparent (non-physical) source S'. A small fringe shift will occur.

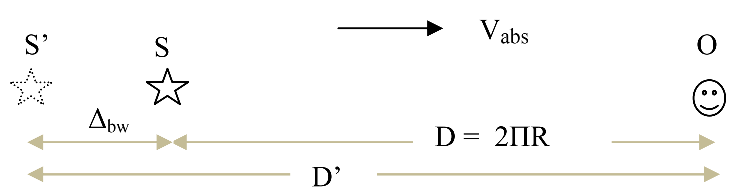
Sagnac effect

Let us consider a hypothetical Sagnac interferometer.



Assume that the light source emits light in the opposite directions tangentially. The two light beams travel in circular paths in opposite directions before being detected at the detector. A circular mirror is used to make light travel in circular path.

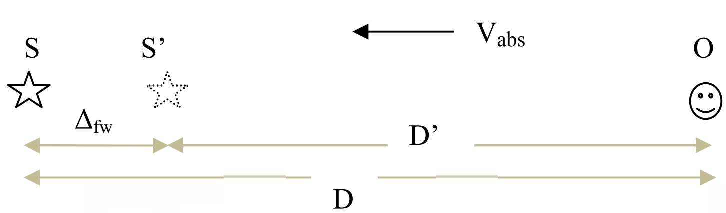
Consider the light emitted in the forward direction. This case can be considered to be an absolute translation problem already discussed, with the observer in front of the source.



From our previous analysis:

$$D' = D\frac{c}{c - V_{abs}} = 2\Pi R\,\frac{c}{c - V_{abs}} \quad \text{and} \quad \Delta_{bw} = D\,\frac{V_{abs}}{c - V_{abs}}$$

The case for light emitted backwards can be represented as follows.



$$D' = D\frac{c}{c + V_{abs}} = 2\Pi R\,\frac{c}{c + V_{abs}} \quad \text{and} \quad \Delta_{fw} = D\,\frac{V_{abs}}{c + V_{abs}}$$

The observer sees two different apparent sources: when looking in the backward direction and when looking in the forward direction. The distance of the apparent source when looking in the backward direction is greater than the physical source observer distance D = 2ΠR. The distance of the apparent source when looking in the forward direction is less than the physical source observer distance D = 2ΠR.With the apparatus rotating, therefore, a fringe shift will be observed at the detector.

The path difference of the forward and back ward beams will be:

$$\Delta = \Delta_{fw} + \Delta_{bw} = D \frac{V_{abs}}{c + V_{abs}} + D \frac{V_{abs}}{c - V_{abs}} = D \frac{2V_{abs}c}{c^2 - {V_{abs}}^2}$$

But , D = 2ΠR and $V_{abs} = \omega R$

From which

$$\Delta = 2\pi R \frac{2V_{abs}c}{c^2 - {V_{abs}}^2} = 4\pi R \frac{\omega R c}{c^2 - \omega^2 R^2} = 4\pi R^2 \frac{\omega c}{c^2 - \omega^2 R^2} = 4A \frac{\omega c}{c^2 - \omega^2 R^2}$$

where $A = \Pi R^2$ is the area of the circle.

Dividing both the numerator and denominator by c^2

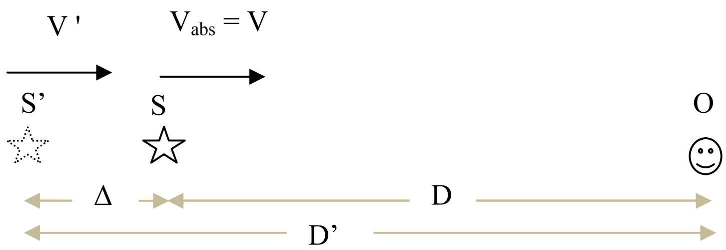
$$\Delta = \frac{4\omega A c}{c^2 - \omega^2 R^2} = \frac{\frac{4\omega A}{c}}{1 - (\frac{\omega R}{c})^2}$$

In the above analysis of a hypothetical Sagnac experiment, we just interpreted it as two absolute translational motions, with the observer chasing the light source and the observer escaping from the light source. There is no reason why we can't consider the Sagnac effect as an absolute translation, at least for this hypothetical, simplest case. This is because the observer is moving along the light paths, just like an observer behind or in front of a light beam, for absolutely co-moving (translating) source and observer.

Moving source experiments

So far we have been considering the special case of absolutely co-moving source and observer. A general principle governing the speed of light is proposed as follows. The procedure of analysis of any light speed experiment is as follows:

1. Determine the distance between the observer and the apparent source *at the instant of emission.* This is determined from source observer physical distance at the instant of emission and *source absolute velocity.*
2. From the absolute velocities of the source and the observer, determine the velocity of the source *relative* to the observer, from which the velocity of the apparent source *relative* to the observer will be determined
3. Solve the problem by assuming that the speed of light is constant *relative to the apparent source*



Now we apply the above general analysis to the specific case of moving source and stationary observer shown above. Consider a light source moving towards an observer that is at absolute rest. We want to show that the speed of light is independent of the speed of the source.

Assume that the distance between source and observer *at the instant of light emission* is D. Assume also that the observer is at absolute rest.

The procedure of analysis is to determine the distance between the *apparent source* and the observer at the instant of emission and the velocity of the apparent source relative to the observer.

The apparent source distance D' at the instant of emission is :

$$D' = D\frac{c}{c - V_{abs}}$$

The velocity V' of the apparent source is determined by differentiating both sides of the above equation with respect to time:

$$D' = D\frac{c}{c - V_{abs}} \Rightarrow \frac{dD'}{dt} = \frac{dD}{dt}\frac{c}{c - V_{abs}} \Rightarrow V' = V\frac{c}{c - V_{abs}}$$

where V is the velocity of the real source and V' is the velocity of the apparent source relative to the observer.

According to AST, the speed of light is constant relative to the apparent source. So the speed of light relative to the observer will be $c + V'$. Therefore, the time elapsed between emission and detection of light will be:

$$T = \frac{D'}{c + V'} = \frac{D\frac{c}{c - V_{abs}}}{c + V\frac{c}{c - V_{abs}}} = \frac{Dc}{c\,(c - V_{abs} + V\,)} = \frac{D}{c} \qquad (\text{ because } V_{abs} = V)$$

Physically the light always starts from the real source S but light behaves as if it started from S' . Even though light appears to have been emitted from an apparent distance D' > D, the increase in distance is exactly compensated by the increase in the velocity of light. The velocity of light relative to the observer is c + V', where V' is the velocity of the apparent source relative to the observer. Therefore, the physically measured speed of light is independent of source velocity.

This shows that the physically measured speed of light is independent of source velocity, as confirmed by several experiments.

Discussion

The main aim of this paper is to present a new *model* of the speed of light that can consistently predict and explain the results of light speed experiments. But a question would surely arise: what is the physical meaning of Apparent Source Theory (AST) ? I would like to note that the physical meaning of AST has no importance in the analysis of light speed experiments, but is only useful for some intuitive understanding of the theory. AST can be understood intuitively as follows: the speed of light is $c + V_{abs}$ in the backward direction and $c - V_{abs}$ in the forward direction *relative to a source* moving with absolutely velocity V_{abs}. This is why the speed of light does not depend on the speed of the source. If a source moving towards a stationary observer emits light, the light will not arrive earlier because the speed of light relative to the observer will be the sum of the speed of light relative to the source in the forward direction (which is $c- V_{abs}$) and the speed of the source relative to the observer : $(c-V_{abs}) + V_{abs} = c$. AST implies bending of light rays relative to the source in lateral directions. Hence AST implies aberration of light even for absolutely co-moving source and observer.

AST turns out to be a fusion of ether (absolute motion) and emission theories. Most of the conventional experiments on the speed of light can be explained *either* by the emission theory *or* by the ether theory. This is a hint that the correct model of the speed of light is some form of fusion of the ether theory and the emission theories.

As a successful theory, AST also gives profound implications regarding the fundamental nature of light itself. The puzzle of light being a local or a non-local phenomenon is a centuries old puzzle and is still unsolved. The solution to the puzzle as implied by AST is proposed as follows:

Light is a dual phenomenon: local and non-local (action at a distance).

The other important problem is the implication of AST on Maxwell's equations. The electric and magnetic fields at every point in space seem to be controlled independently by the source. Consider absolutely co-moving source and observer. The light detected at the point of observation is more accurately understood as coming directly at the speed of light from the (*apparent*) source, and not from an adjacent point as in local phenomenon (e.g. sound wave). What is meant here is that light at point of observation comes from adjacent points of space, but we can't observe this physically, we just imagine it. If one tries to observe what is happening at an adjacent point, they will detect a wave coming to that point only. To every point of observation comes *its own* wave. Light is a dual phenomenon: local and non local. The current understanding of Maxwell's equations is based on a tacit assumption of the ether. Electromagnetic wave is still thought to be a local phenomenon, just as material waves, which is wrong. An EM wave propagates from the (apparent) source to the point of observation according to Maxwell's equations. We should not think this as material waves. We can't observe the propagation of the wave in the path between the apparent source and the observer: we just imagine it. *Each point in space surrounding the source observes its own, independent EM wave coming from the (apparent) source.* This is the distinction between electromagnetic waves and material waves. In material waves, all points along the path of a wave see the same wave, only differing in phase. *In the case of a light source (an EM wave source), an independent wave propagates to each point in space !*

Conclusion

We have seen that Apparent Source Theory (AST) can consistently explain the Michelson-Morley experiment, Sagnac effect, moving source experiments, and moving observer experiments. Existing theories of light including Special Relativity, ether theory and emission theory fail on least on one of these experiments.

Thanks to God and His Mother, Our Lady Saint Virgin Mary

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