Co-existence of Absolute Motion and Constancy of the Speed of Light - Scientific Proof of God

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01 August 2020

Abstract

Centuries of experimental and theoretical investigations on the speed of light have shown that light does not behave consistently in the various experiments. In some experiments light appeared to behave according to classical ether theory, in other experiments it appeared to behave according to emission theory, and yet in other experiments according to neither theory. In some experiments the speed of light appeared to be constant and in other experiments it appeared to be variable. These confusions have also been expressed in other ways. Is it only the two-way speed or the one-way speed of light also that is constant (or not constant)? Does the speed of light depend on observer's velocity? Does the speed of light depend on mirror velocity? In this paper, we propose and show that the constancy of the vacuum speed of light, regardless of source/observer/ mirror uniform or non-uniform motions, underlies all the apparent contradictions in the behavior of the speed of light. The fact that some experiments showed non-constancy of the speed of light is only apparent and the speed of light is fundamentally constant c in vacuum for all observers. According to the new theory, Apparent Source Theory (AST), the speed of light is constant and absolute motion exists at the same time. AST reveals a new distinction that the ether doesn't exist but absolute motion does exist. Albert Einstein correctly proposed the constancy of the speed of light. However, his interpretation of the light postulate, which is the relativity of space and time, is logically inconsistent and has been disproved experimentally. In this paper, we propose a new interpretation that the constancy of the speed of light points to an intelligent being, God, Who always adjusts the point in space and time where and when light is emitted and the velocity of the center of the wave fronts, so that the speed of light in vacuum is always constant c relative to all observers. In this paper, we show that absolute motion and constancy of the speed of light can co-exist.

Introduction

The problem of absolute motion and the speed of light is a long standing one that is at least three centuries old in its modern form. It began when Galileo stated his principle of relativity, with his thought experiment, that no mechanical experiment existed that could reveal one's (absolute) motion. He argued that an observer inside a closed room in a steadily sailing ship will observe all physical phenomena as an observer at rest, regardless of the speed of the ship.

However, another phenomenon seemed to contradict Galileo's principle of relativity. Beginning with Isaac Newton, scientists wondered about the nature of light for centuries. Newton proposed that light was stream of tiny particles. Christian Huygens, on the other hand, proposed the wave theory of light, which contradicted Newton's corpuscular view. It was like searching in the dark in an era when few experimental evidences existed. In 1804 Thomas Young's double slit experiment eventually shed light on this problem; it revealed that light was actually a wave phenomenon, causing the abandonment of Newton's view. The triumph of the wave theory implied a medium (ether) for light transmission, which in turn implied the existence of absolute motion.

Thus was born the fundamental problem of absolute motion and the speed of light that would confound science for centuries. The success of Newton's laws of motion and gravitation, in which the principle of relativity was implicit, appeared to prove Galileo right, thereby implying Newton's corpuscular theory of light. On the other hand, the success of wave theory of light appeared to prove absolute motion (ether) theory. Moreover, James Clerk Maxwell formulated his equations that predicted the speed of light which was close to the known speed of light, which had been determined from Roamer's observation, from Bradley's stellar aberration and also from terrestrial experiments. Maxwell's equations were based on the assumption of the ether. Confirmation of Maxwell's equations thus appeared to be a proof of the ether. These contradictions created a dilemma between wave theory and particle (emission) theory of light.

In 1720 James Bradley discovered the phenomenon of stellar aberration, unexpectedly, while searching for stellar parallax. He observed that he had to tilt his telescope slightly forward to see the stars due to an apparent change in the position of the stars. The phenomenon was related to the velocity of the Earth in its orbit around the Sun. He explained this phenomenon by the corpuscular theory of light, by the law of addition of velocities. This appeared to support Newton's corpuscular theory. Actually, Bradley's experiment, together with the earlier Roamer experiment, succeeded in determining the order of magnitude of the speed of light.

In 1810 François Arago figured out an experiment that he thought could prove emission theory. He believed that light from different stars had different velocities and this would manifest as different angles of refraction of star light incident upon a glass prism put in front of a telescope. For this he would first observer a star with a telescope. Then he would put the glass prism in front of the telescope, which would cause loss of the star image, and turn the telescope until he observed the star again, and note the angle through which the telescope was turned. From this he could infer the angle of refraction of light from the different stars. Arago observed that the angle of refraction of light was the same for all stars and he concluded that light from all stars had the same velocity regardless of the velocity of the stars. This disproved the particle theory of light, and seemed to imply ether theory. Arago then repeated the experiment to test ether theory. While he observed light from different stars in his first experiment, in his second experiment he observed light from the same star at different times of the year, expecting to observe variations in refraction angle of star light due to motion of the Earth through the ether in its orbit around the Sun. Again he did not observe any variation in the angle of refraction, implying that the speed of light is constant independent of motion of the observer. His observations were consistent neither with corpuscular theory nor with ether theory. The speed of light appeared to be constant independent of source or observer velocity. In 1871 George Biddell Airy repeated the Arago experiment using water filled telescope and obtained a null result. Arago's experiment was the first experiment that clearly established the paradoxical nature of the speed of light.

In order to explain the null result of the Arago experiment, in 1818 Augustin-Jean Fresnel proposed ether drag hypothesis in which the ether is dragged by transparent media such as glass and water in such a way as to cancel out the effect of absolute motion[1]. Although Fresnel's hypothesis was found to be wrong as it led to some conceptual problems, the Fresnel ether drag coefficient was curiously confirmed in the 1851 Fizeau experiment. This was a turning point in the history of physics as it led physicists to think that any future theory of light should explain the Fresnel drag coefficient, which became the center of subsequent theoretical developments. Lorentz, and later Einstein, developed the Lorentz transformation in an effort to explain the Arago and the Fizeau experiments.

In 1881 A. Michelson set out to measure the velocity of the Earth relative to the ether, and settle the light speed problem. He used an optical interferometer in which light from a source is split into two orthogonal beams by a beam splitter. The longitudinal and transverse beams are then reflected from mirrors back to a detector where an interference pattern is formed. Michelson figured out that motion of the apparatus relative to the ether would induce change in the path length of each beam, with the longitudinal beam more affected than the transverse beam, which would show as a fringe shift. Michelson predicted a fringe shift of at least 0.04 corresponding to the velocity of the Earth relative to the Sun which is 30km/s. However, to his great disappointment, Michelson did not observe the expected fringe shift. He observed fringe shifts much smaller than the predicted value. In 1887 Michelson and Morley undertook an exhaustive repetition the experiment. They were so influenced by the 1881 null result that they took much care and increased the light path length tenfold to increase the sensitivity of the experiment. As it turned out, the outcome of the 1887 experiment was even 'worse' than the 1881 experiment. Unlike the 1881 experiment, the observed fringe shift was even much smaller than the predicted value. Since the fringe shifts were much smaller than predicted, they were interpreted as null ever since, and considered experimental errors. The 'null' result of the Michelson-Morley experiment brought the already puzzling problem of the speed of light to its climax.

Lorentz abandoned the Fresnel's theory of ether dragging, but adopted the Fresnel drag coefficient in his search for a new theory. He created the so-called 'local time' in order to give an alternative explanation to the Arago experiment and the Fizeau experiment, hence the Fresnel drag coefficient. The use of local time enabled Lorentz to keep Maxwell's equations invariant in a system moving relative to the ether, to first order in V/c, and enabled him to explain first order experiments. However, the Michelson-Morley experiment was a second order experiment which could not be explained by Lorentz's local time. The Lorentz-Fitzgerald length contraction hypothesis was then invented and added to explain the Michelson-Morley null result. However, based on the principle of relativity that no absolute motion effect should be detected for all orders of V/c and for all physical phenomenon, Lorentz, Larmor and Poincare subsequently developed the complete Lorentz transformation we know today. Under this transformation, Maxwell's equations, and hence the speed of light, are covariant/invariant for *all* orders of V/c. The constancy of the speed of light in all reference frames can explain all the null results observed so far. There is a subtle difference between Einstein's theory that postulates absolute motion does not exist and Lorentz's theory that asserts absolute motion exists but is undetectable.

One of the experiments being cited as evidence of relativity are the modern 'Michelson-Morley' experiments using optical cavity resonators that give (almost) complete null results. The problem is that physicists have been pursuing only those experiments that give null results and keeping pushing the limits, and ignoring those experiments that give evidence of absolute motion.

Einstein's relativity (and Lorentz's ether theory) is crucially based on the *assumption* that absolute motion will never be detected by any mechanical, electromagnetic or optical experiment. This means that a single experiment that can successfully detect absolute motion can invalidate the whole of relativistic physics. Einstein was aware of this and expressed his serious concern when Miller reported small but consistent fringe shifts.

Absolute motion has been observed in the Miller experiments, the Sagnac effect, the Marinov experiment, the Silvertooth experiment, the CMBR anisotropy experiment, the Roland De Witte experiment and others. Profoundly, the Silvertooth experiment measured almost the same magnitude and direction as the CMBR anisotropy experiment, 378 km/s towards Leo constellation.

Some experiments have also disproved other aspects of special relativity (SRT). A recent experiment [2] has apparently disproved the light postulate of SRT. The assertion by SRT that no information can travel faster than light has also been disproved by another experiment [3]. Astronomical observations have also found galaxies moving up to nine times the speed of light.

In this paper, we propose a new theory called Apparent Source Theory [4][5][6] that can successfully solve many of the problems of (absolute) motion and the speed of light. In the various experiments and observations carried out over decades and centuries, light has behaved in apparently contradictory ways. In some experiments, light appeared to behave according to ether theory, and in other experiments it appeared to behave according to ether theory. The physics community should have recognized and addressed these apparent inconsistencies in the nature of the speed of light, instead of trying to promote only those experiments that support relativity and suppressing those that do not. It turns out that, as we will see in this paper, the solution lies in the problem itself: apparent contradictions. As the saying goes, identifying the problem is halfway towards the solution.

Although absolute motion has been detected in several experiments, it should also be noted that ether theory could not explain them all consistently. One example is the Silvertooth experiment. Silvertooth himself could not provide a clear theoretical explanation for the effect he observed. After all, the ether theory has been disproved by the Michelson-Morley experiment. Although the Miller experiments detected small fringe shifts, on the contrary, modern Michelson-Morley type experiments using optical cavity resonators have given complete null results.

The Michelson-Morley experiment appears to be a strong evidence of emission theory. There is also a less known experiment that appears to agree with the emission (ballistic) theory. This is the Venus planet radar range anomaly which was analyzed and exposed by Bryan G Wallace. Ironically, the Shapiro experiment was designed to test Einstein's gravitational time dilation. Radar pulses were sent to Venus and reflected back to Earth at a time when the Earth, the Sun and Venus were on a straight line so that the radar pulses could pass through Sun's gravitational field. Far from confirming gravitational time dilation, the time delays agreed with ballistic theory of light in which the speed of light depended on mirror velocity.

On the contrary, the A.Michelson moving mirror experiment and the Q.Majorana moving mirror and moving source experiments have disproved emission theory. According to emission theory, the wave length of light remains constant regardless of motion of the source and motion of the mirror. This hypothesis has been disproved by the Q. Majorana moving source and moving mirror experiments. A. Michelson in his moving mirror experiment tested the hypothesis that the velocity of light depended on mirror velocity and disproved it. That the speed of light is independent of source velocity has also been confirmed in the modern 'positron annihilation in flight' experiment.

However, there are still some experiments that cannot be explained by classical theories at all and, curiously, agree with Einstein's relativity. One of these is the Ives-Stilwell experiment. Another is the limiting light speed experiment.

Crucially, many of the experiments mentioned so far can be explained *either* by emission theory *or* by ether theory. As we shall see later, this could be a hint that the correct model of the speed of light that eluded physicists for centuries is some form of fusion of ether theory and emission theory.

In this paper, a new theory of motion and the speed of light is proposed. The new theory is a combination of two theories:

1. A new interpretation of absolute motion (Apparent Source Theory)
2. Exponential Doppler effect of light

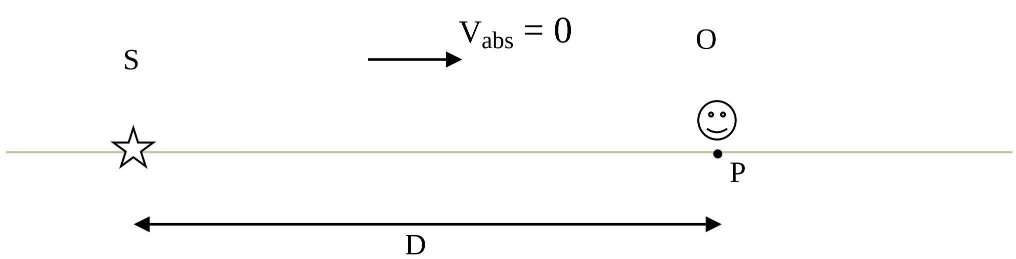
The new theory can explain many experiments such as the Michelson-Morley, the Silvertooth , the Marinov experiments , stellar aberration and the Sagnac effect. A new theory called Exponential Doppler Effect Theory has also been proposed in my other papers [4][5][6]. Apparent Source Theory is a novel, seamless unification of features of ether theory, emission theory and the postulates of special relativity: constancy of the speed of light, and new insights.

Apparent Source Theory

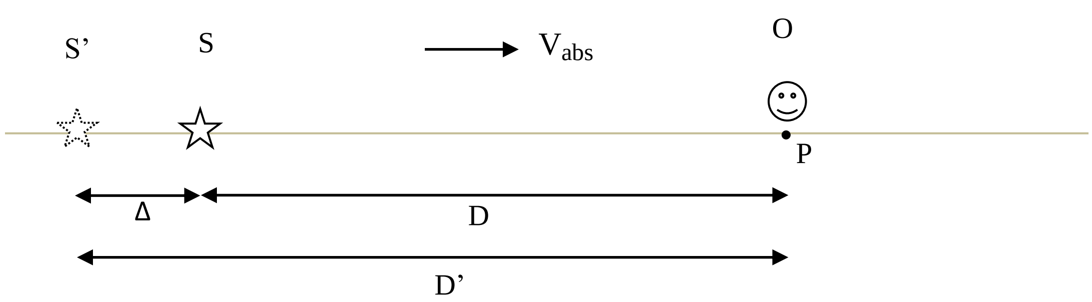
One of the questions that have puzzled physicists for centuries is why experiments such as the Michelson-Morley experiments gave null results? This paper reveals this centuries old mystery.

Consider co-moving light source S and observer O, separated by distance D. Obviously, when they are both at absolute rest, the time taken by an emitted light pulse to reach the observer is:

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



Now assume that the co-moving source and observer are in absolute motion, with velocity V_{abs} to the right, as shown below.



According to Apparent Source Theory, the effect of absolute motion of the co-moving light source and observer is just to create an apparent change in position of the source as seen by the observer. In this case, the position of the source apparently changes from S to S', with S' being at the center of the wave fronts as seen by observer O. It should be noted that S' is the center of the wave fronts only for observer O and the apparent position of the source will be different for observers at different distances. Since the apparent source S' and the observer are co-moving, and since the speed of light is constant *c* relative to the apparent source, it follows that the speed of light is also constant relative to the observer, regardless of the absolute velocity of the observer.

For now we postulate that:

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

and

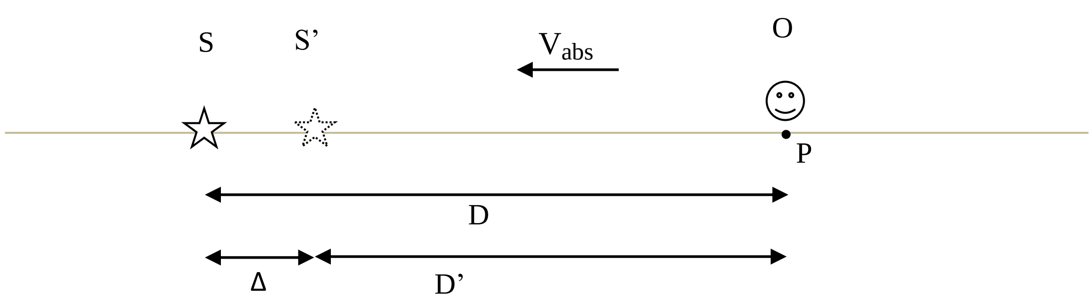
$$\Delta = D\ \frac{V_{abs}}{c - V_{abs}}$$

The time taken by light to move from the (apparent) source to observer is, therefore:

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

Therefore, the effect of absolute motion for co-moving light source and observer is just to create a change in the time delay of light, and not a change in the speed of light relative to the observer.

Next we consider the case of co-moving light source and observer with absolute velocity directed to the left, that is with the observer behind the source.



In this case also the effect of absolute motion of co-moving source and observer is to create an apparent change in the position of the source as seen by the observer. In this case, the source position apparently changes to be nearer to the observer than the actual/physical source position.

In this case,

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

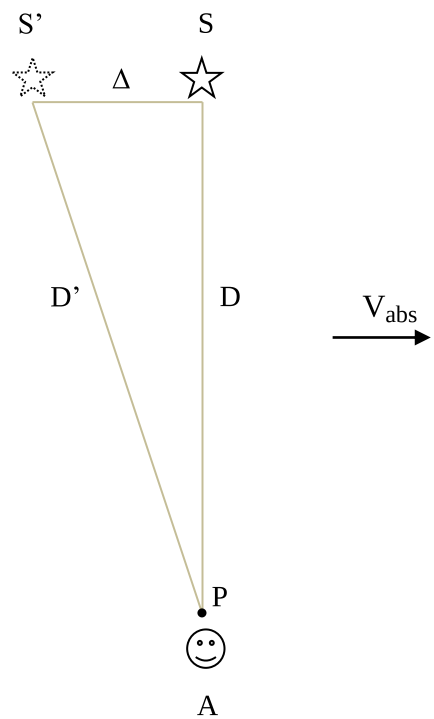
and

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

The time taken by light to move from the (apparent) source to observer is, therefore:

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

Next we will consider the case when the line connecting the light source and the observer is orthogonal to the observer's absolute velocity.



In this case, we postulate that:

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

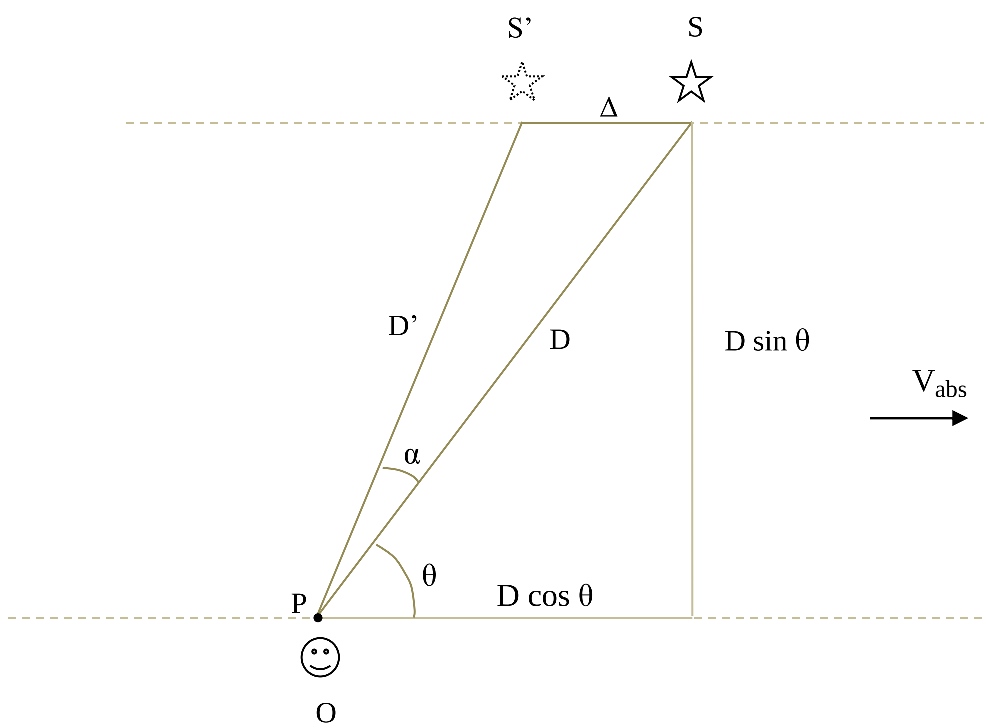
and

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

Therefore,

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

Consider the general case in which the observer O is at an arbitrary point relative to the source at the instant of light emission ($t = 0$) , as shown below.



To determine the point in space where light is emitted for the observer, we proceed as follows.

During the time that the center of the wave fronts ‘moves’ from S’ to S, the light moves from S’ to point P.

Therefore,

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

where

$$\Delta = Dcos\theta - \sqrt{D'^2 - D^2 sin^2\theta}$$

From the above two equations,

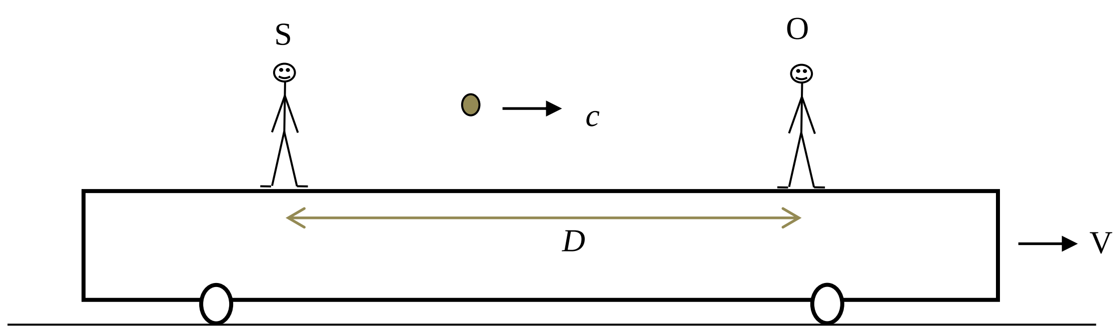
$$D'^2\left(1-\frac{{V_{abs}}^2}{c^2}\right)+\frac{2DV_{abs}}{c}\ cos\theta\ \ D'\ -\ D^2=0$$

which is a quadratic equation from which D' can be determined, which in turn enables the determination of Δ and α.

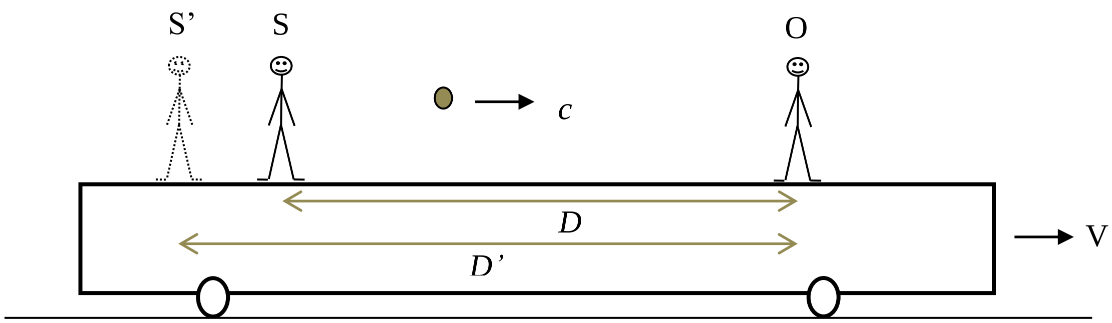
In all the cases we discussed so far, the trick of nature is that, light is not emitted from the actual/physical position of the source, but from a point S' , which is at a distance *D'* away from the moving observer. Light is emitted from distance *D'* , with the center of the wave fronts moving with the same velocity as the absolute velocity of the observer. The light is actually emitted from an apparent source S', which is moving with velocity V_{abs} . The speed of light is constant *c* relative to this apparent source. Since both the observer and the apparent source, which is at the center of the wave fronts, are moving with the same velocity, the speed of light is constant *c* relative to the observer. The apparent source S' will always have the same velocity as the absolute velocity of the observer, so the speed of light relative to the observer will always be constant *c* regardless of the observer's absolute velocity.

Therefore, the effect of absolute motion of an observer is just to change the point in space where light was emitted. This means that the velocity of light relative to the observer will not change because of observer's absolute motion; it is always constant *c*. The change in time of arrival of light is not because the speed of light has changed relative to the observer, but because the point of light emission has changed. This theory is a seamless fusion of ether theory and emission theory.

For further clarification of the new theory, consider an analogy. Two persons S and O are standing on a moving cart. Person S acts as a source throwing balls towards person O who acts as an observer. Assume that S always throws balls with constant velocity *c* relative to himself/herself. Two synchronized clocks, one at S another at O, are used to measure the time delay of a ball going from S to O. Now we want the ball to behave both according to emission theory and according to ether theory, at the same time.



At first assume that the cart is at rest. Let the distance between the source and the observer be *D*. When the cart is at rest, the time taken by the ball to move from S to O is, $t = D/c$. Now suppose that the cart starts moving to the right with velocity *V*. Since, according to *emission theory*, the velocity of the ball relative to the source S is always constant *c* , then the time *t* will still be equal to *D/c*, regardless of the velocity of the cart. But we want the time delay *t* to change due to the motion of the cart, to make the ball appear to behave according to *ether theory* also. How can this be done? To make the ball behave according to ether (absolute motion) theory, the ball should take more time to catch up with observer O when the cart is in motion. Since the source S always throws the ball with constant velocity *c* relative to himself (relative to the cart), the only way to make the time *t* longer is for the source S to move back away from observer O, to a point a distance *D'* away, as shown below.



In this case, the time taken by the ball will be:

$$t = \frac{D'}{c}$$

Therefore, the velocity of the ball relative to the (apparent) source is still equal to *c* , but the point of ball 'emission' has changed from S to S'. Thus, the effect of 'absolute' motion of the cart is to change the point of 'emission' of the ball. The velocity of the ball relative to the observer O is always constant *c*, regardless of the 'absolute' velocity of the cart.

Now, for the ball to exactly simulate its 'wave' nature, i.e. to behave according to ether theory, the time delay should be as predicted by ether theory. According to ether theory, the time delay is equal to the actual distance *D* divided by the velocity of the wave relative to the observer O, which is equal to $c - V$ in this case. Therefore:

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

From the above two equations,

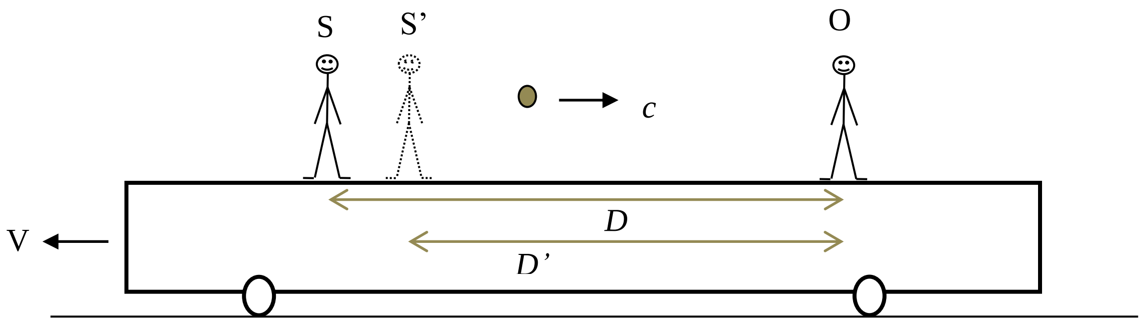
$$\frac{D'}{c} = \frac{D}{c - V}$$

From which,

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

Note that the velocity of the ball as 'seen' by an 'observer' at rest on the ground is equal to $c + V$.

In the above analogy, we have assumed that the observer O is in front of the source S , with respect to the velocity of the cart. Next we consider the case when the observer is behind the source. For this we assume the same arrangement as above except that the cart moves to the left in this case, as shown below.

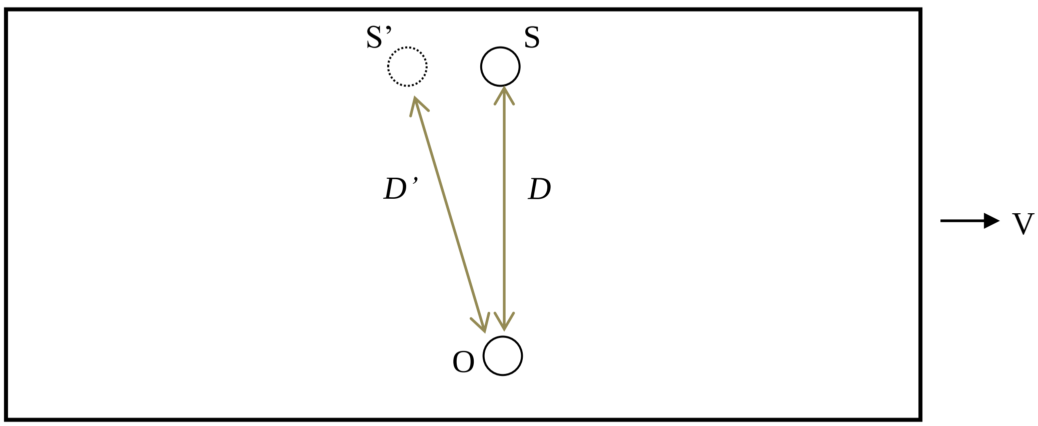


In this case, motion of the cart will make the time delay *t* shorter. By the same argument as above, the source needs to change its position to a distance *D'*, where:

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

The profound result we found is that the speed of the ball is always constant relative to the observer O, regardless of the velocity of the cart. Light behaves in the same way as the ball in the above analogy.

We can repeat the above analogy for other positions of the observer relative to the source, with respect to their common absolute velocity. In the above two cases, we have considered the cases when the line connecting the source and the observer is parallel to the velocity vector. Now consider the case when the line connecting the source and the observer is orthogonal to the velocity vector, as shown in the figure below, which is the top view of the cart.



With the same arguments as above, it can be shown that:

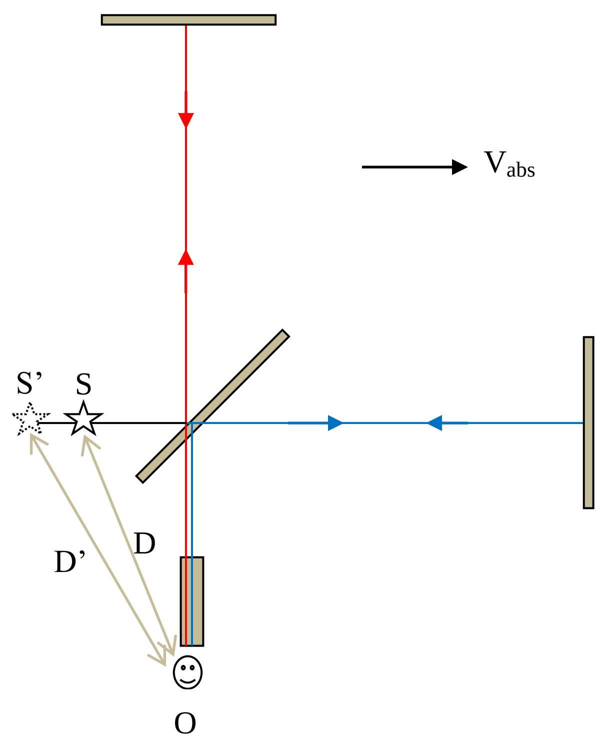
$$D' = D\frac{c}{\sqrt{c^2 - V^2}}$$

This theoretical model reveals the mystery of the speed of light and why the Michelson-Morley experiment gave a null result and failed to detect absolute motion. One can imagine doing a 'Michelson-Morley' experiment and can see why it gives 'null' results.

This theory is called Apparent Source Theory. We formulate Apparent Source Theory for inertially co-moving light source and observer as follows.

The effect of absolute motion for inertially co-moving light source and observer is to create a change in the point of light emission relative to the observer. According to Apparent Source Theory, unlike ether theory, the effect of absolute motion for co-moving light source and observer is to change the point of light emission as seen by the observer, and not to change the speed of light relative to the observer. The speed of light relative to the observer is always constant c , regardless of absolute motion of the observer. The center of the light wave fronts is always co-moving with the observer.

With this theory, we can gain an intuitive understanding of why the Michelson-Morley (MM) experiment gives 'null' results. 'Null' has been quoted here because the MM experiment gives complete null results only for some orientations of the interferometer relative to the absolute velocity vector, and gives small fringe shifts for other orientations.

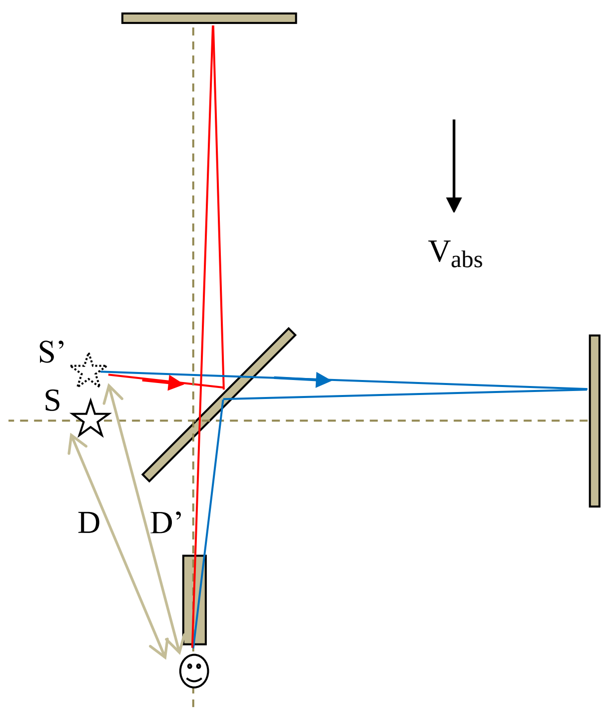


As we can see from the above diagram, absolute motion of the Michelson-Morley interferometer causes only an apparent change in the point of light emission relative to the observer, from S to S'. The velocity of light is always constant *c* relative to the observer, regardless of the absolute velocity of the interferometer.

The best way to clarify this is to ask: will changing the position of the source from S to S' (instead of setting the interferometer in absolute motion) cause any fringe shift ? Obviously, the answer is NO, because both the longitudinal and transverse waves will be delayed by the same amount and hence no fringe shift will occur.

Note that the velocity of light as 'seen' by an 'observer' at absolute rest is equal to $c + V_{abs}$. However, this velocity ($c + V_{abs}$) is only an illusion because the *real observer* is the one who is actually *detecting* the light, which is observer O. This is what makes the behavior of light extremely elusive. Therefore, according to AST, when we say the velocity of light is constant c relative to all *observers*, we mean observers who are actually detecting the light. The source of all the confusions caused in physics during the last century is the fallacy of trying to make the speed of light constant relative to some third 'observer' who is not actually detecting the light. In special relativity, this 'observer' is the reference frame. Special relativity states that the speed of light is constant in all inertial reference frames.

What about the small fringe shifts observed in the Miller experiments? For absolute velocities parallel to the longitudinal axis of the interferometer, the fringe shift caused by absolute velocity is completely null. However, fringe shifts can occur for absolute velocities not parallel to the longitudinal axis. For example, for absolute velocity perpendicular to the longitudinal axis and directed downwards, the situation is as follows.



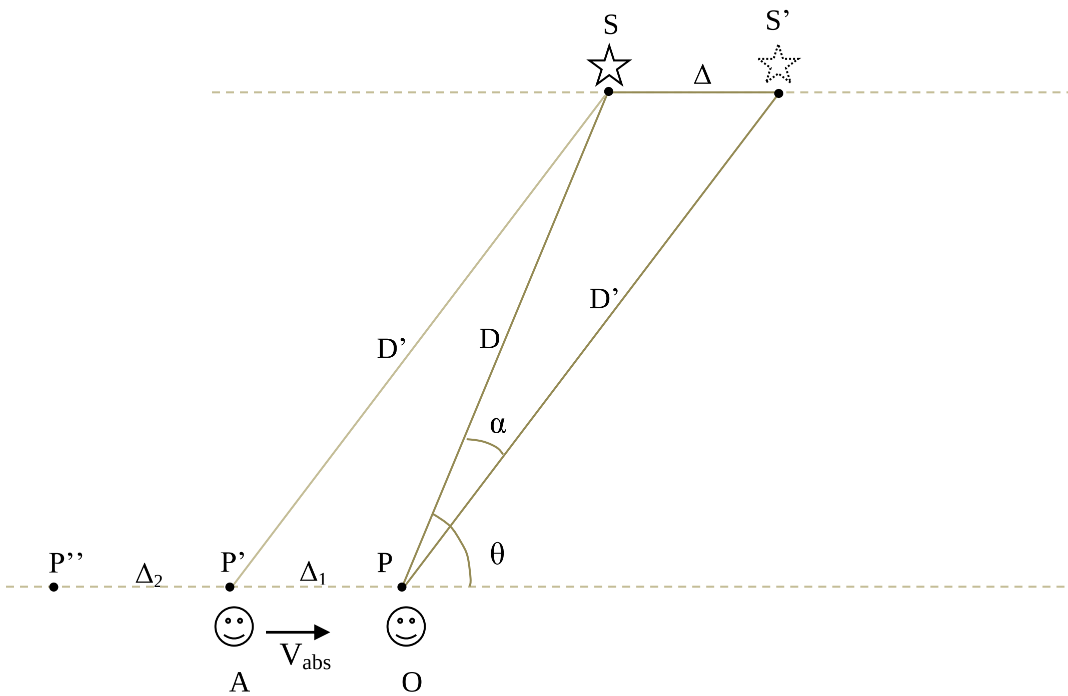
The path lengths of the longitudinal (blue) and the transverse (red) light beams are changed slightly *differently* due to absolute motion, and hence causing a small fringe shift.

Stellar aberration

Apparent Source Theory (AST) successfully explains the Michelson-Morley experiment, the Marinov experiment, the Silvertooth experiment, the Venus planet radar range anomaly, and the Sagnac effect. However, the phenomenon of stellar aberration remained a challenge for AST. Stellar aberration contradicted the initial formulation of AST[4][5][6]. The hint to the solution of this puzzle finally came from the solution to the quantum puzzle [7][8]. The ultimate mystery behind the problem of the speed of light and the quantum puzzle turns out to be the same.

We will reformulate Apparent Source Theory to resolve the contradiction with stellar aberration as follows. This will not change the analysis we made so far, for co-moving source and observer, and for $V_{abs} << c$.

Consider a stationary light source S and an observer O who is at rest at point P. Another observer A is moving with absolute velocity V_{abs} to the right. Suppose that the source emits a short light pulse at time t = 0, and that, at the instant of light emission, observer A is at point P''.



We propose the new theory (model) as follows.

At time t = 0 light is emitted from S, *for observer O*. At time t = t_0 light is detected by observer O who is at absolute rest at point P, where:

$$t_0 = \frac{D}{c}$$

At t = 0 observer A is at point P''. At $t = t_0$ observer A reaches point P' and light is emitted from S *for observer A.* During the time interval (t_0) that light moves from S to O, observer A moves from P'' to P'. Therefore, the length of line segment P''P', which is Δ_2, will be:

$$\Delta_2 = V_{abs}\, t_0 = V_{abs} \frac{D}{c} = D \frac{V_{abs}}{c}$$

Observer A will then detect the light at point P, after travelling distance Δ_1 . This means that during the time interval that observer A travels distance Δ_1 , the light moves distance SP' (or distance S'P), which is *D'*.

Therefore, unconventionally, we postulate that light is emitted at t = 0 for stationary observer O and at $t = t_0$ for moving observer A. Light is emitted for observer A t_0 seconds later than the same light is emitted for observer O. Conventionally, light is emitted at the same instant of time for all observers, regardless of their positions and velocities.

The second postulate is that the position (distance and direction) of the light source relative to a moving observer at the instant of light emission (*emission for that observer*) is the same as the position of the apparent source relative to that observer at the instant of light detection. Therefore, the position of the source S at the instant of light emission relative to observer A , at point P', is the same as the position of the apparent source S' relative to observer A at the instant of light detection, at point P. This means that line SP' and line S'P are parallel and have equal lengths, which is *D'*. It means that the path length of light for a moving observer is determined at the instant of light emission (*emission for that observer*). Therefore, the time delay of light for moving observer A will be, $t = D'/c$. Conventionally, $t = D/c$ for moving observer A also. The apparent source S' is considered to be real and is not an illusion. Conventionally, the change in the position of the source in stellar aberration is only an illusion.

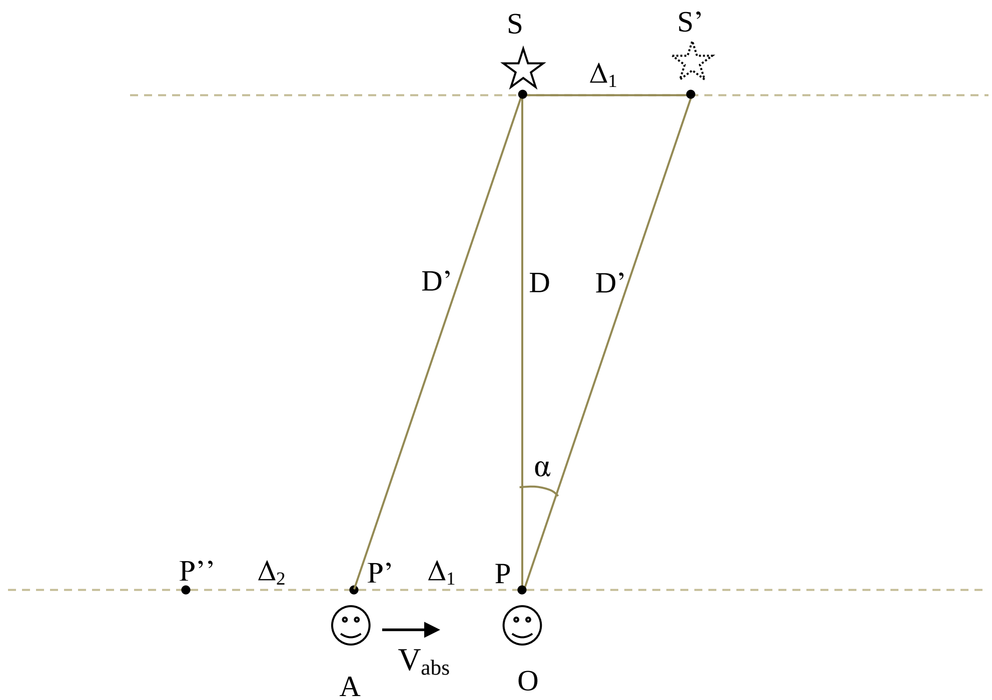
In other words, *for observer A*, light is emitted from S when observer A has just reached point P', with the center of the wave fronts moving with the same velocity as observer A, that is with velocity V_{abs} to the right. At the instant of light detection at point P, the moving observer A and the center of the wave fronts are co-moving, thereby ensuring the constancy of the speed of light relative to observer A. Since the speed of light is constant c relative to the center of the wave fronts, and since the center of the wave fronts is co-moving with the observer, this ensures that the speed of light is always constant c relative to the moving observer.

After a time delay of D'/c , observer A will detect the light pulse, at point P. Observer A will detect the light at point P, where:

$$\frac{D'}{c} = \frac{\Delta_1}{V_{abs}}$$

We can see that stationary observer O sees the light at point P as coming from the direction of S , whereas moving observer A sees the light at point P as coming from the direction of S'. The angle α between line SP and line S'P is the angle of stellar aberration.

To provide an example of a quantitative analysis, consider a stationary light source S emitting a short light pulse at $t = 0$, as shown in the following figure. At the instant of light emission, stationary observer O is at absolute rest at point P and observer A is moving to the right with absolute velocity V_{abs} at point P''. The line SP is perpendicular to the absolute velocity vector.



At $t = 0$ light is emitted *for observer O* and observer A is moving with velocity V_{abs} to the right at point P''. At $t = 0$ light is not yet emitted *for observer A*. Observer O detects the light pulse after a time delay of:

$$t = t_0 = \frac{D}{c}$$

During the time interval (t_0) that light moves from S to P , observer A moves a distance Δ_2 , from P'' to P'. At $t = t_0$ observer A will be at point P' and light will be emitted *for observer A*. Therefore, the length of line segment P'' P' , which is Δ_2 , is :

$$\Delta_2 = V_{abs}\, t_0 = V_{abs}\, \frac{D}{c} = D\, \frac{V_{abs}}{c}$$

For observer A, light has to travel the path length of SP' (or S'P), which is *D'*. Therefore, observer A will detect the light pulse after a time delay of:

$$t_1 = \frac{D'}{c}$$

During the time interval (t_1) that light moves the path length of SP', observer A moves distance Δ_1 , from P' to P :

$$\frac{D'}{c} = \frac{\Delta_1}{V_{abs}} \implies \Delta_1 = \frac{V_{abs}}{c} D'$$

But

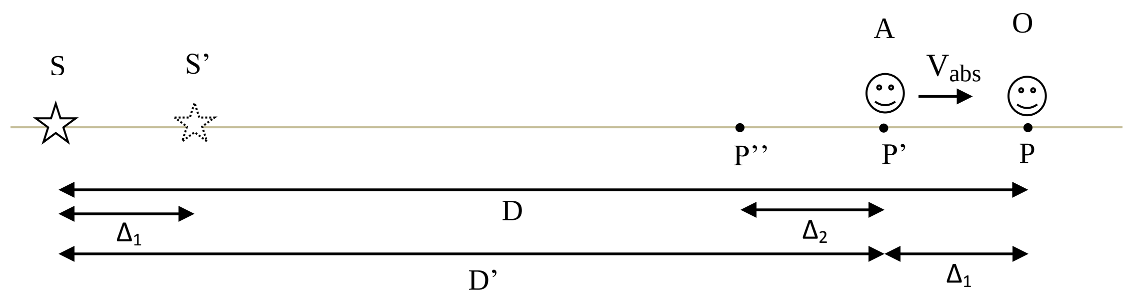
$$D' = \sqrt{D^2 + {\Delta_1}^2} = \sqrt{D^2 + (\frac{V_{abs}}{c} D')^2}$$

Therefore,

$$\implies D' = \frac{D}{\sqrt{1 - \frac{{V_{abs}}^2}{c^2}}}$$

We can see that stationary observer O sees the light pulse at point P as coming from the direction of S , whereas moving observer A sees the same light pulse at point P as coming from the direction of S'.

Next consider the following case. At $t = 0$ the source S emits a short light pulse.



At the instant of emission ($t = 0$), stationary observer O is at absolute rest at point P and observer A is moving with absolute velocity V_{abs} to the right at point P''.

At $t = 0$ light is emitted from S *for observer O*. The light will be detected by observer O after a time delay of:

$$t = t_0 = \frac{D}{c}$$

At t = t_0 observer A will reach point P' and light will be emitted from S *for observer A*, with the center of the wave fronts co-moving with observer A. Therefore, during the time interval (t_0) that light moves from S to O, observer A moves from P'' to P'. The length of line segment P''P', which is Δ_2 , is therefore:

$$\Delta_2 = V_{abs}\, t_0 = V_{abs}\, \frac{D}{c} = D\, \frac{V_{abs}}{c}$$

Observer A will then detect the light at point P , after travelling an additional distance of Δ_1, after a time delay of:

$$t_1 = \frac{D'}{c}$$

But, during this interval (t_1) the observer will also move from P' to P, a distance of Δ_1.

Therefore,

$$\frac{D'}{c} = \frac{\Delta_1}{V_{abs}} \Rightarrow \Delta_1 = \frac{V_{abs}}{c}\, D'$$

But

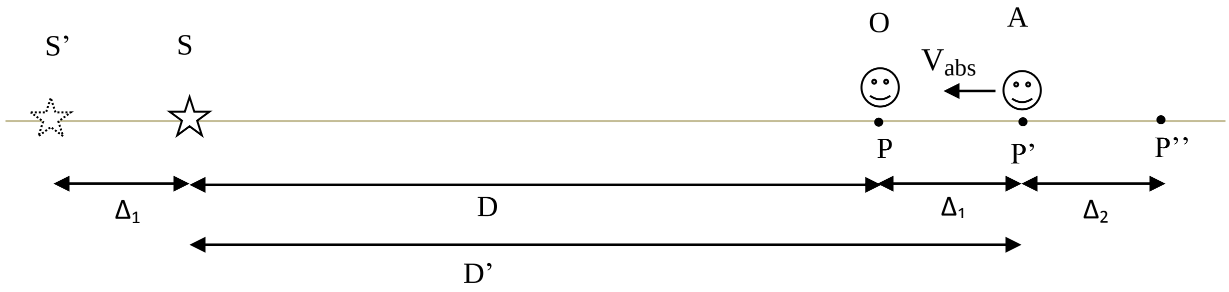
$$D' = D - \Delta_1$$

Therefore,

$$\Delta_1 = \frac{V_{abs}}{c}\, D' = \frac{V_{abs}}{c}\, (D - \Delta_1)$$

$$\Rightarrow \Delta_1 = D\, \frac{\frac{V_{abs}}{c}}{1 + \frac{V_{abs}}{c}}$$

In the case of an observer moving towards the left:



At the instant of emission ($t = 0$), stationary observer O is at absolute rest at point P and observer A is moving with absolute velocity V_{abs} to the left at point P''.

At $t = 0$ light is emitted from S *for observer O*. The light will be detected by observer O after a time delay of:

$$t = t_0 = \frac{D}{c}$$

At $t = t_0$ observer A will reach point P' , after travelling distance Δ_2 , and light will be emitted from S *for observer A*, with the center of the wave fronts co-moving with observer A. Therefore, during the time interval (t_0) that light moves from S to O, observer A moves from P'' to P'. The length of line segment P''P', which is Δ_2 , is therefore:

$$\Delta_2 = V_{abs}\, t_0 = V_{abs} \frac{D}{c} = D \frac{V_{abs}}{c}$$

Observer A will then detect the light at point P , after travelling an additional distance of Δ_1, after a time delay of:

$$t_1 = \frac{D'}{c}$$

But, during this interval (t_1) the observer will also move from P' to P, a distance of Δ_1.

Therefore,

$$\frac{D'}{c} = \frac{\Delta_1}{V_{abs}} \implies \Delta_1 = \frac{V_{abs}}{c} D'$$

But

$$D' = D + \Delta_1$$

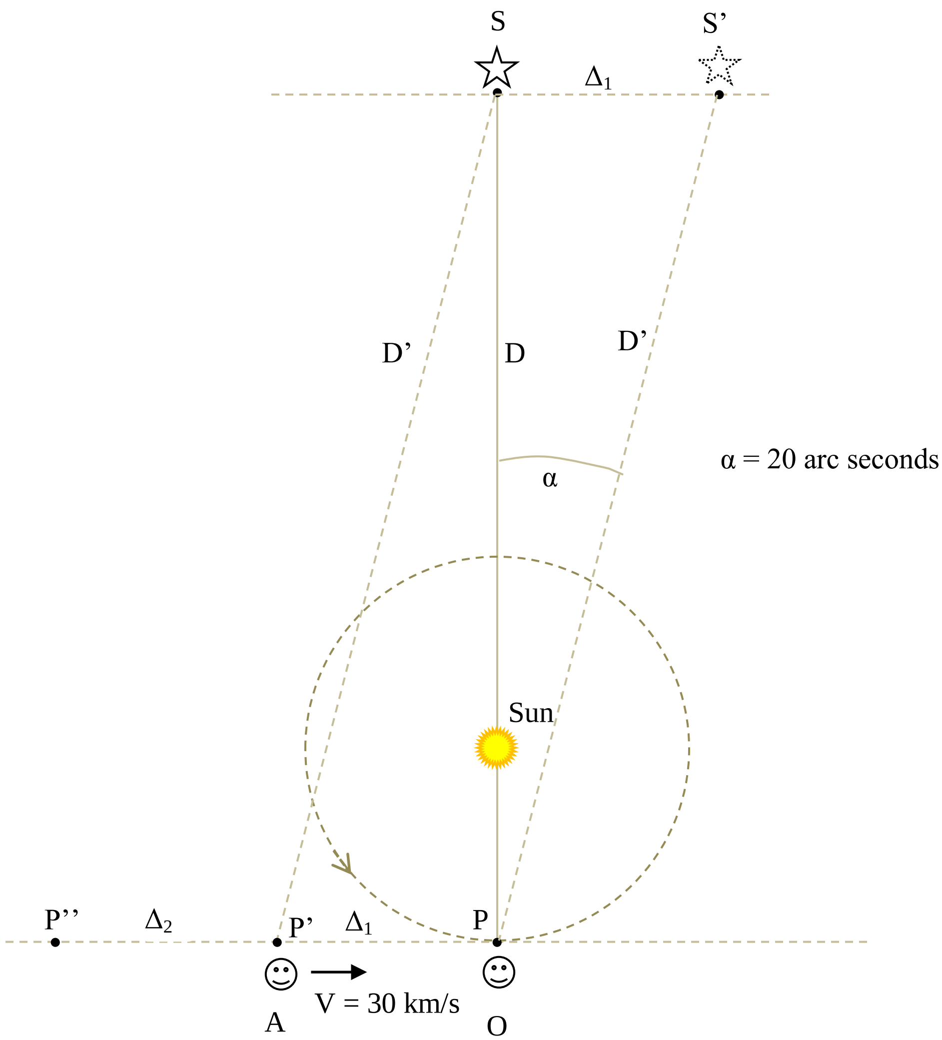
Therefore,

$$\Delta_1 = \frac{V_{abs}}{c} D' = \frac{V_{abs}}{c} (D + \Delta_1)$$

$$\Longrightarrow \Delta_1 = D \frac{\frac{V_{abs}}{c}}{1 - \frac{V_{abs}}{c}}$$

We can now apply the above theory to the actual phenomenon of stellar aberration. Assume that the star is ten light years away. Suppose that at the instant of light emission observer O is at absolute rest at point P and observer A is moving to the right with absolute velocity V_{abs} = 30 km/s at point P'', as shown in the following figure.

Suppose that the star emits light at t = 0, *for observer O*. In accordance with the theory proposed above, during the time interval $t_0 = D/c$ that light moves from S to P and detected by observer O, observer A moves from point P'' to point P', a distance of Δ_2. At the time instant $t = t_0$ light is *detected by observer O* and *light is emitted for observer A*. Thus, while observer O is detecting the light, the light *for observer A* is just being emitted from S. Note again that conventionally light is emitted for all observers at the same instant of time.



The time interval t_0 taken by light to move from S to P is:

$$t_0 = \frac{D}{c}$$

At $t = t_0$ observer A will be at point P’ and light for observer A is just being emitted. For observer A , the path length of light is *D’* (length of line SP’ or line S’P). Therefore, at $t = t_0$ light will be emitted from S for observer A, with the velocity of the center of the wave fronts moving to the right with the same velocity as the absolute velocity of observer A. Therefore, the center of the wave fronts is co-moving with observer A. Thus, when observer A reaches point P the center of the light wave fronts reaches point S’. Thus while the light is travelling the path length SP’ (or S’P), observer A moves from point P’ to point P, a distance of Δ_1 .

During the time interval that light moves from S to P, observer A moves from point P'' to point P'. The length of line segment P''P' , which is Δ_2 will be:

$$\frac{D}{c} = \frac{\Delta_2}{V_{abs}} \quad \Longrightarrow \quad \Delta_2 = \frac{V_{abs}}{c} \, D$$

Therefore, light is emitted at $t = 0$ for observer O. Light is detected by observer O and emitted for observer A at:

$$t = t_0 = \frac{D}{c}$$

The time delay of light for observer A will be:

$$t_1 = \frac{D'}{c}$$

During the time interval t_1 that light moves from S to P', i.e. a distance of D' , observer A will move from point P' to point P, a distance of Δ_1 .

Therefore,

$$\frac{D'}{c} = \frac{\Delta_1}{V_{abs}}$$

$$\Longrightarrow \Delta_1 = \frac{V_{abs}}{c} \, D'$$

But,

$$D' = \sqrt{D^2 + {\Delta_1}^2} = \sqrt{D^2 + (\frac{V_{abs}}{c} \, D')^2}$$

$$\Longrightarrow D' = \frac{D}{\sqrt{1 - \frac{{V_{abs}}^2}{c^2}}}$$

$$\Longrightarrow \Delta_1 = \frac{V_{abs}}{c} \, D' = \frac{V_{abs}}{c} \, \frac{D}{\sqrt{1 - \frac{{V_{abs}}^2}{c^2}}}$$

Therefore,

$$t_1 = \frac{D'}{c} = \frac{\frac{D}{\sqrt{1 - \frac{{V_{abs}}^2}{c^2}}}}{c} = \frac{D}{c} \frac{1}{\sqrt{1 - \frac{{V_{abs}}^2}{c^2}}}$$

Therefore, observer A will detect the light at point P, at time instant:

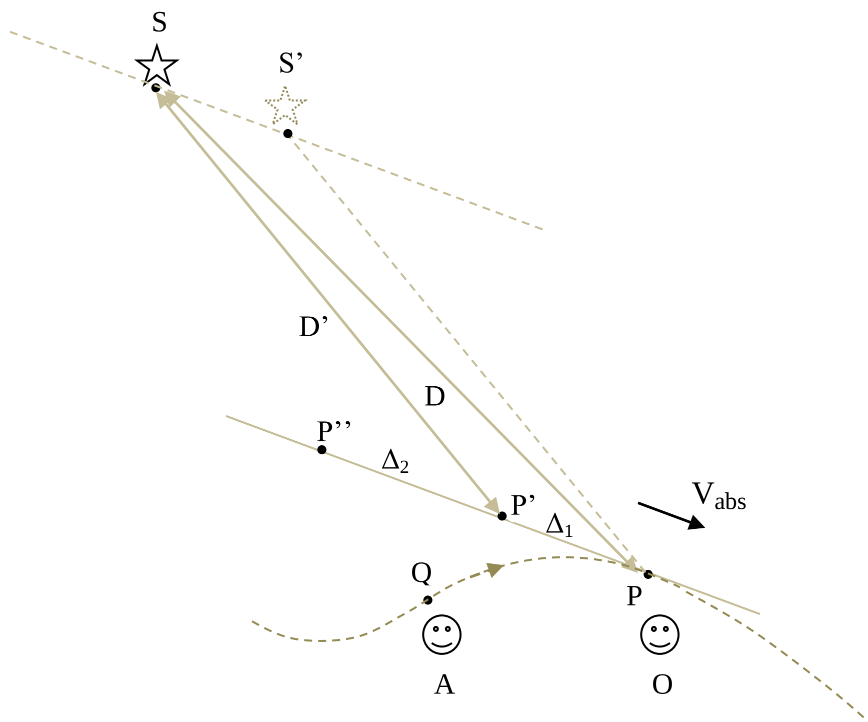
$$t = t_0 + t_1 = \frac{D}{c} + \frac{D}{c} \frac{1}{\sqrt{1 - \frac{{V_{abs}}^2}{c^2}}} = \frac{D}{c} \left(1 + \frac{1}{\sqrt{1 - \frac{{V_{abs}}^2}{c^2}}} \right)$$

Therefore, we can see that observer O sees the star light at point P as coming from the direction of S, while moving observer A sees the light at point P as coming from the direction of S'. The angle of aberration (α) between line SP and line S' P is given by:

$$\sin \alpha = \frac{\Delta_1}{D'} = \frac{\frac{V_{abs}}{c} D'}{D'} = \frac{V_{abs}}{c}$$

Acceleration

So far we have considered inertial observers. Now let us consider the case of a non-inertial observer. Suppose that a stationary source S emits a short light pulse at time $t = 0$. A non-inertial (accelerating) observer A is at point Q at the instant of light emission. The dotted line is the path of the non-inertial observer. The magnitude and direction of the observer's absolute velocity continuously changes.



To analyze this problem using numerical method we proceed according to the following procedure. The problem can also be solved analytically.

1. We start by assuming that the non-inertial observer A will detect the light at some assumed point P along the path. From this $t_0 = D/c$ can be determined. Also the instantaneous absolute velocity of observer A at point P will be determined. We also assume an imaginary inertial observer A' who reaches point P at the same instant as non-inertial observer A, and with the same velocity as the instantaneous velocity V_{abs} of observer A at point P.

2. Once point P and V_{abs} are determined/assumed, the next problem is to fix the location of point P''. For this, we start by assuming some point P'', from which point P' is fixed:

$$\Delta_2 = D\ \frac{V_{abs}}{c}$$

Then we check if the time it takes to travel from S to P' , a distance of D' , is equal to the time it takes imaginary inertial observer A' to move from P' to P, a distance of Δ_1 . That is, we check if:

$$\frac{D'}{c} = \frac{\Delta_1}{V_{abs}}$$

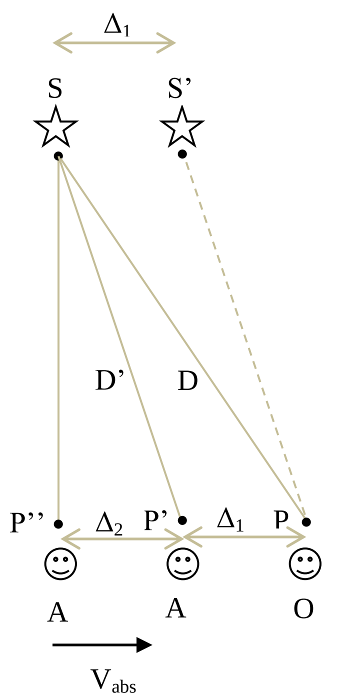
3. If the above equation is not satisfied (it is not likely to be satisfied at the first trial), then we check another point P'' and repeat the above procedure. If we get a point P'' that satisfies the above equation, then we have completed the analysis.

4. However, since we have chosen point P at random, it is unlikely that we will get the correct point P at the first trial. In this case we choose another point P and repeat the above procedures.

Reconciling stellar aberration and Apparent Source Theory

In this section we review how to resolve the contradiction of stellar aberration with the initial formulation of Apparent Source Theory [4][5][6] using the new formulation of Apparent Source Theory presented in the last section.

Consider co-moving light source S and observer O who is at absolute rest at point P, as shown below. Another observer A is moving to the right. At time $t = 0$ the source emits a short light pulse from S, and observer A is moving to the right with absolute velocity V_{abs} at point P''.

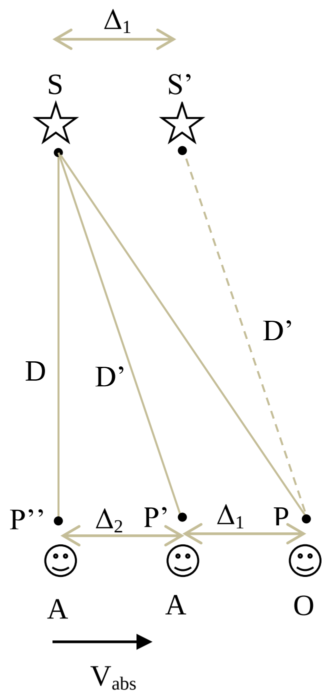


Therefore, at $t = 0$ a light pulse is emitted *for observer O* from S. At $t = t_0 = D/c$ the light pulse is detected by observer O at point P. During the time interval (t_0) that the light pulse moves from S to point P, observer A moves from point P'' to point P'. For observer A the light pulse is emitted at $t = t_0$, when observer A reaches point P'. Therefore, the light for observer A is emitted from point S at $t = t_0$, with the center of the wave fronts moving to the right with the same velocity as the absolute velocity (V_{abs}) of observer A. Thus, when observer A reaches point P, the center of the wave fronts reaches point S'. Observer A detects the light pulse at point P.

We can see how the new theory is consistent with both Apparent Source Theory (the initial formulation) and stellar aberration.

We can see that the angle between line SP and line S'P is the angle of stellar aberration. And the angle between line SP'' and line SP' is due to *apparent change of point of light emission in the reference frame of (relative to) moving observer A, due to absolute velocity of observer A*, which is the initial formulation of Apparent Source Theory.

However, the two formulations lead to different formulas that give almost equal values for $V_{abs} << c$, but may diverge as V_{abs} approaches the speed of light. Consider co-moving source S and observer A as shown below. Another observer O is at absolute rest at point P.



At time t = 0, the source is at S and the co-moving observer A is at point P''. At t = 0 , the source emits light from point S for stationary observer O. During the time interval that the light moves from S to P, observer A moves from P'' to P'.

Therefore,

$$t_0 = \frac{\sqrt{D^2 + (\Delta_2 + \Delta_1)^2}}{c} = \frac{\Delta_2}{V_{abs}}$$

For moving observer A the light is emitted when it reaches point P', at time $t = t_0$. During the time interval t_1 that observer A moves from P' to P, a distance of Δ_1 , the light travels a distance of D' , and observer A will detect the light at point P.

Therefore,

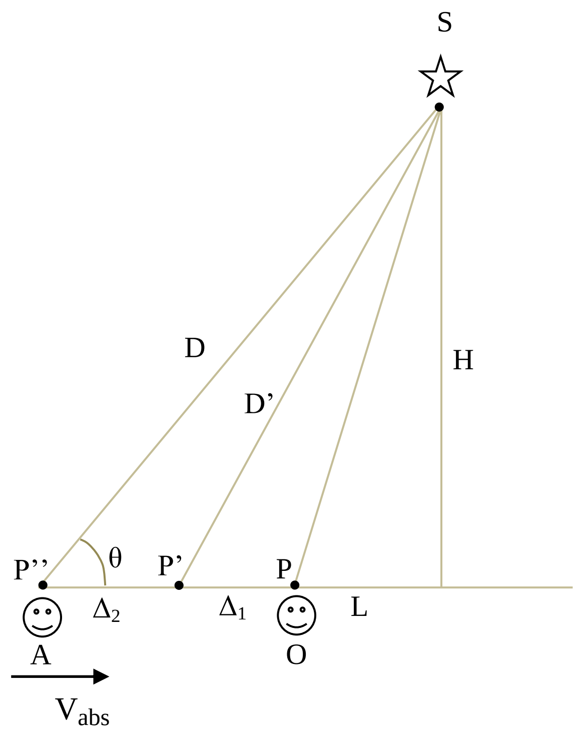
$$t_1 = \frac{\sqrt{D^2 + \Delta_2^{\ 2}}}{c} = \frac{\Delta_1}{V_{abs}}$$

From the last two equations Δ_1 , Δ_2 , t_0 , t_1 can be determined.

In the next section we will see a more detailed and quantitative reformulation of Apparent Source Theory.

New formulation of Apparent Source Theory

Assumed that at $t = 0$, the source emits light from point S *for observer O* who is at rest at point P. At $t = 0$, observer A is at point P'', moving with absolute velocity V_{abs} to the right.



During the time t_0 that light moves from S to P, observer A moves from P'' to P', a distance of Δ_2 .

That is,

$$t_0 \ = \ \frac{\Delta_2}{V_{abs}} \ = \ \frac{\sqrt{H^2 + L^2}}{c} \quad \Longrightarrow \quad \Delta_2 \ = \ \frac{V_{abs}}{c} \ \sqrt{H^2 + L^2} \quad . \quad . \quad . \quad (1)$$

For observer A, light is emitted at $t = t_0$ when observer has just reached point P'. At $t = t_0$ light is emitted for observer A, with the center of the wave fronts moving with the same velocity as the absolute velocity (V_{abs}) of observer A. Therefore, the center of the wave fronts of light emitted *for observer A* will move with velocity V_{abs} to the right.

During the time interval t_1 that observer A moves from P' to P, a distance of Δ_1 , the light moves a distance of D' .

That is,

$$t_1 \ = \ \frac{\Delta_1}{V_{abs}} \ = \ \frac{\sqrt{H^2 + (\,L + \ \Delta_1)^2}}{c} \quad \Longrightarrow \quad \Delta_1 \ = \ \frac{V_{abs}}{c} \ \sqrt{H^2 + (\,L + \ \Delta_1)^2} \quad . \quad . \quad . \quad (2)$$

But,

$$\frac{H}{tan\ \theta} \ = \ \Delta_1 \ + \ \Delta_2 \ + \ L \quad . \quad . \quad . \quad (\,3\,)$$

From equation (2) above:

$$\frac{c^2}{{V_{abs}}^2} \ {\Delta_1}^2 \ = \ H^2 + (\,L + \ \Delta_1)^2$$

$$\Longrightarrow \quad \frac{c^2}{{V_{abs}}^2} \ {\Delta_1}^2 \ = \ H^2 + \ L^2 + \ {\Delta_1}^2 \ + \ 2\,L\,\Delta_1$$

$$\Longrightarrow \quad {\Delta_1}^2 \left(\frac{c^2}{{V_{abs}}^2} \ - \ 1 \right) - \ 2\,L\,\Delta_1 \ - (\,H^2 + \ L^2\,) = 0$$

$$\Delta_1 = \frac{2L + \sqrt{4L^2 + 4\left(\frac{c^2}{{V_{abs}}^2} - 1 \right)(H^2 + L^2)}}{2\left(\frac{c^2}{{V_{abs}}^2} - 1 \right)}$$

From equation (3)

$$L = \frac{H}{tan\, \theta} - \Delta_1 - \Delta_2$$

$$\Longrightarrow \quad L = \frac{H}{tan\, \theta} - \frac{2L + \sqrt{4L^2 + 4\left(\frac{c^2}{{V_{abs}}^2} - 1 \right)(H^2 + L^2)}}{2\left(\frac{c^2}{{V_{abs}}^2} - 1 \right)} - \frac{V_{abs}}{c} \sqrt{H^2 + L^2}$$

$$\Longrightarrow L = \frac{H}{tan\, \theta} - \frac{L + \sqrt{L^2 + \left(\frac{c^2}{{V_{abs}}^2} - 1 \right)(H^2 + L^2)}}{\left(\frac{c^2}{{V_{abs}}^2} - 1 \right)} - \frac{V_{abs}}{c} \sqrt{H^2 + L^2} \quad . . . (4)$$

Once L is calculated from the above equation, Δ_1 , Δ_2 , t_0 , t_1 can be determined.

Let us check the above equations with respect to known facts.

For example, for L = 0 and V << c, we should be able to get the classical formula for stellar aberration for a star directly overhead. For this, from equation (1)

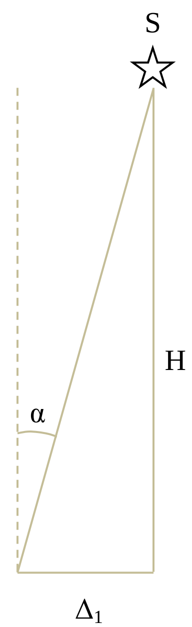
$$\Delta_2 = \frac{V_{abs}}{c} \sqrt{H^2 + L^2} \quad \Longrightarrow \quad \Delta_2 = \frac{V_{abs}}{c} H$$

and from equation (2) :

$$\Delta_1 = \frac{V_{abs}}{c} \sqrt{H^2 + (L + \Delta_1)^2} \quad \Rightarrow \Delta_1 = \frac{V_{abs}}{c} \sqrt{H^2 + {\Delta_1}^2}$$

$$\Rightarrow {\Delta_1}^2 = \frac{{V_{abs}}^2}{c^2} \left(H^2 + {\Delta_1}^2 \right) \quad \Rightarrow {\Delta_1}^2 \left(1 - \frac{{V_{abs}}^2}{c^2} \right) = \frac{{V_{abs}}^2}{c^2} H^2$$

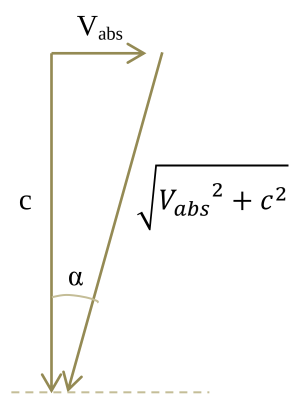
$$\Rightarrow \quad \Delta_1 = \frac{\frac{V_{abs}}{c} H}{\sqrt{1 - \frac{{V_{abs}}^2}{c^2}}}$$



The angle of aberration (α) is given by:

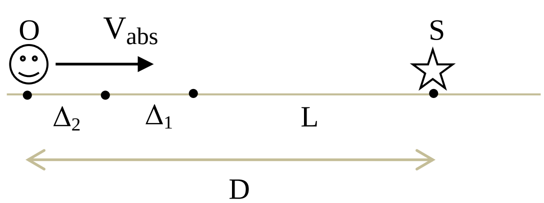
$$\sin\alpha = \frac{\Delta_1}{\sqrt{H^2 + {\Delta_1}^2}} = \frac{\frac{\frac{V_{abs}}{c} H}{\sqrt{1 - \frac{{V_{abs}}^2}{c^2}}}}{\sqrt{H^2 + H^2 \frac{{V_{abs}}^2}{c^2} \frac{1}{1 - \frac{{V_{abs}}^2}{c^2}}}} = \frac{V_{abs}}{c}$$

According to classical addition of velocities, the aberration angle will be:



$$\sin\alpha = \frac{V_{abs}}{\sqrt{{V_{abs}}^2 + c^2}} = \frac{\frac{V_{abs}}{c}}{\sqrt{1 + \frac{{V_{abs}}^2}{c^2}}} \approx \frac{V_{abs}}{c} \quad , \quad for \;\; V_{abs} \ll c$$

Now let us consider the case when H = 0.



From equation (4)

$$\Rightarrow L = \frac{H}{tan\,\theta} - \frac{L + \sqrt{L^2 + \left(\frac{c^2}{{V_{abs}}^2} - 1\right)(H^2 + L^2)}}{\left(\frac{c^2}{{V_{abs}}^2} - 1\right)} - \frac{V_{abs}}{c}\sqrt{H^2 + L^2}$$

We will use D in place of (H/ tan θ) and H = 0 in the above equation.

$$\Rightarrow L = D - \frac{L + \sqrt{L^2 + \left(\frac{c^2}{{V_{abs}}^2} - 1 \right) L^2}}{\left(\frac{c^2}{{V_{abs}}^2} - 1 \right)} - \frac{V_{abs}}{c} L$$

$$\Rightarrow L = D - \frac{L + \sqrt{L^2 + \left(\frac{c^2}{{V_{abs}}^2} - 1 \right) L^2}}{\left(\frac{c^2}{{V_{abs}}^2} - 1 \right)} - \frac{V_{abs}}{c} L$$

$$\Rightarrow L \left(1 + \frac{V_{abs}}{c} \right) = D - \frac{1 + \sqrt{1 + \left(\frac{c^2}{{V_{abs}}^2} - 1 \right)}}{\left(\frac{c^2}{{V_{abs}}^2} - 1 \right)} L$$

$$\Rightarrow L \left(1 + \frac{V_{abs}}{c} \right) = D - \frac{1 + \frac{c}{V_{abs}}}{\left(\frac{c^2}{{V_{abs}}^2} - 1 \right)} L$$

$$\Rightarrow L \left(\left(1 + \frac{V_{abs}}{c} \right) + \frac{1 + \frac{c}{V_{abs}}}{\left(\frac{c^2}{{V_{abs}}^2} - 1 \right)} \right) = D$$

$$\Rightarrow L \left(\left(1 + \frac{V_{abs}}{c} \right) + \frac{1 + \frac{c}{V_{abs}}}{\left(\frac{c}{V_{abs}} + 1 \right)\left(\frac{c}{V_{abs}} - 1 \right)} \right) = D$$

$$\Rightarrow L \left(\left(1 + \frac{V_{abs}}{c} \right) + \frac{1}{\left(\frac{c}{V_{abs}} - 1 \right)} \right) = D$$

$$\Rightarrow L = \frac{D}{\left(1 + \frac{V_{abs}}{c}\right) + \frac{1}{\left(\frac{c}{V_{abs}} - 1\right)}}$$

$$\Rightarrow L = \frac{D}{\left(1 + \frac{V_{abs}}{c}\right) + \frac{V_{abs}}{c - V_{abs}}}$$

$$\Rightarrow L = \frac{D\,(c^2 - V_{abs}\,c)}{c^2 - {V_{abs}}^2 + V_{abs}\,c}$$

$$\Rightarrow L = D\ \frac{1 - \frac{V_{abs}}{c}}{1 - \frac{{V_{abs}}^2}{c^2} + \frac{V_{abs}}{c}} \approx D\ \frac{1 - \frac{V_{abs}}{c}}{1 + \frac{V_{abs}}{c}} = D\ \frac{1 - \frac{{V_{abs}}^2}{c^2}}{1 + \frac{{V_{abs}}^2}{c^2} + \frac{2V_{abs}}{c}}$$

$$\Rightarrow L = D\ \frac{1}{1 + \frac{2V_{abs}}{c}}\quad ,\ for\ \ V_{abs} \ll c$$

Let us see if we will get the same formula according to the initial formulation of AST, according to which:

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

$$L + \Delta_1 = D\ \frac{c}{c + V_{abs}}$$

But,

$$\Delta_1 = \frac{V_{abs}}{c}\ \sqrt{H^2 + (L + \Delta_1)^2} \quad \Rightarrow \quad \Delta_1 = \frac{V_{abs}}{c}\ (L + \Delta_1)$$

$$\Delta_1 = \frac{\frac{V_{abs}}{c}\ L}{1 - \frac{V_{abs}}{c}}$$

Therefore,

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

$$L\ \left(1 + \frac{\frac{V_{abs}}{c}}{1 - \frac{V_{abs}}{c}} \right) = D\ \frac{c}{c + V_{abs}}$$

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

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

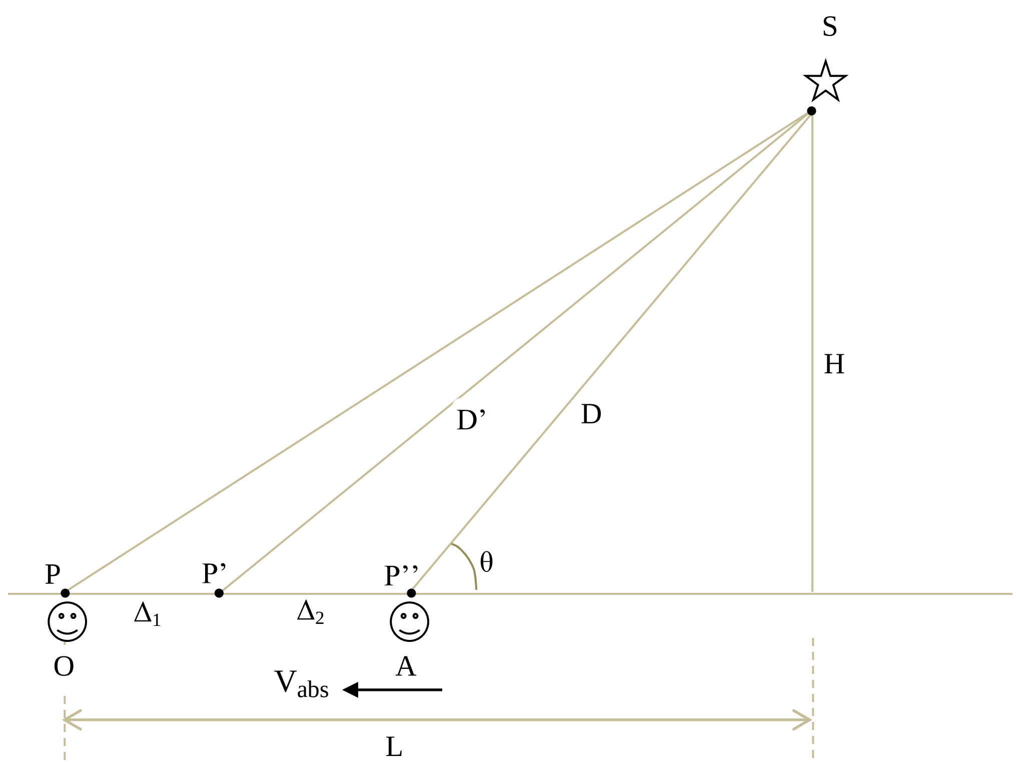
$$L = D\ \frac{c - V_{abs}}{c + V_{abs}}$$

$$L = D\ \frac{c^2 - {V_{abs}}^2}{c^2 + {V_{abs}}^2 + 2\ V_{abs}\ c}$$

$$L = D\ \frac{1 - \frac{{V_{abs}}^2}{c^2}}{1 + \frac{{V_{abs}}^2}{c^2} + \frac{2\,V_{abs}}{c}}$$

$$L \approx D\ \frac{1}{1 + 2\ \frac{V_{abs}}{c}} \quad , \quad for\ \ V_{abs} \ll c$$

We can repeat the above analyses for an observer moving away from the light source, as shown below.



$$t_0 = \frac{\Delta_2}{V_{abs}} = \frac{\sqrt{H^2 + L^2}}{c} \implies \Delta_2 = \frac{V_{abs}}{c}\sqrt{H^2 + L^2} \quad . \quad . \quad . \quad (5)$$

$$t_1 = \frac{\Delta_1}{V_{abs}} = \frac{\sqrt{H^2 + (L - \Delta_1)^2}}{c} \implies \Delta_1 = \frac{V_{abs}}{c}\sqrt{H^2 + (L - \Delta_1)^2} \quad . \quad . \quad . \quad (6)$$

$$\frac{H}{\tan\theta} = L - \Delta_1 - \Delta_2 \quad . \quad . \quad . \quad (7)$$

From equation (6) above:

$$\frac{c^2}{{V_{abs}}^2}\,{\Delta_1}^2 = H^2 + (L - \Delta_1)^2$$

$$\Rightarrow \quad \frac{c^2}{{V_{abs}}^2}\ {\Delta_1}^2 \ = \ H^2 + L^2 + {\Delta_1}^2 - 2\,L\,\Delta_1$$

$$\Rightarrow \quad {\Delta_1}^2 \left(\frac{c^2}{{V_{abs}}^2} - 1 \right) + 2\,L\,\Delta_1 - (H^2 + L^2) = 0$$

$$\Delta_1 = \frac{-2L + \sqrt{4L^2 + 4\left(\frac{c^2}{{V_{abs}}^2} - 1 \right)(H^2 + L^2)}}{2\left(\frac{c^2}{{V_{abs}}^2} - 1 \right)}$$

From equation (7)

$$L = \frac{H}{tan\,\theta} + \Delta_1 + \Delta_2$$

$$\Rightarrow \quad L = \frac{H}{tan\,\theta} + \frac{-2L + \sqrt{4L^2 + 4\left(\frac{c^2}{{V_{abs}}^2} - 1 \right)(H^2 + L^2)}}{2\left(\frac{c^2}{{V_{abs}}^2} - 1 \right)} + \frac{V_{abs}}{c}\ \sqrt{H^2 + L^2}$$

$$\Rightarrow L = \frac{H}{tan\,\theta} + \frac{-L + \sqrt{L^2 + \left(\frac{c^2}{{V_{abs}}^2} - 1 \right)(H^2 + L^2)}}{\left(\frac{c^2}{{V_{abs}}^2} - 1 \right)} + \frac{V_{abs}}{c}\ \sqrt{H^2 + L^2} \quad . . . (8)$$

Once L is calculated from the above equation, Δ_1 , Δ_2 , t_0 , t_1 can be determined.

Conclusion

In this paper, we have proposed that absolute motion and constancy of the speed of light can co-exist. We have shown how absolute motion can exist and the speed of light can be constant at the same time. We have provided a new interpretation of absolute motion and stellar aberration, thereby reconciling the initial formulation of Apparent Source Theory with stellar aberration. All absolute motion and constant speed of light phenomena imply nature's foreknowledge of future observer motions, which implies the intervention of God in all light speed phenomena.

Glory be to Almighty God Jesus Christ and His Mother, Our Lady Saint Virgin Mary

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