A Theoretical Framework of Absolute/Relative Motion and the Speed of Light

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Abstract

This author has already proposed a new theory, Apparent Source Theory (AST), that can explain the Michelson-Morley experiment, the Sagnac effect, the Silvertooth experiment, the Roland De Witte experiment, the Venus planet radar range data anomaly (analyzed and reported by Bryan G Wallace) and other experiments. According to AST, there will be an apparent change in position of a light source as seen by the observer, for absolutely co-moving source and observer. The 'null' result of the Michelson-Morley experiment (MMX) is explained as follows. The effect of absolute motion is just to create an *apparent* change in position of the light source relative to the detector. There will be no (significant) fringe shift in the MMX for the same reason that there will be no (significant) fringe shift if the source position was actually, physically shifted slightly. The fringe shift in Sagnac effect is explained as follows. The source will be apparently shifted away relative to the detector when looking in the backward direction and shifted towards the detector when looking in the forward direction, hence creating a path difference. Einstein's thought experiment ('chasing a beam of light') is re-interpreted and used as one of the foundational arguments in this paper. The new interpretation is that it is the *phase* velocity of light that is always constant irrespective of source, observer and mirror velocity. The *group* velocity behaves in a more conventional way: it is independent of source (absolute) velocity but depends on observer and mirror velocity. For an observer moving near the speed of light away from a light source, the phases will still move past the observer at the speed of light while the group will be at rest relative to the observer. The new theoretical framework consists of two theories: 1. Apparent Source theory 2. Exponential Doppler Effect of light theory . The results of many light speed experiments can be derived from these two theories. Apparent Source Theory determines the phase and group delay of light, whereas Exponential Doppler Effect theory determines the frequency/wavelength of light.

Introduction

According to the principle of relativity, no experiment (optical, electromagnetic or mechanical) exists that can detect absolute motion. This presumption has already been conclusively disproved experimentally, such as by the Silvertooth experiment and the coincidence of its result with the COBE CMBR frequency anisotropy experiment. The failure of conventional first and second order experiments to detect absolute motion was not because absolute motion doesn't exist, but because the experimental setups or their understanding were flawed .

This author has already developed a new theoretical frame work[1], of which Apparent Source Theory (AST) is one component, that can explain the outcomes of many experiments that have succeeded and failed to detect absolute motion.

A contradiction of Apparent Source Theory with the phenomenon of stellar aberration was recently discovered, leading to reconsideration of the foundations of the theory.

It will be shown that Apparent Source Theory has firm logical and experimental foundations. The contradiction will also be shown to be only an apparent one.

Einstein's thought experiment, ' chasing a beam of light '

Einstein's thought experiment (' chasing a beam of light ') was a beautiful and compelling argument. It follows directly from the non-existence of the hypothetical light carrying medium(the ether). However, Einstein took the wrong path while trying to understand and 'explain' the constancy of the speed of light, resorting to illogical ideas of relativity of time and space. This thought experiment is re-interpreted in this paper as the constancy of *phase* velocity[1]. The *group* velocity of light behaves in a more conventional way: it is independent of source absolute velocity but varies with observer and mirror velocity. Einstein never made this distinction and, in fact, it was the failure to make this distinction that resulted in the creation, development and acceptance of Einstein's theories of relativity.

For an observer moving away near the speed of light from a light source, the phases will still go past the observer at the speed of light, but the group will be at rest relative to the observer or 'frozen'.

Imagine a coherent light source and an observer initially at rest, with distance D between them.

The observer notes the phase of the light. Next imagine that the observer starts moving away from the source instantaneously with velocity $V = 0.1\ c$. The constancy of the phase velocity implies that, unconventionally, the phase of the detected light will not change due to motion of the observer. The phase detected by the observer depends only on the source-observer distance at the instant of light emission. Motion of the observer after emission of the light will not affect the phase and the phase velocity of the light.

The constancy of the *phase* velocity of light was crucial in the pathway to the discovery of the new theory, Apparent Source Theory[1], already proposed by this author and will be used as the foundational arguments for the correctness of Apparent Source Theory .

Exponential law of Doppler effect of light

From the theory of constancy of the phase velocity of light proposed above follows an immediate question: what is the law governing the Doppler effect of light. A new theory, Exponential Doppler Effect of Light, has already been proposed by this author[2].

The new theory is formulated as follows.

$$f' = f\, e^{\frac{V}{c}} \lambda' = \lambda\, e^{\frac{-V}{c}}$$

where*e* is Euler's constant and *V* is positive for source and observer approaching each other.

This formula fulfills the constant phase velocity of light proposed above.

$$f'\lambda' = f\, e^{\frac{V}{c}} * \lambda\, e^{\frac{-V}{c}} = f\,\lambda = c$$

It has been shown in paper[2] that this theory can explain the Ives-Stilwell experiment.

The Michelson-Morley experiment and the Sagnac effect

The Michelson-Morley experiment might be explained by the constant phase velocity proposed above. Since the phase velocity of light is always constant, no fringe shift would be observed in the Michelson-Morley experiment.

The Michelson-Morley experiment was carried out using sunlight and star light also. The constancy of phase velocity can explain the null results of these experiments also.

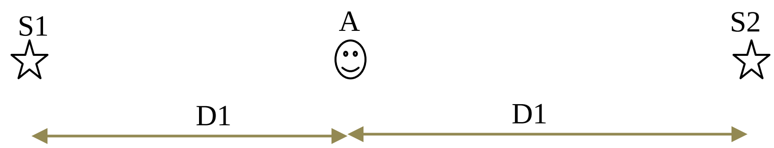
However, the 'constant phase velocity' theory faces an insurmountable problem with the Sagnac effect. Since the phase velocity of light is always constant relative to the observer, there would be no fringe shift when the Sagnac apparatus is rotating. In fact, the Sagnac effect in combination with the postulate of constancy of the phase velocity of light played a crucial role in the discovery and formulation of Apparent Source Theory by this author.

Constant phase velocity and constant/variable group velocity of light

The phase velocity of light is always constant; the group velocity of light varies with observer and mirror velocity, but is independent of source velocity.

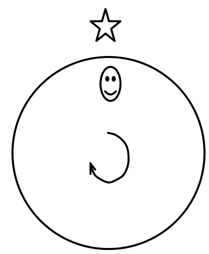
This theory can explain the null result of modified Michelson-Morley experiments using star light and Sun light. The A. Michelson moving mirror experiment, together with the Q Majorana moving source and moving mirror experiments, in combination with the argument of nonexistence of the ether, confirms the constancy of the phase velocity of light. The group velocity of light has been experimentally shown to vary (c ± V) with observer velocity[6]. This theory can explain the Michelson-Morley experiment, but fails to explain the Sagnac effect. Note that it is the phase velocity, not the group velocity that is relevant in all experiments measuring changes in phase differences, by observing fringe shifts or other means. The A. Michelson moving mirror experiment is a proof that the group velocity of light, which varies with mirror velocity and with observer velocity, is irrelevant in such experiments. This theory can be used to design and explain an experiment that can detect absolute motion by using two light sources, by using time of flight method, in which the group velocity is relevant. The group velocity of light is relevant only in time of flight experiments.

This theory particularly fails in the Silvertooth and the Roland De Witte experiments.



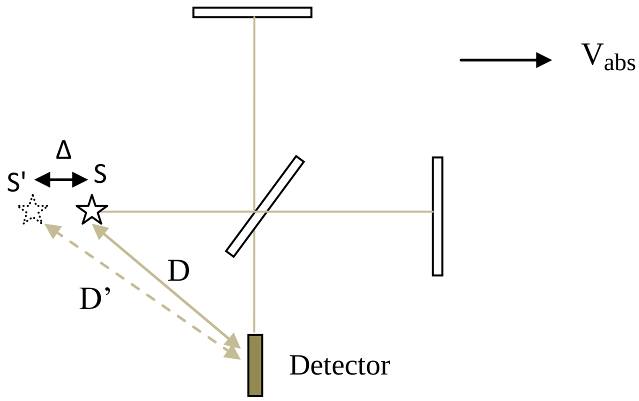
Apparent Source Theory (AST)

Consider a hypothetical Sagnac interferometer, with light propagating in a circular path by continuous reflection from a circular mirror.



If one sticks to the (compelling) postulate of the constancy of the phase velocity of light, the only way to explain the fringe shift in the Sagnac effect is to assume an apparent change in position of the light source as seen by the detector. The light source apparently shifts towards the observer/detector when 'looking' in the forward direction, and away from the detector when looking in the backward direction. The detector is at rest relative to the two apparent sources (when looking forward and backward) , the apparent path lengths of the forward and backward light beams will differ and hence a fringe shift will occur. This is the new theory, Apparent Source Theory (AST) , already proposed in [1] by this author.

This theory (AST) can easily explain the Michelson-Morley experiment null result.



According to Apparent Source Theory, there will be an apparent change in position of the light source as seen by the detector. The apparent change in source position is determined by the source-detector direct distance D, the magnitude of the absolute velocity V_{abs} and the orientation of the experimental apparatus (more precisely, the orientation of the source observer line) with respect to the Earth's absolute velocity vector.

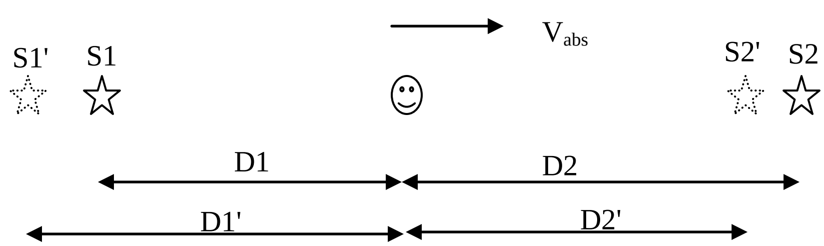
As shown in the above figure, the *apparent* change in source position will not result in any (significant) fringe shift for the same reason that no (significant) fringe shift will occur if the source position was *actually*, *physically* shifted slightly because both the longitudinal and transverse light beams would be affected (delayed or advanced) identically.

Additional experimental evidences of Apparent Source Theory

A contradiction of AST with the phenomenon of stellar aberration (to be presented later on) has brought a new challenge to AST. This led to the reconsideration of the foundations of AST. The purpose of this paper is to present compelling experimental and logical evidences of AST, as an argument that the contradiction between AST and stellar aberration is only an apparent one. Here, we will see additional experimental evidences of AST.

The Roland De Witte experiment

The Roland De Witte experiment detected absolute motion by comparison of the phases of two signals from two RF signal sources.



The constancy of the phase velocity of light predicts a null result for the Roland De Witte experiment. The only way to explain the non-null result of this experiment is to assume an apparent change in the position of the light source, as seen by the observer/detector (as seen from the point of observation), for absolutely co-moving source and observer/detector, which is Apparent Source Theory.

The Venus planet radar range data anomaly (Bryan G Wallace)

The Venus planet radar range experiment is an evidence for emission theory of light. This experiment disproves ether theory and the Special Theory of Relativity. AST, as a fusion of ether theory and emission theory, is the only theory that can explain the Venus planet range data anomaly and also experiments that detect absolute motion.

Solar system observations

Mercury perihelion advance, stability of planetary orbits, direction of Sun's gravity on Earth

Paul Gerber had shown that Mercury perihelion advance can be explained by assuming finite speed (light speed) of gravity. In [1] it has been shown that gravity is just a net electrostatic force: a slight difference between attractive forces between opposite charges and the repulsive force between similar charges. From the experimental observations argued and reported by Tom Van Flandern [3], this author concluded [1] that the speed of gravity must have dual nature: finite (light speed) and infinite.

The direction of Sun's gravitational field on Earth is the same as the direction of arrival of light from the Sun, except for a small 20 arc seconds difference caused by the phenomenon of light aberration, which is due to the relative motion (30 Km/s) of the Earth and the Sun.

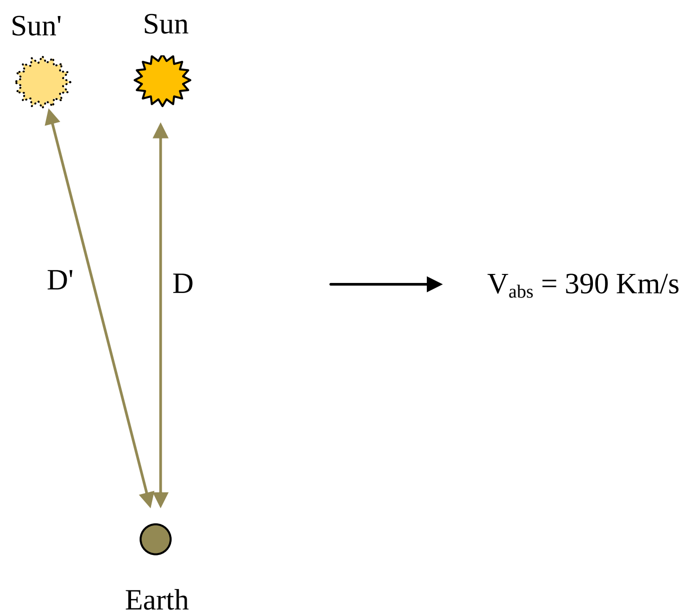
We know that the speed of static fields (electrostatic field, magneto-static field and gravitational field) is infinite. A crucial experiment [4] has been performed that showed that the electric field of a moving electron is rigidly carried by the electron. However, this experiment reveals only one aspect (infinite speed aspect) of the dual nature of the speed of electrostatic fields.

The Silvertooth experiment and the COBE satellite CMBR experiments have revealed that the solar system has an absolute velocity of about 390 Km/s towards constellation Leo.

The question is: if the solar system has such a large absolute velocity of 390 Km/s , how can the direction of arrival of Sun light be almost the same as the direction of Sun's gravity on Earth ? If we assume infinite speed of gravity, this would also imply infinite speed of light, which is wrong. Another possibility is for the speed of gravity to be equal to the speed of light. This is also conceptually wrong because it is not possible to conceive what is meant by finite speed for static fields. Moreover, the speed of electrostatic fields has been proved experimentally to be infinite[4]. Assuming that gravity is fundamentally an electrostatic field, the literal idea of finite speed of gravity is also disproved. What is the solution to this puzzle ?

The only solution to this problem is to assume that the speed of static fields has *dual nature*: *finite (light speed) and infinite.*

Infinite speed of gravity, as proposed by Newton, cannot explain Mercury perihelion advance. The phenomenon of Mercury perihelion advance was explained by Paul Gerber by assuming finite speed (light speed) of gravity. On the other hand, experiments[4] have shown that the speed of static fields is infinite. The only way out of this paradox is to assume dual nature of the speed of static fields: finite (light speed) and infinite.



According to Apparent Source Theory, there will be an apparent change in position of the Sun as seen by the Earth. Therefore, light and gravity come from the direction of the apparent Sun (Sun') and not from the direction of the real Sun (Sun). This is an observational evidence of finite speed (light speed) of gravity. How does the infinite speed of gravity manifest in this system? Imagine that the absolute velocity of the Solar System increased instantaneously from 390 Km/s to 1000 Km/s. The infinite speed of gravity manifests itself by an *instantaneous* change in apparent position of the Sun. Therefore, while the coincidence of the direction of the apparent position of the Sun and the direction of the Sun's gravity on Earth shows finite speed(c) of gravity, instantaneous change in the apparent position of the Sun (as observed from Earth) due to instantaneous change in absolute velocity of the Solar system would show infinite speed of gravity.

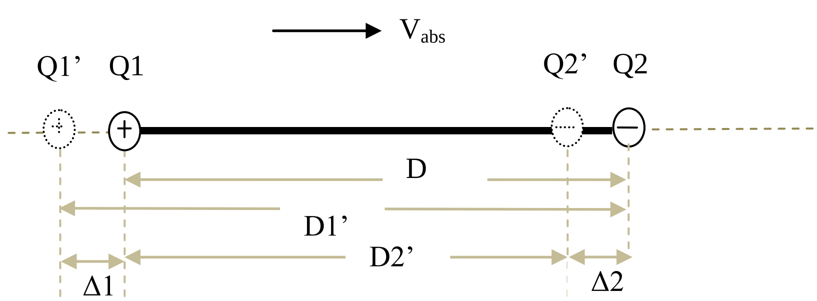
Tom Van Flandern[3] argued that the speed of gravity should be infinite for the observed orbital stability of planetary systems. However, as argued above this literal assumption of infinite speed of gravity fails to explain the phenomenon of Mercury perihelion advance and it would also wrongly imply infinite speed of light because of the coincidence (except for the 20 arc seconds difference due to light aberration caused by Earth-Sun relative velocity of 30 Km/s) of the direction of arrival of Sun light and the direction of Sun's gravity on the Earth. This may be correct only if the Solar system is at absolute rest; we know that the Solar system has an absolute velocity of 390 Km/s, towards constellation Leo. In[1] it has been shown that Apparent Source Theory can explain the stability of planetary orbits, without the literal assumption of infinite speed of gravity.

Therefore, the phenomena of Mercury perihelion advance, the coincidence of direction of Sun light and the direction of Sun's gravity on the Earth and the stability of planetary orbits are astronomical evidences for Apparent Source Theory.

Biefeld-Brown effect

The Biefeld-Brown effect is a phenomenon that is completely mysterious to figure out usingconventional physics. According to Coulomb's law, for two co-moving charged balls fixed to the ends of a rigid rod, the forces of attraction or repulsion of one charge on the other are exactly equal and hence no net force will be exerted on the rod. The Biefeld-Brown effect disproves this assumption. It has been observed in many experiments that a net force exists.

Apparent Source Theory predicts this phenomenon. Imagine two charges Q1 and Q2 each fixed to the two ends of a rigid rod. Assume that the charge system has absolute velocity to the right.



D is the actual, physical distance between real charges Q1 and Q2. D1' is the apparent distance of Q1 as seen by Q2. We can also say that D1' is the distance of apparent charge Q1' from real charge Q2. D2' is the apparent distance of Q2 as seen by Q1.We can also say that D2' is the distance of apparent charge Q2' from real charge Q1.

Now the electrostatic force exerted by Q1 on Q2 will be:

$$F_{12} = \frac{1}{4\pi\varepsilon_0}\frac{Q1\,Q2}{(D1')^2}$$

The electrostatic force exerted by Q2 on Q1 will be:

$$F_{21} = \frac{1}{4\pi\varepsilon_0}\frac{Q1\,Q2}{(D2')^2}$$

But

$$D1' = D\,\frac{c}{c - V_{abs}} \text{ and } \quad D2' = D\,\frac{c}{c + V_{abs}}$$

The above equations for D1' and D2' result from new interpretations of 'speed' of electrostatic fields proposed in my paper[1].

The net force on the rod will be:

$$\Delta F = F_{21} - F_{12} = \frac{1}{4\pi\varepsilon_0}\frac{Q1\,Q2}{(D2')^2} - \frac{1}{4\pi\varepsilon_0}\frac{Q1\,Q2}{(D1')^2} = \frac{1}{4\pi\varepsilon_0} Q1\,Q2\,\left(\frac{1}{(D2')^2} - \frac{1}{(D1')^2}\right)$$

$$\Delta F = \frac{1}{4\pi\varepsilon_0}\frac{Q1\,Q2}{D^2}\left(\frac{4\,V_{abs}}{c}\right)$$

There is a net force on the system ! The force is directed in the direction of the absolute velocity.

This has a profound implication: free energy !

Conclusions regarding Apparent Source Theory

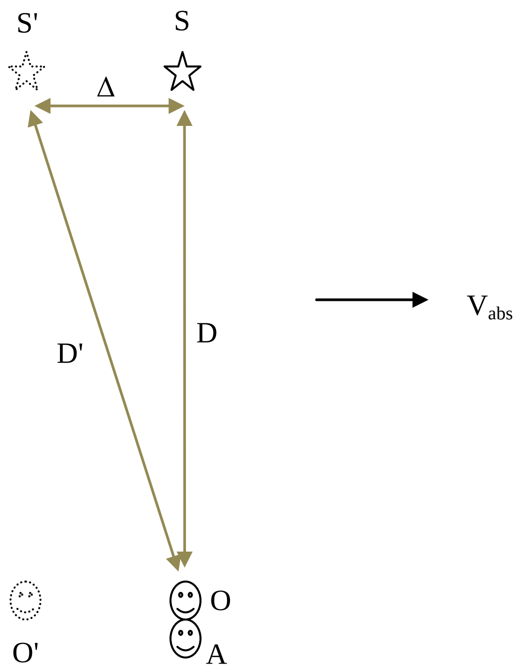
Considering the logical and experimental foundations of AST presented so far, it is reasonable to assume that Apparent Source Theory is a correct theory of light. With so many evidences supporting AST, the existence of some contradictions with AST is mostlikely to be an apparent one, stemming from the conflict between our simplistic, conventional thinking and the subtle nature of the speed of light.This author found that AST is in (apparent) contradiction with the phenomenon of stellar aberration.

Apparent Contradiction between Apparent Source Theory and the phenomenon of stellar aberration

A contradiction between Apparent Source Theory and the phenomenon of stellar aberration, which has been overlooked for years, has been recently discovered by this author. Since AST has a firm logical and experimental foundation, this contradiction is thought to be just an apparent one and an explanation will be provided.

<u>Contradiction of AST with stellar aberration</u>

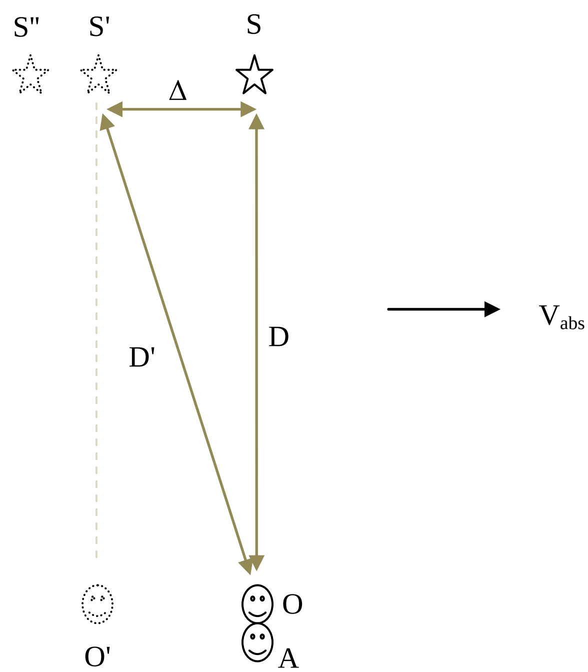
Imagine absolutely co-moving light source S and observer O. Assume also another observer A who is at absolute rest.



Assume that the source emits light at the instant when it is at position S' and the co-moving observer is at position O'. The observer A is always at absolute rest at position A. Assume that moving observer O detects the light just at the instant that he/she is passing through the location of stationary observer A. According to Apparent Source Theory (AST), the co-moving observer O has to point his telescope towards point S' to see the light, due to apparent change in position of the light source for absolutely co-moving source and observer[1]. Since moving observer O and stationary observer A are at the same point at the instant of light detection, observer A will also detect the light at that instant. However, we know that observer A should also point his telescope in the direction of S', the point in space where light was emitted. We see that both the stationary observer and the moving observer would point their telescopes in the same direction to see the light. This is in contradiction with the phenomenon of stellar aberration and is a challenge to Apparent Source Theory.

As another related contradiction, suppose that at the instant of light detection, the co-moving observer O instantaneously starts moving to the left with velocity V_{abs} relative to the source. This would make observer O to be stationary at the point where observer A is located because the forward absolute velocity V_{abs} of observer O to the right will be cancelled by the backward velocity V_{abs} of O relative to the source. Since observer A and observer O are now both stationary at almost the same point in space, both should observe the light in the same way. We know that stationary observer A has to point his telescope towards point S', the point where the source was at the instant of emission. But, according to the theory of light aberration, if observer

O had to point his/her telescope towards S' when co-moving with the source, he should point to point S" when moving relative to S, as shown below. Although observers A and O are at the same point in space and also both at absolute rest (therefore, at rest relative to each other), observer A has to point his telescope in the direction of S' , while observer O has to point his telescope towards direction S", which is a contradiction.

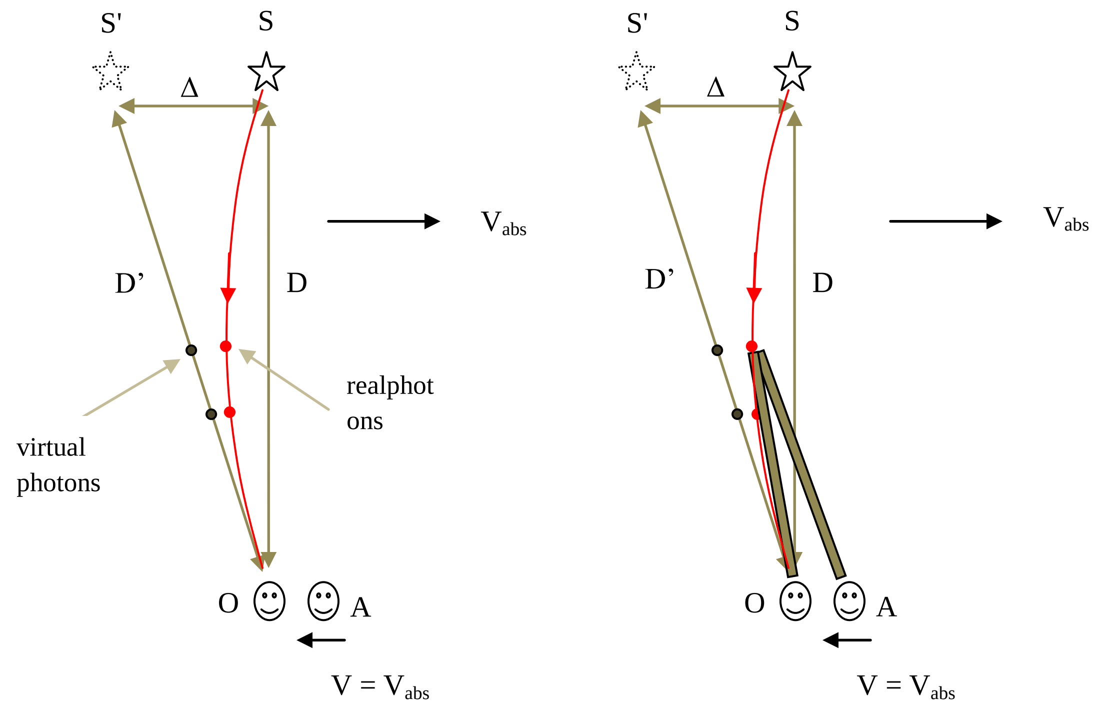


Since both observers are at the same point in space and are at rest relative to each other, the light should come from the same direction for both observers. Which direction is correct ?

Astronomical observations of binary stars shows that stellar aberration depends only on the absolute velocity of the observer and is independent of absolute velocity of the light source[5]. This disproves the theory that observer O will see light coming from direction of S".

Unconventional Apparent Source Theory and conventional understanding of stellar aberration

The contradiction between Apparent Source Theory and stellar aberration is an apparent one, arising from a conflict between conventional understanding of stellar aberration and the subtlety of Apparent Source Theory.



The co-moving observer O has to point his telescope in the direction of S'. The black dots are the virtual photons coming to observer O. However, the real photons (red dots) come to observer O along the curved path. The apparent paradox arose because conventional understanding of stellar aberration was applied to the virtual photons, for the moving observer A. There would be a paradox only if the light coming to the co-moving observer actually came from the direction of S', along the line OS'.

Observer A , who is moving to the left with velocity V_{abs} relative to observer O, should point his telescope not to the virtual photons, but to the real photons, as shown above. Note that, theoretically, observer A should continuously rotate his/her telescope counter- clockwise, from the instant when the photon enters the telescope, until it is detected at the bottom of the telescope, which will happen when observer A is at the same point as co-moving observer O. This is because the photons move along curved path.

Note again that, theoretically, co-moving observer O also needs to rotate his telescope counter-clockwise from the instant that the photon enters the telescope until it is detected at the bottom of the telescope.

Practically, the telescopes are much shorter than shown in the figure and the tangent of the light ray at the point of observer O passes through S' and the curvature of the light ray in the vicinity of observer O will be negligible and observer O needs only to point his telescope towards S'.

Moreover, the time it takes light to travel from the top to the bottom of the telescope is in nanoseconds and it is practically impossible to rotate the telescope with such speed and with the required precision.

As observer A approaches observer O position, the directions of their telescopes become more and more aligned, until both will finally point towards S', at the instant of light detection, when observer A just passes point O (the location of observer O).

That observer A should continuously appropriately rotate his telescope counter- clockwise while moving is theoretical. Practically, the telescope of observer A also is short and will be pointed parallel to line OS' , in the same direction as observer O, in order to see the light at point O.

With this understanding, the contradiction between Apparent Source Theory and the theory of stellar aberration has been shown to be only apparent.

Summary of the new theoretical framework

Although we have seen the different parts of the new theoretical frame work so far, we will present it in a more coherent and complete form, to be applied to any light speed experiment.

<u>Absolutely co-moving light source and observer</u>

We start with co-moving source and observer experiments and establish the procedure of analysis, which is Apparent Source Theory (AST). We then generalize the application of AST to observers moving relative to the light source. We will also see how moving mirror experiments are analyzed within the same theoretical framework.

The new theoretical framework consists of two parts:

1. Apparent Source Theory (AST)

2. Exponential Doppler Effect Theory of light (EDET)

Apparent Source Theory determines the phase (and group) velocity of light, whereas Exponential Doppler Effect theory determines the frequency and wavelength of light.

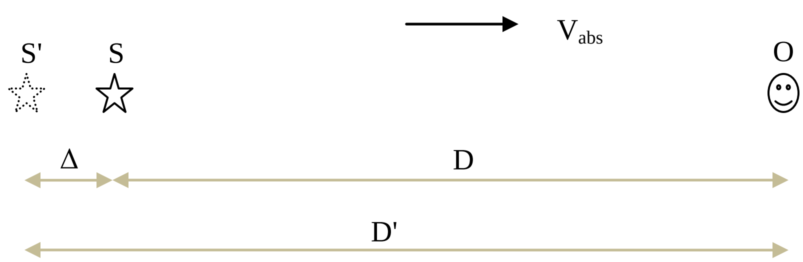
<u>Absolutely co-moving light source and observer</u>

The procedure of analysis of such experiments is fundamental because the outcome of all other experiments is determined by the outcome for a co-moving observer.

The procedure of analysis of light speed experiments involving absolutely co-moving source and observer is:

1. Replace the real source by an apparent source.
2. Analyze the experiment by assuming that the group velocity of light in vacuum is constant *c* relative to the apparent source.

For absolutely co-moving light source S and observer O, with the source behind the observer (as shown below), the source appears to have shifted away from the observer.



The apparent distance (D') of the source relative to the observer is determined as follows.

During the time interval that the source 'moves' from S' to S, light moves from S' to O. i.e.

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

but

$$D' = D + \Delta$$

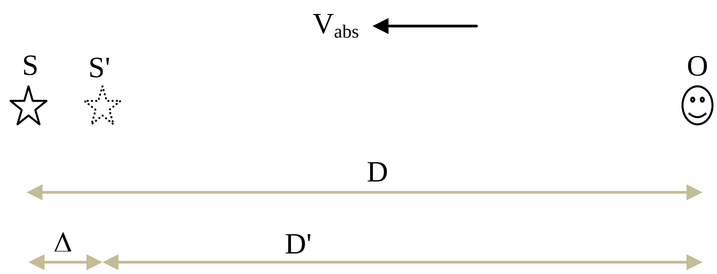
From which,

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

The apparent change in position (Δ) is:

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

For absolutely co-moving light source and observer, with the source in front of the observer (as shown below), the source appears to have shifted towards the observer.



With the same argument as above, during the time interval that the source 'moves' from S' to S, light moves from S' to O. i.e.

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

but

$$D' = D - \Delta$$

From which, the apparent distance (D') of the source relative to the observer is:

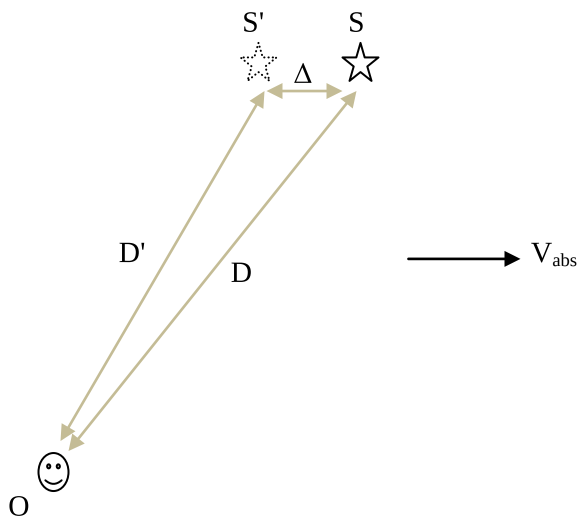
$$D' = D\,\frac{c}{c + V_{abs}}$$

and the apparent change in position (Δ) of the source relative to the observer is:

$$\Delta = D\,\frac{V_{abs}}{c + V_{abs}}$$

Once the real source is replaced by an apparent source, the experiment is analyzed by assuming that the group velocity of light is constant relative to the apparent source. The effect of absolute motion for co-moving light source and observer is to create an apparent change in the *path length*, and not the speed, of light. The physical distance between the source and the observer is D. This is the *path length* of light when the absolute velocity is zero. With the source and observer are in absolute motion ($V_{abs} \neq 0$) , the effective distance between the source and the observer, i.e. the effective path length of light, is no more D, but will change to D'.

The theory of apparent change in position of light source relative to co-moving observer (AST) applies for any orientation of source-observer line relative to the direction of the absolute velocity.



The apparent position (D ') of the source and the apparent change in position (Δ) is determined with the same argument as above.

During the time interval that the source moves from S' to S , light moves from S' to O. i.e.

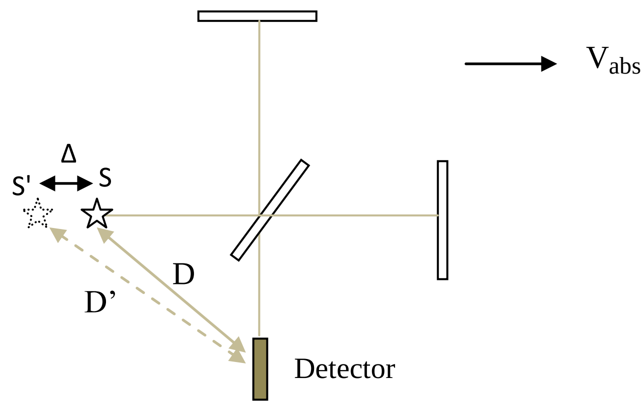
$$\frac{\boldsymbol{\Delta}}{\boldsymbol{V_{abs}}} = \frac{\boldsymbol{D'}}{\boldsymbol{c}} \qquad \text{(vector equation)}$$

But

$$\boldsymbol{D} = \boldsymbol{D'} + \boldsymbol{\Delta} \qquad \text{(vector equation)}$$

This theory applies to all experiments of co-moving light source and observer.

Apparent Source Theory can explain the null result of the Michelson-Morley experiment.



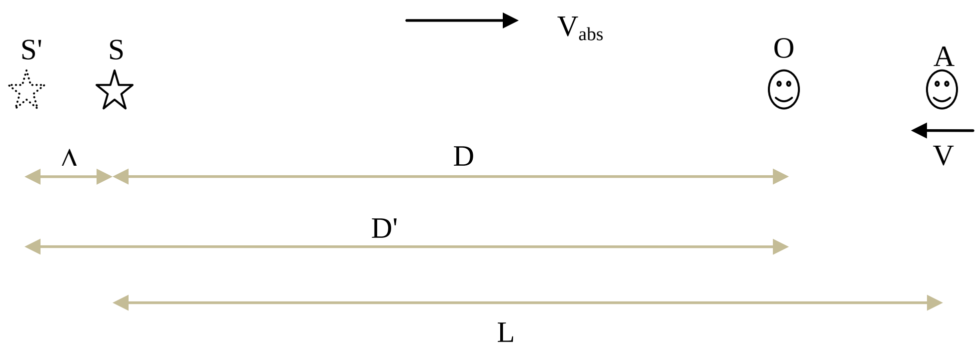
With the experimental apparatus absolutely moving to the right, there will be an apparent change in position of the light source relative to the detector. D is the actual, physical distance between the source and the detector and D' is the apparent distance. Once the real source is replaced by an apparent source, the experiment is analyzed by assuming the speed of light (the group velocity) to be constant relative to the apparent source. The null result of the Michelson-Morley experiment can be easily explained. The best way to understand the null result is to ask: what is the effect of actually, physically slightly changing the position of the source on the position of the fringes ? There will be no (significant) fringe shift because, intuitively, both the transverse and longitudinal beams will be affected equally. Therefore, there will be no (significant) fringe shift due to an apparent change in position of the light source (caused by absolute motion) for the same reason that there will be no significant fringe shift for an actual, physical change of source position.

A key distinction of Apparent Source Theory is that it gets rid of all confusions about 'motion' of the mirrors. Once the real source is replaced by an apparent source to account for absolute motion, the experiment is analyzed as if the whole apparatus is at rest (analogous to conventional emission theory). Motion of the mirrors is considered in ether theory, predicting a fringe shift, which in turn led to the creation of the Lorentz contraction hypothesis and Special Relativity Theory (STR).

__Absolutely moving light source and an observer moving relative to the light source__

This is a more general case than the case of co-moving light source and observer. However, the analysis for the co-moving observer is fundamental because it will determine the outcome for any observer.

Consider a light source S moving with an absolute velocity V_{abs} and an observer O co-moving with the source. Another observer A is moving relative to the source. The problem is to determine the outcome of an experiment for an observer A moving relative to a light source that is itself in absolute motion.



Suppose that the co-moving light source S and observer O are moving with absolute velocity V_{abs} to the right, as shown above. A second observer, observer A , is moving relative to the source, say with a velocity V towards the source. Suppose that the source emits light and that observer A is just at the location of observer O, at the instant that observer O is detecting the light. Then, observer A will also detect the light, since both observers are at the same point in space at the instant of light detection.

Suppose that the source emits light at t = 0. Observer A is at distance L from the source at t = 0. The problem is to find the position of a co-moving observer O who will detect the light at the same instant as observer A.

During the time interval that observer A moves from his initial position to the position of observer O, the light moves from S' to O. The distance between A and O is L - D. Since L is a given, the problem is to find D.

$$\frac{D'}{c} = \frac{L - D}{V}$$

But

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

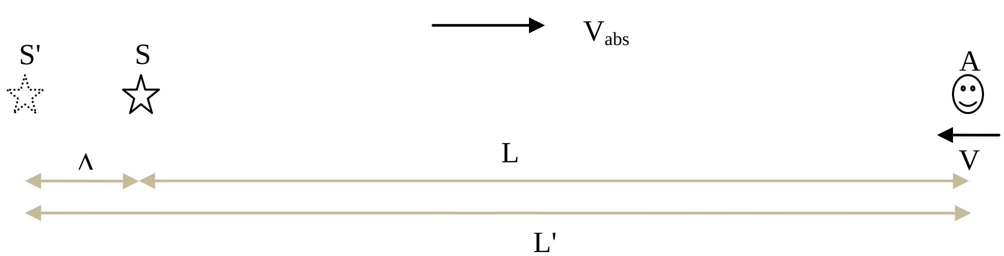
From the last two equations,

$$\frac{D \, \frac{c}{c - V_{abs}}}{c} = \frac{L - D}{V} \quad \Rightarrow \quad \frac{D}{c - V_{abs}} = \frac{L - D}{V} \quad \Rightarrow \quad D = \frac{\frac{L}{V}}{\frac{1}{c - V_{abs}} + \frac{1}{V}} = L \, \frac{c - V_{abs}}{V + c - V_{abs}}$$

Once the position (D) of the co-moving observer is obtained, the time delay of light for observer A to detect the light can be determined.

$$t_D = \frac{D'}{c} = \frac{D \, \frac{c}{c - V_{abs}}}{c} = \frac{D}{c - V_{abs}} = \frac{\frac{\frac{L}{V}}{\frac{1}{c - V_{abs}} + \frac{1}{V}}}{c - V_{abs}} = \frac{L}{V + c - V_{abs}}$$

Another method is to use the apparent source seen by observer A.



The apparent position of the source as seen by observer A is:

$$L' = L \, \frac{c}{c - V_{abs}}$$

But since observer A is moving relative to the source S,

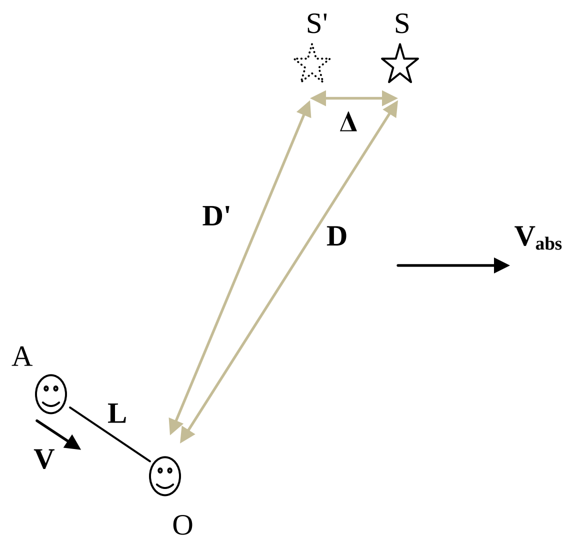
$$L' = L \, \frac{c}{c - V_{abs}} \quad \Rightarrow \quad \frac{dL'}{dt} = \frac{dL}{dt} \, \frac{c}{c - V_{abs}} \quad \Rightarrow V' = V \, \frac{c}{c - V_{abs}}$$

This means that the apparent source is moving towards observer A with a velocity V. Since the group velocity of light is constant relative to the apparent source, the time delay of light to be detected by observer A is:

$$t_D = \frac{L'}{c'} = \frac{L \frac{c}{c - V_{abs}}}{c + V'} = \frac{L \frac{c}{c - V_{abs}}}{c + V \frac{c}{c - V_{abs}}} = \frac{L}{V + c - V_{abs}}$$

which is the same result as above.

One can determine the time delay of detection of light for an observer A moving in any arbitrary direction and in any position relative to the source, with respect to the direction of absolute velocity, as shown below, for example. Note that **D**, **D'** , **Δ** , **L** , **V**, $\mathbf{V_{abs}}$ are vector quantities.



The Sagnac effect is explained by this theory[1].

Phase velocity, group velocity, phase delay, group delay

Once the real source is replaced by an apparent source, the following theories are applied to analyze the experiment.

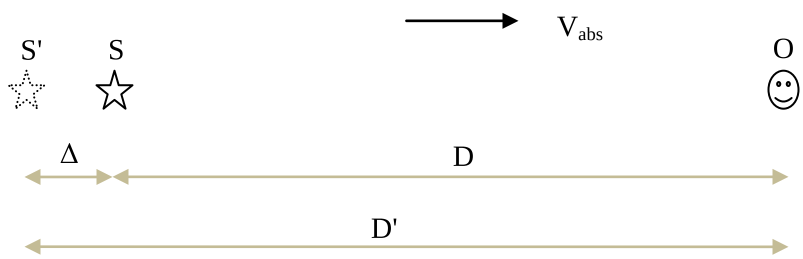
1. The phase velocity of light is always constant, independent of source, observer and mirror absolute or relative velocity.

2. The group velocity of light is independent of source velocity, but varies with observer and mirror velocity. Once the real source is replaced by an apparent source, the group velocity of light is assumed to be constant relative to the apparent source, analogous to the velocity of light being constant relative to the source in conventional emission theory. Once the real source is replaced by an apparent source, conventional emission theory is assumed, in which the group velocity varies with mirror velocity, i.e. c ± 2V.

3. The phase time delay and the group time delay are always equal.

We will explain different experiments with this theory.

<u>Co-moving source and observer</u>



From the above theory, the phase velocity of light is constant relative to observer O. We have already stated that the effect of absolute motion for co-moving light source and observer is to create an apparent (effective) change in path length, not change in (phase or group) velocity. Therefore, both the phase velocity and the group velocity of light are equal to *c* relative to co-moving observer O. The group and phase time delay are both equal and are determined by the apparent (effective) path length.

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

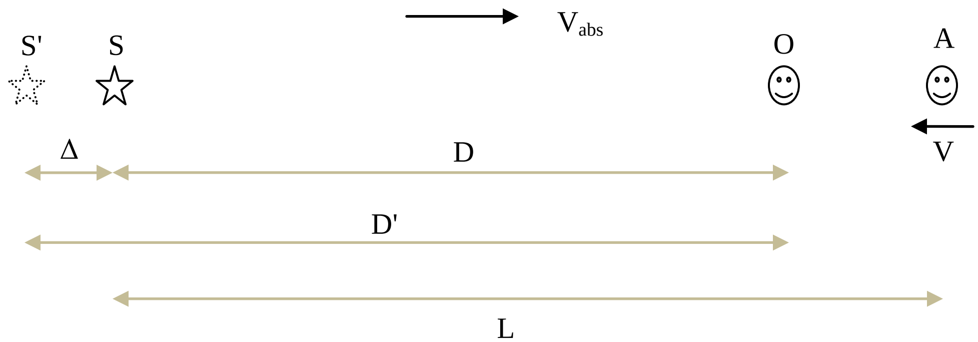
If the light wave emitted by the source is

$$A \sin \omega t$$

then the wave detected by the observer will be

$$A \sin \omega (\, t - t_D) \;, \qquad where \quad t_D = \frac{D}{c - V_{abs}}$$

Absolutely moving light source and an observer moving relative to the light source



We have already determined that,

$$D = \frac{\frac{L}{V}}{\frac{1}{c - V_{abs}} + \frac{1}{V}} = L \frac{c - V_{abs}}{c - V_{abs} - V}$$

and

$$t_D = \frac{L}{V + c - V_{abs}}$$

The phase velocity of light in vacuum is always constant *c* relative to the observer, irrespective of source, observer and mirror absolute or relative velocity.

The group velocity is,

$$\frac{L'}{t_D} = \frac{L \frac{c}{c - V_{abs}}}{\frac{L}{V + c - V_{abs}}} = c \left(\frac{V + c - V_{abs}}{c - V_{abs}} \right)$$

The group (and phase) time delay is,

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

Let us consider specific cases.

Source at absolute rest, observer moving with velocity V relative to the source.

A light source is at absolute rest. An observer A is at distance D from the source and moving with relative velocity V. Suppose that the source emits light at t = 0 . At t = 0 an observer A is at distance D and is moving directly away from the source with relative velocity V. The problem is to determine the group velocity, the phase velocity, the phase delay and the group delay.

As already postulated, the phase velocity is always constant relative to the observer. The group velocity is c - V_{abs} relative to the observer, since both the light and the observer are moving in the same direction.

To determine the group (and phase) time delay, we first determine the path length. The path length is the distance between the point of emission and the point of detection.

The path length is

$$D + \Delta$$

The group time delay is therefore,

$$\frac{D + \Delta}{c}$$

But Δ is determined as follows.

During the time interval that the light travels from S to A', the observer moves from A to A'.

$$\frac{D + \Delta}{c} = \frac{\Delta}{V}$$

From which,

$$\Delta = D \frac{V}{c - V}$$

Therefore, the group (and phase) time delay is,

$$t_D = \frac{D + \Delta}{c} = \frac{D + D\frac{V}{c-V}}{c} = \frac{D}{c - V}$$

Suppose that the source emitted light wave

$$A \sin \omega t$$

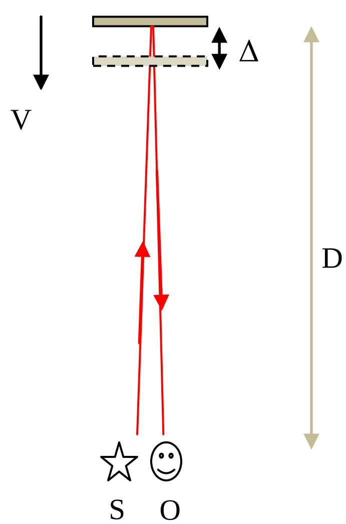
Then the observer will detect the light wave as

$$A \sin \omega' (t - t_D) = \sin 2\pi f' (t - \frac{D}{c - V})$$

where

$$f' = f e^{\frac{-V}{c}} \quad (Exponential\ Doppler\ Effect\ of\ Light\ theory)$$

Next we consider a light source and an observer both at absolute rest and at nearly the same point in space. A mirror is at distance D from the source and observer and moving with velocity V towards the source and the observer, so that the light reflects back on itself towards the observer. The problem is to determine the phase velocity, the group velocity, the phase delay and the group delay.



D is the distance of the mirror at the instant of light emission from the source.

The phase velocity is always constant c relative to the observer, independent of source, observer or mirror velocity. The group velocity of incident light is $c + V$ relative to the mirror and the group velocity of reflected light is $c + 2V$ relative to the observer.

Light will be reflected from the mirror at distance D – Δ from the source, where Δ is the distance moved by the mirror during the transit time of light.

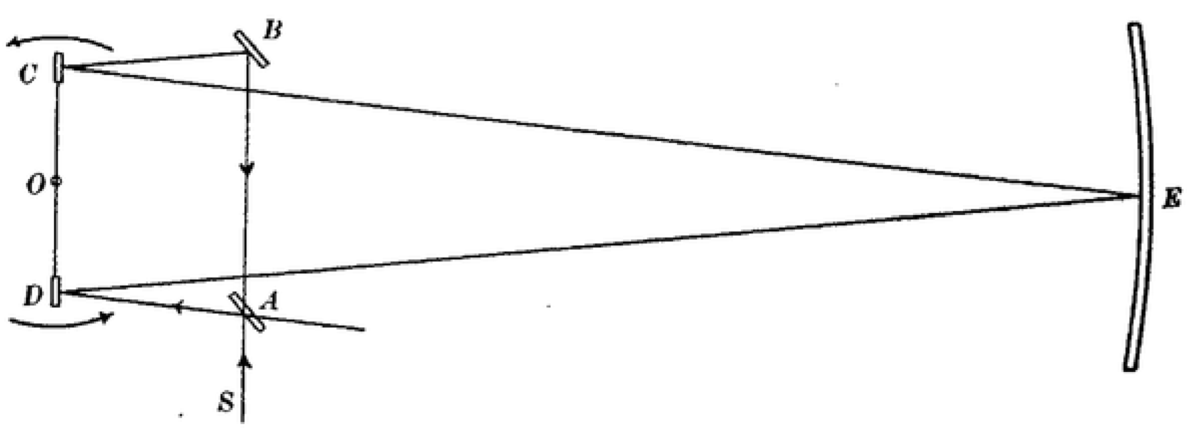
$$\frac{\Delta}{V} = \frac{D - \Delta}{c} \quad \Rightarrow \quad \Delta = D\frac{V}{c + V}$$

The group and phase time delay is, therefore,

$$\frac{D - \Delta}{c} + \frac{D - \Delta}{c + 2V} = \frac{2D}{c + 2V}$$

The development of the above theories was guided by different experiments and theories:
- the A. Michelson moving mirror experiment,
- the Venus planet radar range data anomaly (analyzed and reported by Bryan G Wallace),
- the Sagnac effect, the Dufour and Prunier tests (a modified Sagnac experiment),
- constant phase velocity and variable group velocity. The phase velocity of light is always equal to c. The group velocity of light is independent of source velocity, but it varies with observer velocity ($c \pm V_{abs}$) and mirror velocity ($c \pm 2V$).
- Apparent Source Theory.

The A. Michelson moving mirror experiment needs more attention here. The A. Michelson moving mirror experiment was done to investigate the effect of mirror velocity on the velocity of light, by looking for a fringe shift due to a possible difference in the velocities, and arrival times, of the two light beams.



According to the theory proposed above that the phase delay and the group delay are always equal, then this theory is apparently in conflict with the A Michelson moving mirror experiment. This is because, according to AST the group velocity depends on the mirror velocity. Therefore, this would imply significant fringe shift for the A. Michelson moving mirror experiment with change in velocity of the mirrors because the arrival time of the groups, and hence the phase time delay, will vary with mirror velocity. But no significant fringe shift has been observed that is directly correlated with mirror velocity. This is in apparent contradiction with the theory that the phase delay and the group delay are always equal.

The problem in the above argument is rooted in conventional thinking about forming of interference fringes.

Let us see the quantum mechanical explanation proposed by this author [7][8]. The point on the screen where the photon will land is determined instantly, at the instant of light emission, while the photon is being emitted by the source, long before the photon energy arrives at the screen. The fringe pattern is determined by the two path lengths *at the instant of light emission*. Once the point where the photon will land is determined, the photon will be emitted and will take only one of the two paths, not both paths. Since the point where the photon will land was determined at the instant of emission, the phase time delay (which is equal to the group time delay) of this photon is irrelevant while it lands on the screen. The mirror velocity affects only the phase delay (which is also the group delay) of the photon detected at the screen, not the interference fringe pattern. The fringe pattern is determined only by the difference between the two path lengths of light *at the instant of emission*.

Conclusion

The contradiction of Apparent Source Theory has been one of the most enigmatic problems in the development and understanding of the theory. It has been shown that this contradiction is only apparent, cause by mixing conventional stellar aberration theory with the unconventional Apparent Source Theory.

Thanks to God and the Mother of God, Our Lady Saint Virgin Mary

References

1. Absolute/Relative Motion and the Speed of Light, Electromagnetism, Inertia and Universal Speed Limit *c* - an Alternative Interpretation and Theoretical Framework, by Henok Tadesse, Vixra

2. Exponential Law of Doppler Effect of Light – an Explanation of Ives-Stilwell Experiment, by Henok Tadesse, Vixra

3. The Speed of Gravity – What the experiments say, Tom Van Flandern

4. Measuring Propagation Speed of Coulomb's Field, A. Calcaterra, et al

5. Stellar Aberration and Einstein's Relativity, by Paul Marmet

6. LUNAR LASER RANGING TEST OF THE INVARIANCE OF c, ,Daniel Y. Gezari

https://arxiv.org/ftp/arxiv/papers/0912/0912.3934.pdf

7.Unlocking the Mystery of Interference Patterns in Electron and Photon Double-Slit Experiments and the Puzzle of 'Waves Without Medium', Henok Tadesse, Vixra

8. Explanation of Quantum Phenomena with a New Model of Photon and Electron Emission, Propagation and Absorption, Henok Tadesse, Vixra