Apparent Shift of Past Position of a Light Source due to Absolute Motion; Absolute Space as Defined by Cosmic Massive Objects; Constant Phase Velocity and Variable Group Velocity of Light

Galileo's principle of relativity holds only in an ideal space far away from massive cosmic objects. The absolute space-free space continuum. Speed of light is unaffected by distance from cosmic massive objects. A new Michelson-Morley experiment using two independent coherent light sources.

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Abstract

A new interpretation and theory of absolute motion/ absolute space and the speed of light is proposed. Ether theory and emission theory are not completely wrong, but only incomplete separately. This paper proposes a theory that is a fusion of ether theory and emission theory. We call this : Apparent Source Theory (AST). 1. Space can exist independently of mass (matter). In such an ideal universe/space Galileo's principle of relativity, emission theory, Coulomb's law, Newton's law of gravitation hold. Sagnac, Michelson-Gale, Silvertooth effects do not exist. 2. In our real universe, all matter in the universe creates absolute space. Every cosmic massive objects define, or 'fix' the (absolute) space in their vicinity, with their influence diminishing with distance. The absolute velocity of a body is the (inverse square distance and mass) weighed vector sum of the velocity of the body *relative* to all matter in the universe. Imagine a universe in which only the sun and a small comet exist and assume that they are in relative motion near to each other. Which one is moving? The sun is at rest (mass= 1.988×10^{30} Kg !) and the comet is moving. The sun defines, 'fixes' the space in its vicinity. 3. The effect of absolute motion is to create a change in path length, and not the speed, of light. There will be aberration for absolutely co-moving source and observer. The ***past*** position of a light source apparently changes relative to an observer due to absolute motion. The velocity of light is constant c relative to the *apparent* source, and not relative to the source. The center of the wave fronts neither stays at the point in space where the source was at the instant of emission (as in SRT and ether theories), nor move with the source as in emission theories. The center of the wave fronts moves with the apparent source. The ether doesn't exist. Relative to a detector on a rotating Sagnac device, the source appears farther away when 'looking' in the backward direction than when 'looking' in the forward direction. For static fields, the center of the field is not at the source but at the apparent source. In free space (region of space far from cosmic massive objects) there will be no absolute motion and hence no apparent shift of light source (no 'aberration'). 4. The speed of light is always the same, both in absolute and free space. It is unaffected by massive objects. An experiment is proposed to repeat the Rosa and Dorsey experiment (1907) at different distances from the Earth or the Sun to see if there is any effect on vacuum permittivity and permeability. 5. The phase velocity of light is constant, in accordance with Maxwell's equations, whereas the group velocity is variable. The apparent *phase* velocity c' of light relative to a source at absolute rest increases or decreases by the same amount of the velocity (V) of the observer, so that the phase velocity of light relative to the observer is always equal to c: $c' + V = c$ (algebraic sum). The constancy of phase velocity is also interpreted to explain the 'relativistic mass increase' of the electron. A new result of Einstein's thought experiment is proposed: for an observer moving at the speed of light away from a light source that is at absolute rest, the phases will still move past the observer at the speed of light whereas the group will be frozen. This paper discloses the mystery behind the failure of many experiments to detect any dependence of the (group) velocity of light on the velocity of the source. A fundamental flaws in conventional and modern Michelson-Morley experiments is disclosed. The speed of electrostatic fields is infinite, as confirmed by experiment done by A. Calcaterra, et al. But Coulomb's law has to be modified for charge and observer in relative motion. The field gets apparently expanded or compressed for a moving observer or, equivalently for a moving charge. This is interpreted as infinite group velocity and light speed phase velocity for electrostatic fields. The speed of gravity is shown to be equal to the speed of light, based on observed direction of Sun's gravity on Earth, such as during eclipses. But it is not clear what is propagating in the case of gravity. This shows the usual analogy between electrostatic field and gravity may not be correct.

Introduction

The notions, theories, experiments and phenomena on the nature of space, motion and the nature and speed of light, the process of radiation and the nature of static fields are numerous, divergent and have been the source of centuries of confusions. The resolution of the many associated contradictions and puzzles has remained to be a truly daunting task todate. Despite all successes and advance of modern physics, physics remains to be vague at its fundamental and elementary levels. Many 'elementary' questions remain unanswered. For example, what is the 'speed' of static fields? How is electromagnetic radiation created? e.t.c. The problem of the speed of light is still a puzzle.

There are numerous and divergent experimental and observational evidences related to the speed of light that have accumulated for centuries, but defied any natural and logical explanation by a single theory of light. The conventional and modern Michelson-Morley and the Kennedy-Thorndike experiments, the Trouton-Noble experiment, the Sagnac and Michelson-Gale experiments, de Sitter's binary star argument, moving mirror and moving source experiments, the 'positron annihilation in flight' experiment, bending of starlight near the sun, the Hafele-Keating, 'time dilation' experiments, the GPS correction, astronomical and terrestrial speed of light measuring experiments, stellar aberration, the Ives-Stilwell, the Fizeau experiments, relativistic 'mass increase' of the electron. The Pioneer anomaly, CMBR anisotropy, the Silvertooth and the Marinov experiments, Venus planet radar range data anomaly (Bryan G.Wallace) and Ronald de Witte's experiment are some of the relatively recent anomalies adding to the list.

The principle of relativity, first introduced by Galileo, is known to be one of the most cherished ideas in physics. The idea of absolute space and absolute motion existed since Newton, but with cloudy idea of its meaning. Einstein was the first scientist to clearly and explicitly deny the validity of absolute motion, in a revolutionary way. Einstein's denial was clear, explicit and revolutionary. He clearly stated the emptiness of space. The ether hypothesis was disproved by the Michelson-Morley experiment.

SRT is the theory that claims to have the answer for all these contradictions and puzzles. SRT apparently agrees better with experiments and observations, but it is counterintuitive and is full of paradoxes.
The SRT presumes fundamentally that there is no experiment that can detect absolute motion[4].

A mind blowing evidence of absolute motion of the earth was disclosed by Silvertooth in his experiment of 1986. Silvertooth's experiment revealed an absolute velocity of 378 Km/s, correlated with sidereal time and consistently pointing to the constellation Leo. Measurement of CMBR spectrum anisotropy by NASA COBE satellite showed a velocity of 390 Km/s of the solar system relative to the CMBR, in the same direction of constellation Leo, in striking agreement with Silvertooth's experiment. However, the analysis and explanation given by Silvertooth himself was based on the ether theory and was not clear. Other experiments pointing to absolute motion were also performed by different physicists, such as the earlier Marinov experiment and the later experiment carried out by Ronald DeWitte. The Sagnac and Michelson- Gale experiments clearly confirm absolute motion but are controversial because they are based on rotation.

As its second postulate, SRT assumes that the speed of light is the same for all observers. However, there is no direct, not-controversial evidence for this postulate to date. We had to rely only on Einstein's (beautiful) light speed thought experiment. For example, one possible experiment could have been for an observer moving towards a stationary light source and looking for a change in wavelength implied by Einstein's light postulate.
On the other hand, the speed of light has been measured for centuries with increasing accuracy, from astronomical observations and terrestrial experiments, with such experiments as the Albert Michelson rotating mirror experiment and modern experiments using laser beams and cavity resonators. The fact that

no significant variation has been found in different experiments shows that the measured speed of light does not depend on the orientation of the measuring apparatus relative to the earth's orbital or absolute velocity.

The ether and emission theories were the other two theories competing with SRT. Both are intuitive, logical, natural. However, they have decisively failed on a number of experiments. Apparently, no dependence of the velocity of light on the velocity of its source and no anisotropy of the velocity of light has ever been detected.

Therefore, there is no single theory of the speed of light so far that does not fail decisively on one or more experiments and observations.

The light speed problem is seen as the interpretation of the constant c in Maxwell's equations. But electromagnetism is still vague.

The principle of relativity and the absolute notion both seem to have supporting evidences and the absolute notion has never been truly ruled out as often claimed in SRT. All the three well known theories/postulates of light namely, Einstein's light postulate, emission theories and the absolute space (ether), seem to have supporting evidences.

This paper is an attempt to develop a coherent theoretical framework that may unify all or most of the theories, experimental evidences and observations related to the speed of light. A new theoretical framework is proposed in which absolute space/ absolute motion theory, emission theory and Einstein's light postulate, are fused into a single model, with features of each theory that do not fit into the new model left out.

Discussion

A new interpretation of absolute motion

The notion of absolute space and the ether hypothesis existed for centuries. The two concepts have always been wrongly referred to be the same. In this paper a new interpretation of absolute space and its distinction from the ether or classical absolute space theory will be proposed.

The emission theory may explain the Michelson-Morley, the Kennedy-Thorndike and the Trouton-Noble experiments. The observed isotropy of light speed also agrees with emission theory. The ether theory fails on these experiments.

The ether theory may explain the Sagnac, the Michelson-Gale, the Silvertooth, the Marinov, moving source and moving mirror experiments (Albert Michelson, Q.Majorana, positron annihilation in flight, …), de Sitter's binary star experiments. Emission theory fails on these experiments.

Stellar aberration may be explained by either emission or ether theory.

We see that many of the experiments on the speed of light can be explained intuitively, naturally, logically either by the emission or the ether theory. This is the hint to the resolution of the paradoxes and contradictions related to the speed of light:

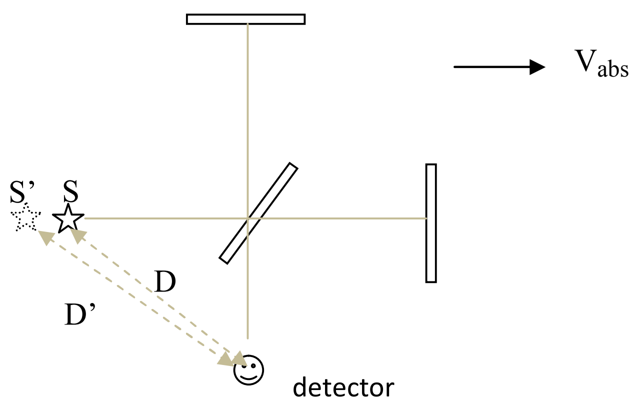
a fusion of the emission and the ether theories.

Hence emission theory and ether theory may not be necessarily wrong but each may be only incomplete separately. If the supporters of both only thought of a possibility to fuse the two theories, the history of physics may have been different.

Such a theory, which is a fusion of emission theory and ether theory, may also explain other ‘exotic’ experiments and effects such as the Ives-Stilwell experiment, ‘GPS correction’, ‘time dilation’, relativistic ‘mass increase’ of the electron, … , or pave the way for their understanding, or make them non-existent or invalid. Such a theory would render special relativity unnecessary.
The fusion of ether and emission theories is presented as follows:

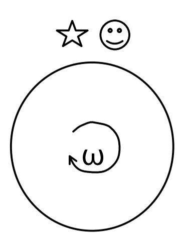
The effect of absolute motion (of the Michelson-Morley and Sagnac interferometers) is to create a change in path length, and not the speed, of light. The effect of absolute motion of the Michelson-Morley and the Sagnac interferometers is to create an apparent change of position (distance and direction) of the light source, as seen by the detector/observer. The center of the wave fronts moves with the apparent source, and not with the source. The velocity of light is c relative to the apparent source.
The effect of absolute motion is to create an apparent change in the ***past*** *position of a light source relative to an observer.*

Consider the Michelson-Morley (MM) apparatus.

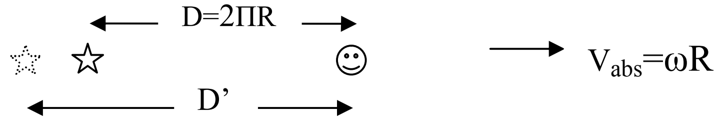


As seen in the figure above, the source has shifted apparently from its real position S to an apparent position S’, *relative to the detector*, due to absolute motion of the device. The effect of apparent change of position of the source can be understood as follows. Actually (physically) shifting the source position to position S’ would not, obviously, result in a fringe shift. The same holds for apparent change of source position: no fringe shift would occur. This is because the forward and lateral beams are affected identically by the change of source position from S to S’.

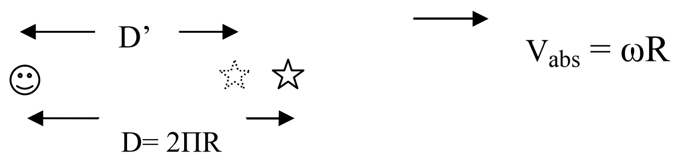
The same kind of interpretation can explain the fringe shift of a rotating Sagnac device. If we ‘unwind’ the Sagnac interferometer, we can see how the fringe shift arises.



Relative to the detector, the source appears farther than it actually is (D’ > 2ΠR) when ‘looking’ in the backward direction, as shown below,



and the source appears to be nearer than it actually is (D’ < 2ΠR) when ‘looking’ in the forward direction (direction of motion), as shown below.



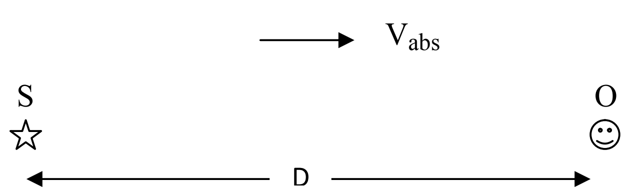
Since the path lengths of the forward and back ward light beams will be different due to rotation, there will be a fringe shift. The reader is asked to critically see the distinction from ether theory. In Apparent Source Theory (AST) the speed of light is always equal to c relative to the observer, unlike ether theory, for a co-moving source and observer. AST is also distinct from emission theory.

This interpretation is the central theme of this paper and will be applied throughout this paper. It has been discovered by this author that this interpretation of the MMX and Sagnac experiments is a special case of a more general interpretation. In the MMX and Sagnac experiments, the source and the observer/detector are co-moving and hence they will always have equal absolute velocities /speeds, and no relative motion between them. The general case is for the source and the observer to have independent/ different absolute velocities, and hence with relative motion between them.
The new theory is restated as follows:
Suppose that a light source emits light and an observer is at a distance D from the source, *at the instant of emission.* The effect of absolute motion of the source is to create an apparent change of the position (distance D) of the source. At the instant of observation, it appears to the observer as if the source emitted light not from a distance D but from a distance D’. This means that absolute motion creates an apparent change in the *past* position of the source. A more complete presentation is ahead.

In the next section an elementary analysis for co-moving source and observer will be presented based on the new interpretation, followed by the application to the analysis of MM, Sagnac, Silvertooth, … experiments.

(Absolutely) Co-moving source and observer

Imagine a light source S and an observer O co-moving in space to the right.



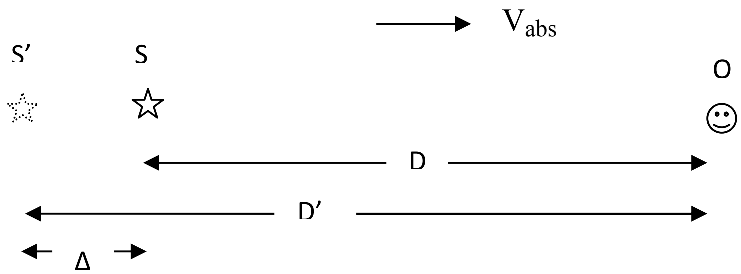
We will assume that the light source and the observer are moving absolutely, with absolute velocity V_{abs}

to the right , and then give the new interpretation of absolute motion.

If V_{abs} is zero, i.e if the light source and the observer are at absolute rest, then a light pulse emitted from S will be received by the observer O after a time delay of:

$$t_d = D/c$$

If V_{abs} is not zero, however, the time delay will be determined as follows:



The observer detects a light pulse emitted not from a point in space where the source *is* at that instant of detection but from a point S' in space where the source *was* some time ago, at the instant of emission.

During the time (t_d) that the source moves from point S' to point S, the light pulse moves from point S' to point O, i.e. the time taken for the source to move from point S' to point S is equal to the time taken for the light pulse to move from point S' to point O.

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

But

$$D + \Delta = D'$$

From the above two equations:

$$D' = D * (c / (c-V_{abs}))$$

and

$$\Delta = D* (V_{abs} / (c - V_{abs}))$$

The above analysis is based on classical absolute space or ether theory.

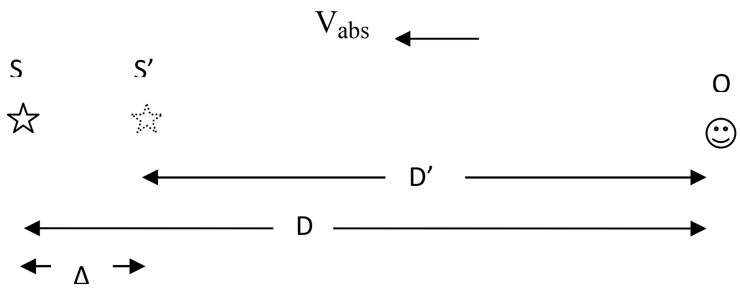
The light beam is thought as starting from an absolute point in space: 'a point in space'. The center of the wave fronts is thought to be or to remain at that 'point in space' where the source was at the instant of emission. Special Relativity and the ether (or classical absolute space) theory are based on such assumption. This assumption, however, has been disproved by the Michelson-Morley experiment (MMX) null result.

The new interpretation is presented as follows.

To the observer, the light source appears to have shifted by an amount Δ backwards away from the observer, but the center of the wave fronts is always at the apparent source position, for a constant absolute velocity V_{abs}.
There is no 'point in space' to be the center of the wave fronts. Space is empty and there is no medium (ether). The center of the wave fronts is always at the (apparent) source. This is the new interpretation.

The light behaves as if it was emitted from distance D', not from D. i.e. the *past* position of the source changes apparently. Note that neither SRT, nor ether theory, nor emission theory ever doubt about the 'point' where a light beam started, i.e. the *past* position of the light source.

The same analysis can be done if the source and the observer were co-moving absolutely to the left.

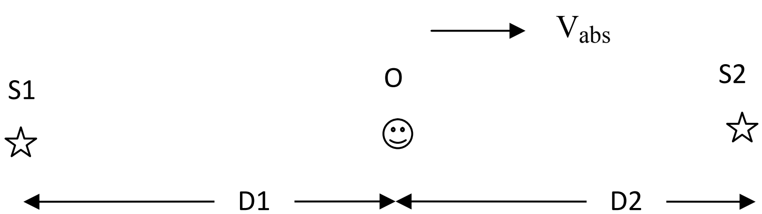


In this case, the source appears to have shifted by an amount Δ towards the observer.

$$D' = D\,(c / (c+V_{abs}))$$

$$\Delta = D\,(V_{abs} / (c+V_{abs}))$$

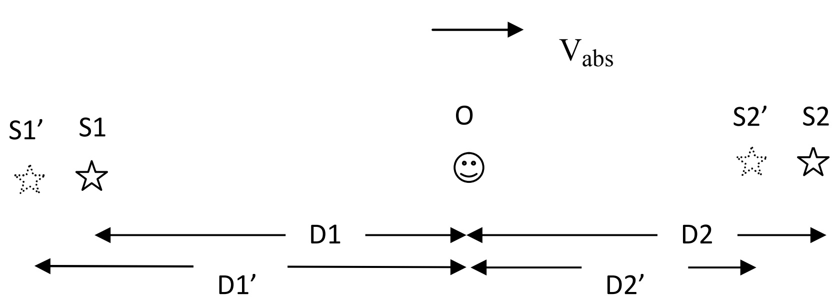
Imagine two light sources S1 and S2 co-moving with the observer O to the right, with absolute velocity V_{abs} .



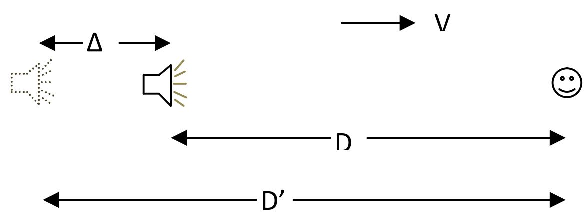
S1 and S2 are at distances D1 and D2 from O, respectively.
Assume that initially V_{abs} is zero (i.e. absolute rest). Then light pulses emitted from S1 and S2 arrive at O after delays:

$$t_{d1} = D1 / c$$
$$t_{d2} = D2 / c$$

If V_{abs} is not zero, then S1 appears to have shifted backwards away from O , where as S2 appears to have shifted towards O.



Hence if observer O used an interferometer, he would detect a fringe shift as the absolute velocity increased from zero to V_{abs}.
So according to the new theory any problem of absolute motion of source and observer is solved by replacing the real source with an apparent source and then assume that absolute velocity is zero.
The distinction of this theory will be clearer if we consider the case for sound or water waves, or the ether. Assume that the sound source and the receiver are on a common platform moving with velocity V relative to air, as shown below. We can analyze the problem as if the source and the receiver are at rest relative to the air, but replace the real source by an apparent source, as we did for a light source, as shown below.



Unlike light, the velocity of sound waves relative to the observer is $c_s \pm V$, where V is the velocity of the receiver relative to air, c_s is the velocity of sound relative to air. In this case it will be c-V because the receiver is moving in the same direction as the sound wave. The time it takes sound to travel distance D' is equal to the time it takes the source to travel distance Δ .

Therefore,

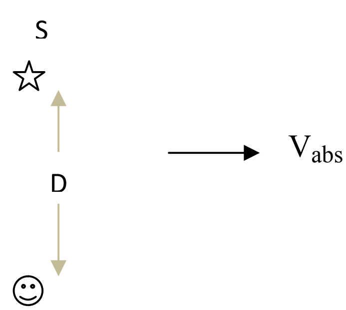
$$D'/ c_s = (D' - D) / V$$

D' will be:

$$D' = [(c_s - V) / (c_s - 2V)] . D$$

So we get a different formula for sound.

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

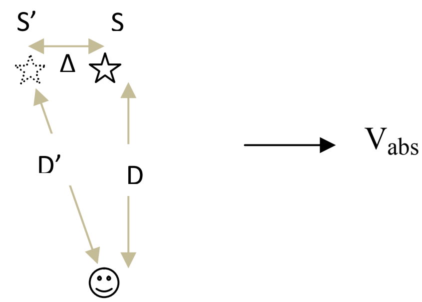


S and O are moving to the right with absolute velocity Vabs.

If Vabs is zero, a light pulse emitted from S will be received by O after a time delay t_d

$$t_d = D/c$$

If Vabs is not zero, then the light source appears to have shifted to the left as seen by observer O.



In the same way as explained previously,

$$D' / c \;=\; \Delta / V_{abs}$$

But,

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

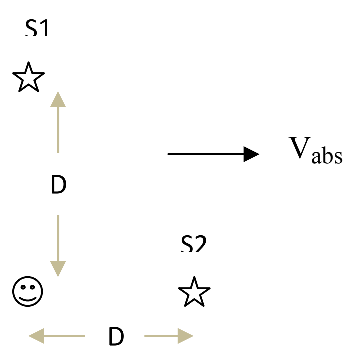
From the above two equations

$$D' \;=\; D * \; (c / (c^2 - V_{abs}{}^2)^{1/2})$$

Therefore, the time delay t_d between emission and reception of the light pulse in this case will be

$$t_d \;=\; D' / c \;=\; (D / (c^2 - Vabs^2)^{1/2})$$

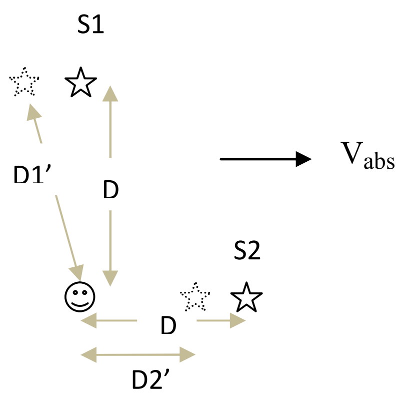
Now suppose that there are two light sources S1 and S2 , as shown below.



S1, S2 and observer O are co-moving absolutely to the right with absolute velocity *Vabs*.
If V_{abs} is zero the two time delays will be equal.

$$t_{d1} \;=\; t_{d2} \;=\; D / c$$

If *Vabs* is not zero, the positions of the sources will change apparently relative to the observer as shown below and hence the two time delays will be affected differently and hence a fringe shift will occur.



In this case, the two time delays will be different..

$$D1' = D * (c / (c^2 - Vabs^2)^{1/2})$$

$$D2' = D * (c / (c + Vabs))$$

Therefore

$$t_{d1} = D1' / c$$

$$= D / (c^2 - Vabs^2)^{1/2}$$

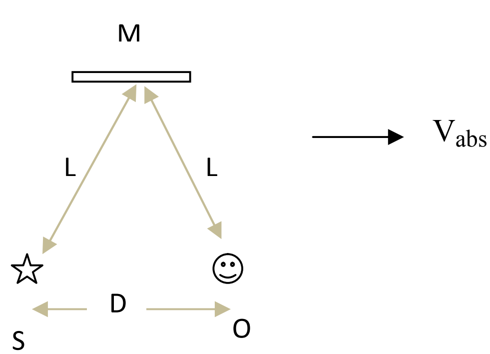
and

$$t_{d2} = D2' / C = D / (C + Vabs)$$

Hence, a fringe shift would occur as the absolute velocity is increased.

So far we considered only the simplest ideal systems in which only a light source and an observer existed. However, real experiments involve mirrors, so we will analyze a system additionally consisting of mirrors in the next section.

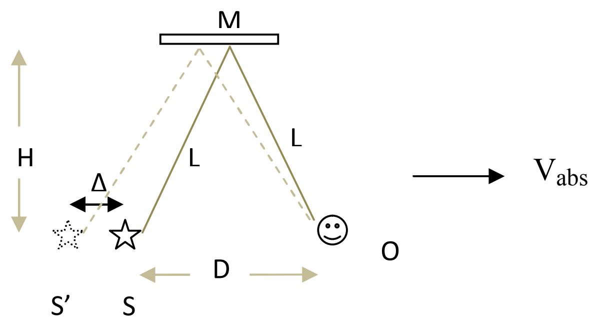
Consider a light source S, an observer O and a mirror M , co-moving to the right with absolute velocity Vabs.



If *Vabs* is zero, then the time delay between emission and reception of a light pulse will be

$$t_d = 2L / C$$

If Vabs is not zero, then, as discussed previously, the source S appears to have shifted away from the observer O. The effect will be the same as physically shifting the source in a Galilean space and use emission theory.



$$\Delta = D * (Vabs / (c-Vabs))$$

Hence the length of the light path from S' to O will be:

$$2 * (((D+\Delta)/2)^2 + H^2)^{1/2})$$

Therefore, the time delay will be

$$t_d = (1/c) * 2* (((D+\Delta)/2)^2 + H^2)^{1/2})$$

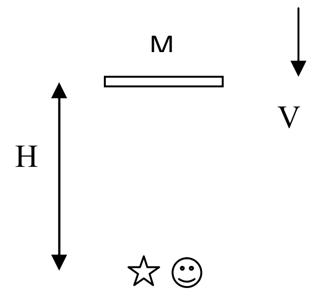
where D is the *direct* distance from observer to source. Note that, throughout this paper, we always take source observer *direct* distance to determine apparent position of the source.
So the effect of absolute motion is just to create an apparent shift in the position of the light source relative to the observer. This avoids all the confusions that arise in systems consisting of mirrors. We would not say, for example, that the mirror will move to a different position while the light beam is in transit, etc., as in standard interpretations in ether theory and SRT. Only the position of the light source is thought to shift apparently relative to the observer.

What if the mirror is moving? Assume that the mirror is moving towards or away from the source and the observer with velocity V, with the source and observer at rest relative to each other, but with a common absolute velocity as shown in the figure. How is this experiment analyzed?
The procedure of analysis is:

1. Replace the real source with the apparent source (i.e. a source at the apparent position)
2. Analyze the experiment by assuming conventional emission theory and Galilean space .

Let us consider a simpler case in which the distance D between source and observer is much less than the distance H to the mirror, so that we can assume that the source and observer are at the same point in space. From our analysis so far, the less the distance between co-moving source and observer, the less will be the apparent change of source position. In this case, there will not be any significant apparent change of position of the source relative to the observer. The source and the observer are considered to be at rest (according to the procedure mentioned above), with the mirror moving towards them with velocity V. A good example of such a case is the explanation for ' the anomalous radar range data of planet

Venus as discovered by Bryan G.Wallace'. The detail analysis of this experiment will be made in the section ahead.



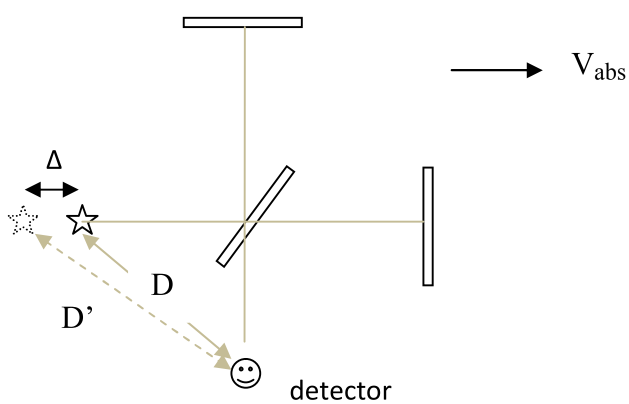
If the mirror is not moving, the round trip time of a light pulse emitted by the source will be:

$$T_d = 2H/c$$

Since we apply emission theory after replacing the real source by the apparent source, the velocity of the reflected light will be c + 2V, relative to the observer.

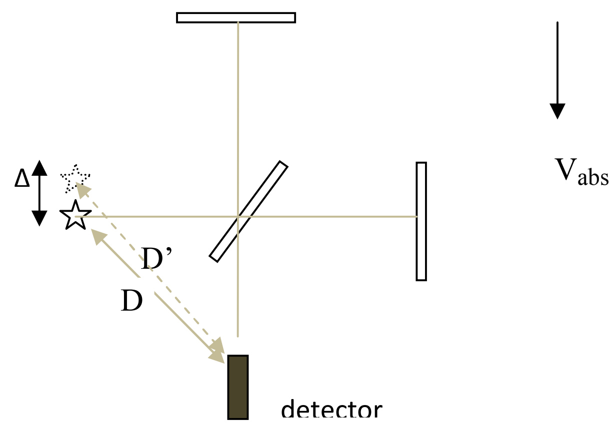
The analysis of the round trip for the case of a moving mirror will be made in the section ahead which explains the Bryan G.Wallace experiment. In this experiment, the planet Venus acts as the mirror M.

With the interpretation(theory) presented so far, the Michelson- Morley and the Kennedy-Thorndike experiments can be explained. The secret behind the null results of these experiments is that only a single light source was used, with a single light beam split into two.



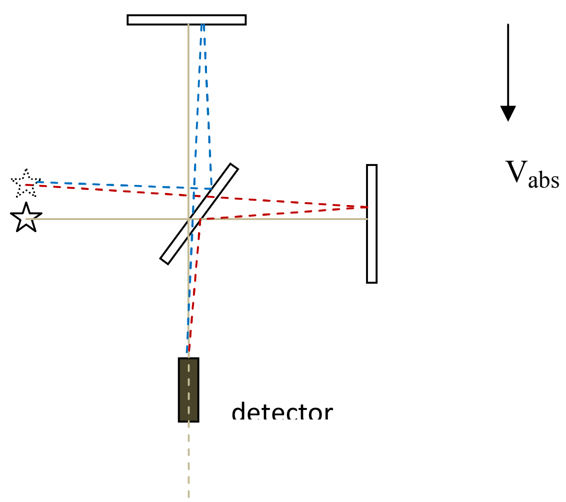
From the above diagram, we see that the effect of absolute velocity is just to create an apparent shift of the position of the light source, for absolute velocity Vabs directed to the right. Therefore, the apparent shift of the source is common both to the forward and lateral beams and hence the path lengths of both beams are affected in the same way and hence no fringe shift will occur. Again, the effect is the same as physically changing the source position (in Galilean space), which will not create any fringe shift obviously.

For an absolute velocity Vabs directed downwards, the apparent position of the light source will be as shown below.



Note that there is no beam with slant path as in the conventional MMX analysis of SRT or ether theory. This is the distinction of the new theory.

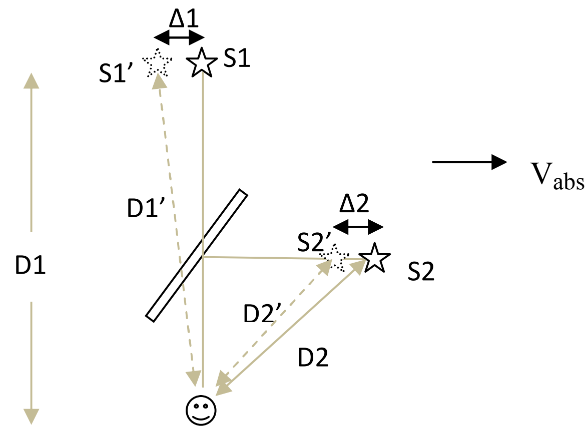
Now we can see why there were NON-NULL results in many conventional MM experiments, such as the Miller experiment. There will be the same fringe shift as if the light source was actually (physically) shifted to the apparent position. If the light source is physically shifted to the position shown, the length of the path of the two beams arriving at the observer (detector) should change slightly differently.



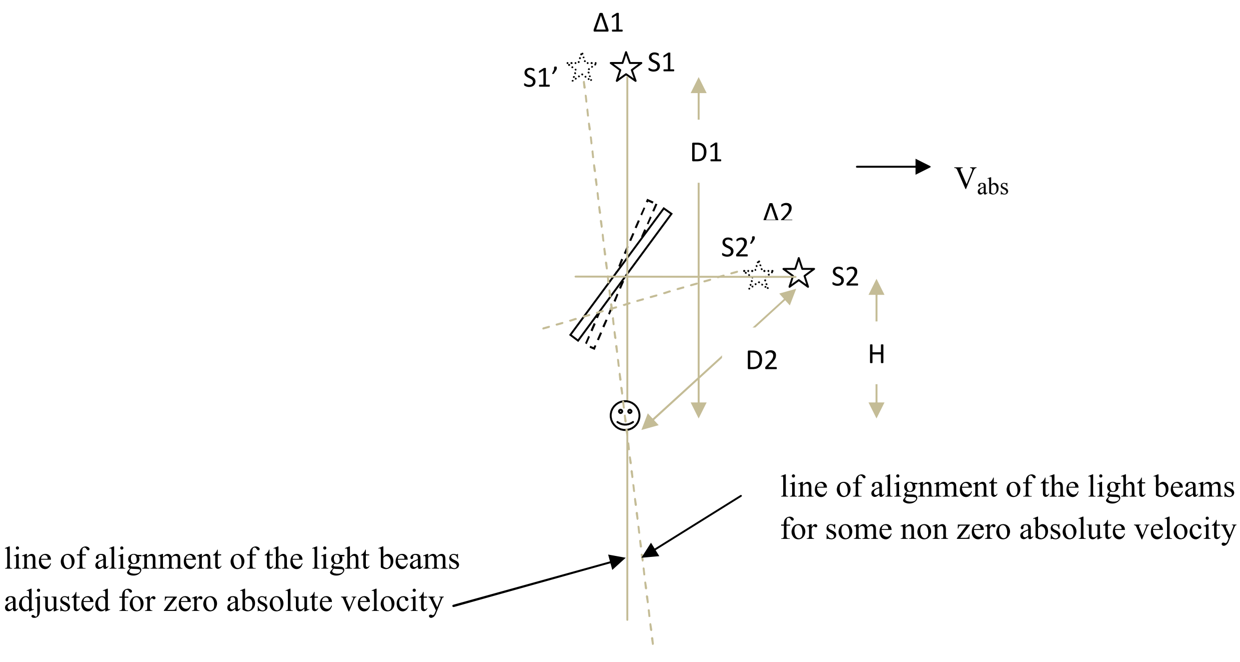
The blue and red dotted lines show the two beams. The drawing is not drawn to be accurate but only to illustrate the idea.

New proposed Michelson-Morley experiment

To detect absolute motion with an MMX type experiment, thus, we need two ideal coherent light sources, as shown below. The single light source is omitted and the two reflecting mirrors are replaced by two coherent light sources.



With zero absolute velocity, the two light beams arriving at the detector are aligned. However, with non zero absolute velocity, the two beams will be misaligned. Therefore, it becomes necessary to rotate the beam splitter until the two light beams are aligned and circular fringe shifts can be observed, from which absolute velocity can be determined, by taking into account the rotation of the beam splitter. Or the position of the source S1 may be adjusted (towards the right), until the two light beams are aligned. The amount of adjustment of position of S1 required to align the two beams can be used to determine the absolute velocity.



Let the two light sources be at distances D1 and D2 from the detector . Note that D1 and D2 are the *direct* distances between the detector and the sources and *not* between the mirror and the sources.
As discussed previously, therefore

$$t_{d1} = D1'/c$$
$$= D1/(c^2-Vabs^2)^{1/2}$$

and

t_{d2} can be determined after D2' is determined from the following equations.

$$D2' / c = V_{abs} / \Delta 2 \quad \ldots\ldots\ldots \; (1)$$

$$(D2'^2 - H^2)^{1/2} - (D2^2 - H^2)^{1/2} = \Delta 2 \quad \ldots\ldots\ldots.(2)$$

A large fringe shift corresponding to the absolute velocity of the earth (about 390 Km/s) should be observed..

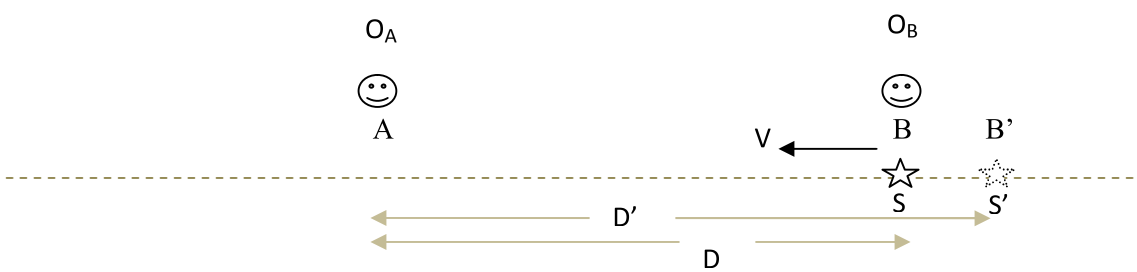
One may ask: The modern MMX experiments which are based on optical resonators use two independent orthogonal laser light beams from two laser light sources; why did the experiments fail to detect absolute motion? These experiments look for differences in the frequencies of the two orthogonal beams. As explained so far, the effect of absolute motion is to create a change in path length and hence a change in phase. The phases of the two beams change differently. Hence, there will be no effect on the frequencies. A change in phase difference (and not a change in frequencies) occurs.

But there is a problem with the practicality of the above proposed experiment. The coherence time of even the best lasers available is in the order of one millisecond. It is not possible/practical to rotate the apparatus within one millisecond to detect the absolute motion of the earth. The above proposed experiment is only theoretical and provided only to clarify the theory.
The good news is that a more practical and basically the same kind of experiment has already been carried out. This is the Ronald de Witte's experiment. He used two independent, Cesium stabilized 5 MHz sources with co-axial cables. He detected absolute motion by comparing the phases of the two independent signals.

Where does a light beam start? Apparent contradiction in the new interpretation

Even though we have seen so far that the new interpretation has succeeded in resolving the most challenging contradictions and paradoxes of the speed of light, a more fundamental explanation underlying this interpretation is still to be given. This is evident from the paradox that follows the new interpretation.

Assume two observers O_A and O_B, both at absolute rest, at points A and B, respectively, with distance between them equal to D.



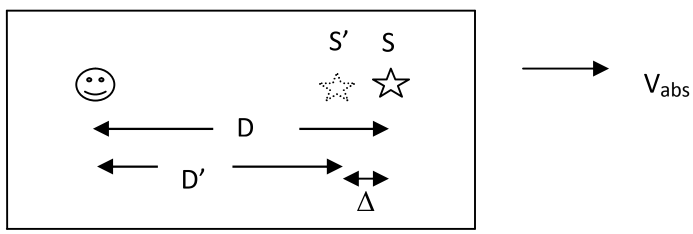
A light source is moving towards observer O_A. Assume that the source emits a very short light pulse just at the moment it is passing through point B, as seen by observer O_B. The light pulse will be seen by observer O_A after a delay of time. A key idea introduced in this paper is as follows:

For observer O_B , the light beam was emitted from its own position, from point B. For observer O_A , however, the light beam was emitted from the apparent source position, point B', and not from point B. Obviously, this is counterintuitive at first sight. According to all conventional theories, the light beam starts from the same point, for all observers, with an implicit assumption of the ether.

Observer O_B witnessed that the source emitted light from point B, from his own position. Who is right ? Logically no other observer can be more sure than observer O_B regarding where the source was at the instant of emission, i.e. from which point the light pulse was emitted. This is because observer O_B was in the proximity of the source at the instant of emission.

The solution of this apparent paradox is as follows.

1. For a light source that is at absolute rest, light always starts from the source's position, for all moving or stationary observers.
2. For a source that is in absolute motion, however, the apparent point where a light beam started (the past position of the source) is determined by two factors
    - The absolute velocity of the source
    - The distance between the source and the observer *at the instant of emission*.



Imagine a light source and an observer in a closed room (Galileo's ship thought experiment). The light source emits a light pulse. The observer wants to know the point in space (in the lab's reference frame) where the light pulse started.
If the laboratory is at absolute rest, the light started from the point where the source physically is, i.e. from point S which is at a distance D from the observer. If the laboratory is in absolute motion, as shown, the light pulse started not from the current/instantaneous point where the source is now, in the lab's frame, but from a point in space S' that is at a distance D' from the observer.

From our previous discussions,

$$D' = D \, . \, c \, / \, (c + V_{abs}) \;\; , \quad \Delta = D - D' = \;\; D. \;\; [\;\; V_{abs} \, / \, (c + V_{abs}) \;\;]$$

From the above formula, we see that the point where the source started depends on two factors:
- Physical distance D between source and observer and
- Absolute velocity of the laboratory

This means that for D= 0 , i.e. source and observer exactly at the same point in space (which is actually not possible, but assume conceptually), the distance Δ between the real source position and the apparent source position will be zero, i.e. the light starts exactly from where the source is physically. For D= 0 , absolute velocity has no effect on the point where the light starts.

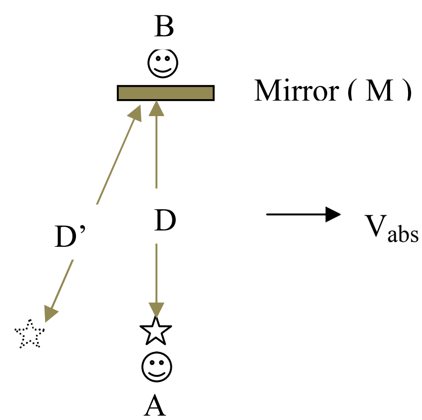
For a non-zero distance D, however, absolute velocity will have an effect on the (apparent) point where the light pulse started. As distance D becomes larger and larger, this will 'amplify' (multiply) more and more the effect of absolute velocity. This means that absolute velocity affects the amount of apparent change of position of the light source *through* distance D, because Δ is a *product* of D and [V_{abs} / (c $\pm V_{abs}$)].

Returning back to the case of observers O_A and O_B , for observer O_B the light source started (was emitted by the source) almost from point B, the point through which the source was passing at the instant of emission. For observer O_A , however, the light started not from point B, but from point B'.

This is the distinctive idea which enabled the resolution of many paradoxes and contradictions between experiments.

As another illustration, the following contradiction arose on the way to the new theory.

Assume an absolutely co-moving system below.



Suppose that a light pulse is emitted from the source towards the mirror M and reflected back to the source (to observer A). We assume that observer A is at the same point in space as the light source, hence, for observer A, the apparent position of the source will be the same as the real position of the source, because the effect of absolute velocity will be diminished because observer A is almost at the same point as the source, as discussed above. Hence, observer A will predict that the time delay between emission of the light pulse and its reception (after reflection from mirror) will be:

$$t = 2D/ c$$

From this, observer A predicts that the time interval between emission and reflection at the mirror to be:

$$t/2 = D/c$$

Assume that A and B each have synchronized clocks. Observer B recorded the time instant when he/she detected the light pulse. Observer B detected light after a delay of

$$t = D'/c$$

and not D/c.

Instead of synchronized clocks, assume that A and B have a means to communicate instantaneously. Just a time delay of D/c after emission of the light pulse, observer A calls observer B (through instantaneous communication) and asks him/her if he/she has just detected the light pulse. Observer B says that the light pulse hasn't arrived yet. This is a paradox !

It can be resolved as explained above. For observer B, the light started not from the real (physical) position of the source, but from the apparent position of the source and hence the light pulse has to travel a larger path length (D') before arriving at observer B's location.

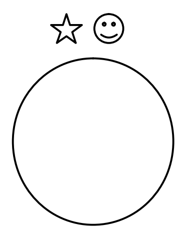
But a question still arises: How can the light be reflected from the mirror 'before arriving at the mirror', as the time instant (interval) (D/c) calculated by observer A for the light pulse to *arrive* at the mirror is less than the time instant (D'/c) of *detection* calculated by observer B ? Perhaps quantum mechanics has something to do with this ? Or, is this just an apparent paradox again ? Is this an effect that is normally interpreted as 'time dilation'?

A more probable solution is that observer A and observer B will never detect the *same* photon. A photon is absorbed either by observer A or observer B. A photon reflected from the mirror will not be detected by observer B and a photon detected by observer B will never reflect back to observer A. The paradox is only a result of classical (purely wave) theory of light.

The Sagnac effect

The analysis of (absolute) rotational motion is somewhat different from that of translational motion. In this case we will not take the direct source-observer distance to determine the apparent position of the light source, as in the analysis of absolute translational motion.

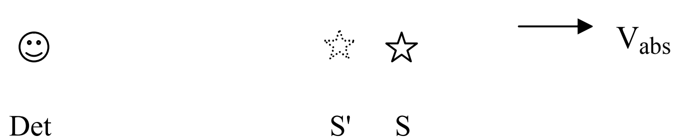
Consider a Sagnac device at absolute rest, i.e. not in absolute translation and rotation.



In this case the time delay for the forward and backward beams will be equal.

$$t_d = 2\pi R / c$$

Assume now that the device is rotating clockwise with angular velocity ω. We will apply the previous analysis for absolute translational motion. First consider the detector as 'looking' in the forward direction. This will be considered equivalent to a translational motion with co-moving source and detector, with the detector behind the source.



In this case, the source appears to have shifted by an amount Δ towards the detector. From previous discussion,

$$D' = D\,(c/(c+Vabs))$$
$$\Delta = D\,(Vabs/(c+Vabs))$$

$$\text{But } D = 2\pi R \;, \quad Vabs = \omega R$$

$$\Delta_{FW} = 2\pi R\,(\omega R)/(c+\omega R)$$

$$= 2\omega A/(c + \omega R)$$, where A is area of the circle

Now consider the detector as 'looking' in the backward direction.
This will be considered equivalent to a translational motion with co-moving source and detector, with the detector infront of the source.

☆ ☆ ☺ ⟶ V_{abs}

S' S Det

In this case, the source appears to have shifted by an amount Δ away from the detector. From previous discussion,

$$D' = D\,(c/(c-Vabs))$$

$$\Delta = D\,(Vabs/(c-Vabs))$$

$$\text{but } D = 2\pi R \;, \quad Vabs = \omega R$$

$$\Delta_{BW} = 2\pi R\,(\omega R)/(c-\omega R)$$

$$= 2\omega A/(c - \omega R)$$

The total path difference will be the sum of Δ_{FW} and Δ_{BW}.

$$\Delta = \Delta_{FW} + \Delta_{BW}$$

$$= 2\omega A/(c + \omega R) + 2\omega A/(c - \omega R)$$

$$= 4\omega Ac \,/\, (c^2 - (\omega R)^2)$$

This can be written as:

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

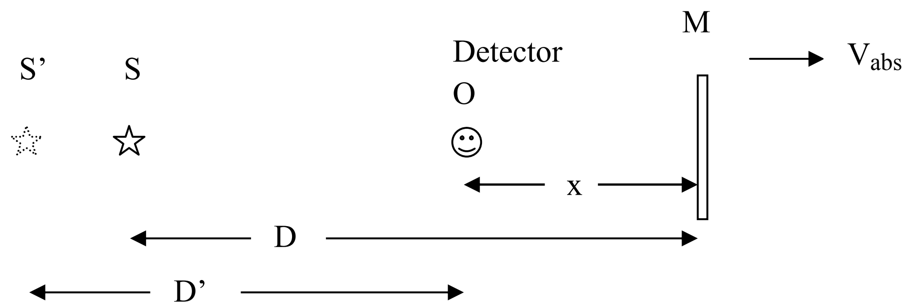
The well known standard equation for the path differences is: $4\omega A / c$

The Silvertooth experiment

Although the Sagnac effect can be taken as a strong evidence in support of absolute space/motion, it is usually claimed be explained by the Galilean principle of relativity and has been controversial.
The Silvertooth experiment is the other crucial evidence of absolute motion. Doug Marett has repeated the

experiment[3].

In this section, the 'wavelength change effect' in Silvertooth experiment will be explained.
Imagine a light source S, an observer O and a mirror M , co-moving with absolute velocity Vabs to the right as shown below.



Wavelength and velocity of incident light

Light emitted by S at time $t = 0$ will be received by observer O after time delay t_d.

From the previous discussions

$$D' = (c / (c\text{-}Vabs)) . D$$ (note that this D is not the one shown in the above figure)

Substituting $D\text{-}x$ in place of D

$$D' = (c / (c\text{-}Vabs)) . (D - x)$$

Time delay will be

$$t_d = D' / c = (D\text{-}x) / (c\text{-}Vabs)$$

Assume that the source emits according to

$$\sin \omega t$$

The light wave will be received at the detector as

$$\sin \omega(t\text{-}td) = \sin \omega (t\text{-} D /(c\text{-}Vabs) + x / (c\text{-}Vabs))$$

$$= \sin (\omega t - \omega D / (c\text{-}Vabs) + \omega x / (c\text{-}Vabs))$$

The above is a wave equation. If we take a 'snapshot' of the wave at an instant of time $t = \tau$, the above equation will be:

$$\sin (\omega \tau - \omega D / (c\text{-}Vabs) + \omega x / (c\text{-}Vabs))$$

The two terms $\omega \tau$ and $\omega D / (c\text{-}Vabs)$ represent constant phases. The 'wavelength' is determined from the third term:

$$\omega x / (c\text{-}Vabs)$$

If we have a function

$$\sin kx$$

then the wavelength can be shown to be

$$2\pi / k$$

In the same way, for the function

$$\sin(\omega x / (c - Vabs))$$

$$k = \omega / (C - Vabs)$$

Hence the 'wave length' of the incident light will be

$$\lambda_{INC} = 2\pi / k = 2\pi / (\omega / (c - V_{abs})) = 2\pi(c - Vabs)/\omega = (c - Vabs) / f$$
$$\lambda_{INC} = (c - Vabs) / f$$

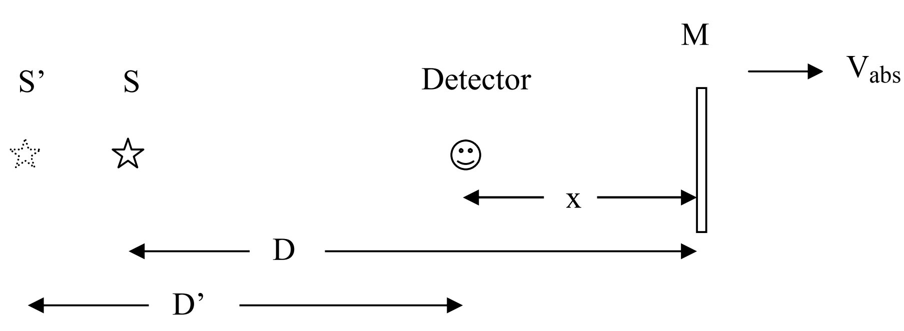
One may think that the speed of light relative to the observer changes and will be $c-v$ because of change in wave length shown above (since frequency will not change for co-moving source and observer, as stated by Silvertooth in his paper).This would disagree with the constant light speed postulate and also with emission theory in which the velocity of light is constant relative to the source.

However, one important interpretation in this analysis is that the 'wave length' determined above is not to be considered as a wavelength. According to the new theory, the apparent position of the source is different for two observers at different points of x. So an observer at point x can measure only the frequency and time delay and not wavelength because it is impossible to measure wavelength at a point. Therefore, the speed of light relative to an observer at point x is defined as the ratio of the distance from point x to the apparent source and the time delay between emission and reception, and this ratio is always equal to c for a source and observer at rest relative to each other, and cannot be determined as the product of wavelength and frequency. Wave length can be applied correctly for a light source at rest.

Note that the wavelengths predicted here are different in form than the wavelength predicted by Silvertooth, in his paper, but the results obtained are nearly the same as will be shown shortly.

Wavelength and velocity of reflected light

Next we determine the wavelength of the reflected light.



Time delay between emission and reception before reflection of light from mirror M, at point x, has been determined as follows (preceding section).

$$D' = (D-x)\,(c / (c-Vabs))$$

Relative to an observer at point x, who is observing the reflected light, time delay between emission and reception of reflected light will be:

$$t_d = D'/c + 2x/c = (D-x) / (c-Vabs) + 2x/c$$

$$= D / (c-Vabs) - x / (c-Vabs) + 2x/c$$

$$= D / (c-Vabs) - x\,(1/(c-Vabs) - 2/c)$$

$$= D / (c-Vabs) + x\,(c-2Vabs) / c(c-Vabs)$$

If the source emits light according to

$$\sin \omega t$$

The light wave will be received at point x as

$$\sin \omega\,(t-t_d) = \sin \omega\,[\,t- D/(c-Vabs) - x\,(c-2Vabs)/c(c-Vabs)]$$

The coefficient of x is

$$k = \omega\,(c-2Vabs) / c(c-Vabs)$$

As before, the 'wavelength' of reflected light will be:

$$\lambda_{REF} = 2\pi / k = 2\pi / [\omega\,(c-2Vabs) / c(c-Vabs)\,]$$

$$= c\,(c-Vabs) / f\,(c-2Vabs) = 1/f\,.\,[\,c\,(c-Vabs) / (c-2Vabs)]$$

Conventionally, one would expect the 'wave length' of the reflected light to be equal to (c + Vabs) / f , because the 'wavelength' of incident light is (c - Vabs) / f . However, it turned out in the above analysis that this is not the case. However, it can be shown that the actual difference between the two is very small.

The absolute velocity of the earth is known to be Vabs = 390 Km/s

$$\lambda_{REF} = 1/f\,.\,[\,c\,(c-Vabs) / (c-2Vabs)]$$

$$= 1/f\,.\,[\,300{,}000\,(300{,}000-390) / (300{,}000 - 2*390)\,]$$

$$= 1/f\,.\,300{,}\,391\ Km$$

According to $1/f\,.(c+ Vabs)$ it will be (conventional knowledge)

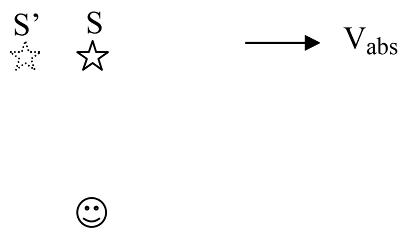
$$1/f\,.\,(300{,}000 + 390) = 1/f\,.\,300{,}390\ Km$$

The difference between the two apparent velocities is only 1 Km/s , which is only about 0.25 % of 390 Km/s .

Therefore, the 'wave length' change detected in the Silvertooth experiment has been justified above. However, this is not to be interpreted as a change of wave length. It should be interpreted as change in path length resulting from absolute motion.

In the above analyses, we considered the simplest cases in which the source, the observer and the mirror are in line and move along this line, with the light beam incident perpendicularly on a mirror and reflected back on itself. It is possible to extend the analysis to more general cases for a better clarification of the theory. In the next section we will look at the application of the new theory to some of these cases. As the resulting solutions are more complicated (but straight forward) , we will see only how to proceed.

Let us look at a case in which the source observer relative position is perpendicular to the absolute velocity.



From previous discussion

$$t_d = D' / c = (D / (c^2 - Vabs^2)^{1/2})$$

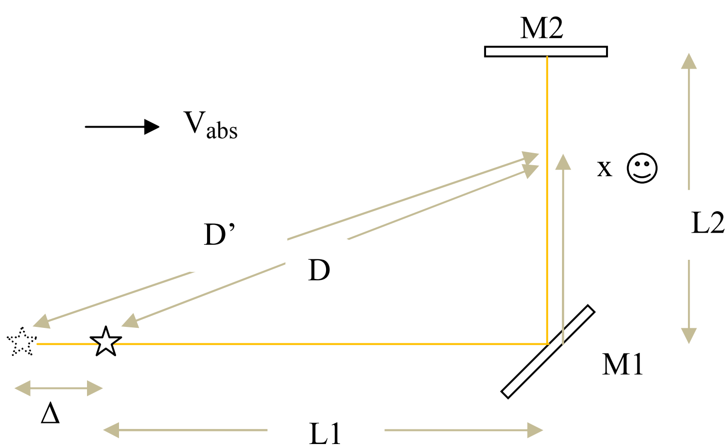
If the source emits according to

$$\sin \omega t$$

then the light received will be

$$\sin(\omega t - t_d)$$

Next consider the following case, as in Doug Marett's replication of Silvertooth experiment [3]. An observer at point x will observe the incident light (light reflected from mirror M1, but before reflection from mirror M2) and the reflected light (light reflected from mirror M2).



To analyze this problem, we first have to determine the change (Δ) in apparent position of the source due to absolute motion.

$$t_d = (\Delta + L1 + x) / c$$

But

$$D' / c = \Delta / Vabs$$

The above equation means that the time it takes a *direct* light beam to reach the observer from the apparent source position S' is equal to the time it takes for the source to move from position S' to position S. Note that we have assume a direct light beam from point S' to point x to determine the apparent change in the position of the source (Δ) for an observer at point x, even though there is no direct light beam from the source to the observer in this case (i.e. the observer observes only light reflected from mirror M1 in the case being considered)

Also

$$(\Delta + L1)^2 + x^2 = D'^2$$

and

$$L1^2 + x^2 = D^2$$

From the above three equations, the solution for Δ can be obtained as follows.

$$(\Delta + L1)^2 + x^2 = D'^2$$
$$(\Delta + L1)^2 = c^2 \Delta^2 / Vabs^2 - x^2$$

resulting in the quadratic equation

$$\Delta^2 (c^2 / Vabs^2 - 1) - \Delta (2 L1) - (L1^2 + x^2) = 0$$

The solution for delta will be

$$\Delta = [2L1 + [4L1^2 + 4 (c^2/ Vabs^2 -1) (L1^2 + x^2)]^{1/2}] / 2 (c^2 / Vabs^2 - 1)$$

Now the time delay t_d can be obtained in terms of x from the previous equation:

$$t_d = (\Delta + L1 + x) / c$$

The solution for Δ shows that time delay varies with x in a more complex way.
The term under square root should be expanded.

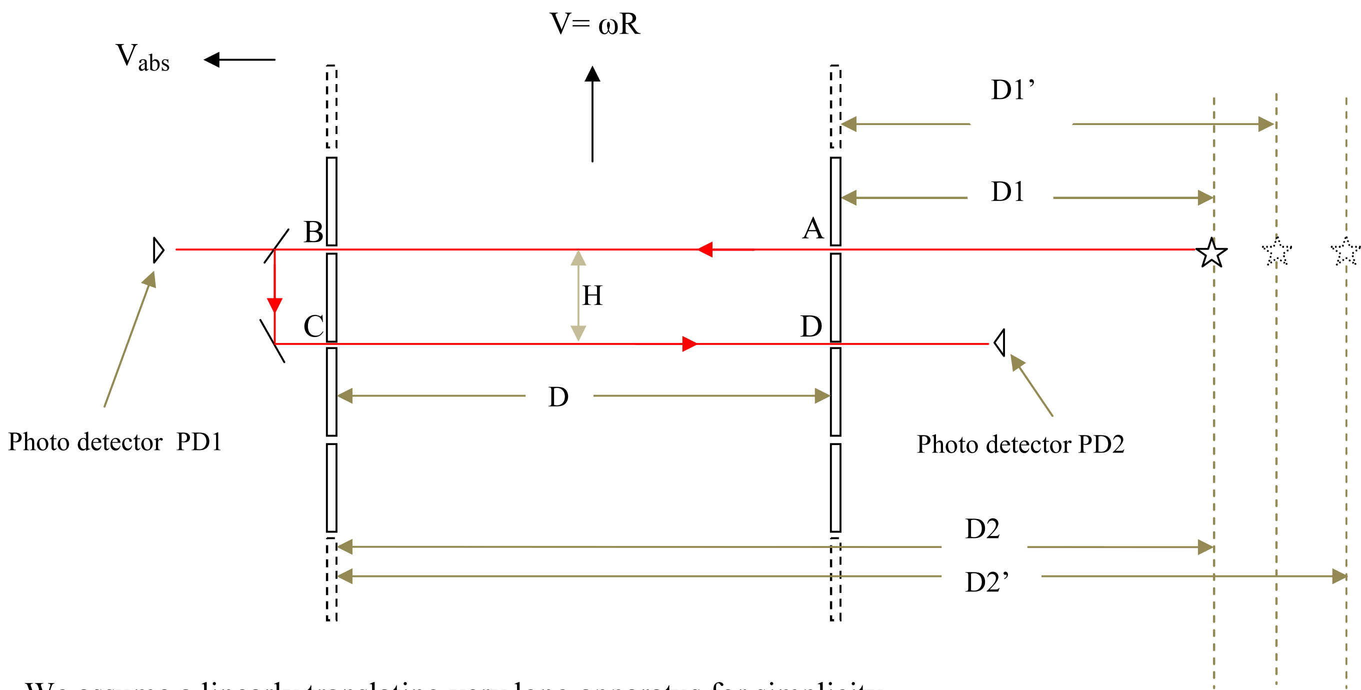
It can be seen that the time delay does not depend on x but on higher powers of x . This results in dependence of 'wavelength' on x .

For reflected light the equation for time delay t_d will be :

$$t_d = (\Delta + L1 + x + 2 (L2 - x)) / c$$

The equation for Δ obtained above should be substituted in the above equation to determine the time delay and hence the 'wave length ' of the reflected light.

The Marinov Coupled Shutters Experiment



We assume a linearly translating very long apparatus for simplicity.

Two photo detectors, PD1 and PD2 are placed as shown. Assume that four other photo detectors (not shown in the figure above) are placed at the four holes, at points A, B, C and D, just at the outlets/inlets of the holes. Assume that the light source emits a very short light pulse at time t=0. First we determine the time interval between detection of the light pulse at points B and A.

$$D1' = D1 \,.\, [\, c / (c - V_{abs})\,] \quad \text{and} \quad D2' = D2 \,.\, c / (c - V_{abs})$$

The time delay for light detection at point A will be

$$T_A = D1' / c = D1 \,.\, [\, c / (c - V_{abs})\,] \;/\; c = D1 / (c - V_{abs})$$

The time delay for light detection at point B will be

$$T_B = D2' / c = D2 \,.\, [\, c / (c - V_{abs})\,] \;/\; c = D2 / (c - V_{abs})$$

The time taken by light to move from A to B

$$T_{AB} = T_B - T_A = [\, D2 / (c - V_{abs})\,] - [\, D1 / (c - V_{abs})\,]$$

$$= (D2 - D1) / (c - V_{abs}) = D / (c - V_{abs})$$

The velocity of light propagation between the holes is :

$$D / T_{AB} = c - V_{abs}$$

As the absolute velocity changes in direction and magnitude, the time of flight between A and B varies.

This variation in the measured speed of light, is only apparent . The real cause for the variation in time of flight is the ' change in path length' effect introduced in this paper.

Now let us determine the round trip time. We make some assumptions to simplify the problem. The separation distance (H) between the holes is nearly zero. Therefore,

$$T_B \approx T_C$$

From the assumption that $H \approx 0$, also follows that the photo detectors at points A and D are also almost at the same point and hence the same apparent distance (D1') of the source for both photo detectors.

The round trip time will be:

$$T_{AB} + T_{CD} = (T_B - T_A) + (T_D - T_C)$$

Let us first determine, T_D, the time of detection of the pulse at point D.

$$T_D = (D1' + 2D) / c$$

But

$$D1' = D1 \, . \, [c / (c - V_{abs})]$$

Therefore,

$$T_D = (D1' + 2D) / c = D1'/c \; + \; 2D/c \; = D1/ (c - V_{abs}) \;\; + \;\; 2D / c$$

Now we can determine the time interval between detection of the pulse at point C and at point D.

$$T_{CD} = T_D - T_C \; = T_D - T_B \; = \; [D1/ (c - V_{abs}) \;\; + \;\; 2D / c \;] \;\; - \;\; D2 / (c - V_{abs})$$

$$= \; (D1 - D2) / (c - V_{abs}) \;\;\; + \; 2D / c$$

$$= \; 2D / c \;\; - \;\; [(\; D2 - D1) / (c - V_{abs}) \;]$$

But, $D = D2 - D1$

Therefore,

$$T_{CD} \; = \; 2D / c \; - \; [D / (c - V_{abs}) \;] \; = \; (D / c \;) \; . \;\; [(c - 2 V_{abs}) / (c - V_{abs})]$$

$$= D / [c \, . \, ((c - V_{abs}) / (c - 2V_{abs}))]$$

From the above equation, we can see that the velocity of light propagation between points C and D is:

$$c \, . \, [(c - V_{abs}) / (c - 2V_{abs})]$$

This is distinct from

$$c + V_{abs}$$

which is the velocity of light propagation between points C and D according to the ether theory. But the difference between the above two expressions is very small. If we substitute V_{abs} = 390 Km/s (absolute velocity of solar system) and c = 300, 000 Km /s into the former equation:

$$300{,}000\ [\ (300000-390)\ /\ (\ 300000-780)\ ] = 300,\ 391.0166 \approx 300,\ 391\ \text{Km/s}$$

From the latter equation:

$$c + V_{abs} = 300{,}000 + 390 = 300,\ 390\ \text{Km/ s}$$

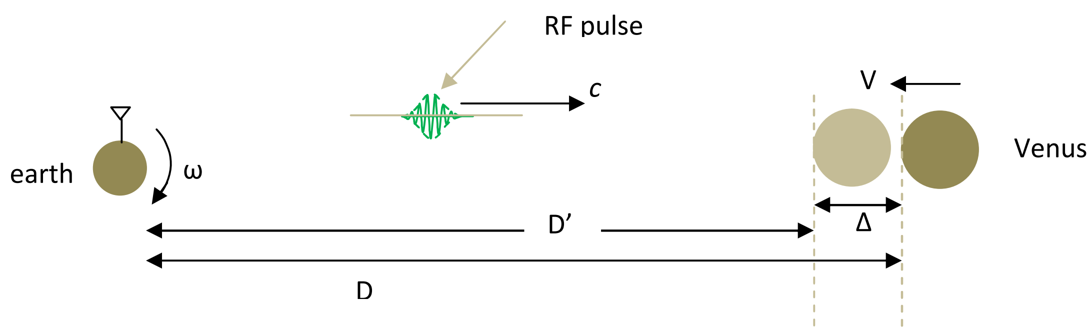
The difference between the two results is only 1 Km/s which is less than 0.25 % of the earth's (solar system's) absolute velocity.

Note that photo detectors PD1 and PD2 are assumed to be just at the holes B and D, respectively.

<u>'Anomalous' radar range data from Venus planet as dicovered by Bryan G. Wallace</u>

One of the observations that seem to be in contradiction with Einstein's light postulate is the discovery by Bryan G.Wallace that analysis of radar range data of planet Venus did not conform to the principle of constancy of the speed of light.

The analysis of Bryan G. Wallace's experiment belongs to this section of co-moving source and observer because the source (RF transmitter) and the observer (RF receiver) are co-moving as both are bound to the earth. The planet Venus acts as a mirror moving relative to the earth. The effect of earth's absolute velocity is negligible in creating an apparent change of position of the RF transmitter as 'seen' by the RF receiver because they are located at nearly the same location and because the distance to Venus is much greater than the distance between the transmitter and the receiver, which may be not more than a few tens of meters.



According to Special Relativity Theory (SRT), the center of the wave fronts of the transmitted RF pulse remains at the point in space where the source was at the instant of emission.
According to this paper, the center of the wave fronts moves with the (apparent) source, for a constant source observer velocity. In this case, there is no significant difference between the real and the apparent positions of the source (the transmitter / antenna).

Remember the procedure of analysis:
1. Replace the real source with the apparent source (in this case almost the same as the real source)
2. Then analyze the problem by applying conventional emission theory and assuming Galilean space.

In the this case, the velocity of the RF pulse reflected from Venus relative to an observer on earth is c+2V, according to emission theory, where V is the earth Venus relative velocity.

Suppose that at the instant of the bouncing of the RF pulse from Venus surface the distance between the Earth and Venus is *D* and the Earth – Venus relative velocity is V.

The round trip time can be determined if we know the velocity of the RF pulse in the earth's reference frame (which can be considered to be at rest, according to emission theory and Galilean relativity). The velocity of the transmitted RF pulse is obviously equal to *c* relative to the transmitter. The velocity of the reflected pulse will be $c + 2V$, relative to the earth again (reflection from a moving mirror).

Therefore, the total round trip time is determined as:

$$t = t_1 + t_2 = D/c \ + \ D / (c+2V) = D\,(2c + 2V) / [c\,(c + 2V)\,]$$

$$\square\ D = (t/2)\ .\ c\ .\ \ (c + 2V) / (c + V)$$

where t_1 is the forward flight time, t_2 is the backward flight time and t is the round trip time of the pulse. The distance at the instant of reception of the pulse on earth will be:

$$D' = D - \Delta = D - t_2\ .\ V$$

But

$$t_1 = D/c \qquad t_2 = D / (c + 2V) \qquad \text{and} \quad t_1 + t_2 = t$$

From which

$$t_2 = (t/2\,)\ .\ \ [\,c / (c + V)\,]$$

Therefore,

$$D' = D - t_2\,.\,V \ = \ t\,.\,c/2$$

In the case of Einstein's light postulate this would be:

$$D' = tc\ /\ 2\ -\ tv\ /2$$

Source and observer in absolute and relative motion. Why/how experiments failed to detect any dependence of the velocity of light on the velocity of the source.

In all our discussions so far, we have been considering the special case of (absolutely) co-moving source and observer. Hence, the source and the observer had equal (common) absolute velocities and there would be no relative motion between them.

In this section, we seek a way to formulate a general interpretation of absolute motion, which can be applied to the general case of source and observer having independent, arbitrary absolute velocities, differing in magnitude and/or direction, and hence also moving *relative* to each other. This problem involves a 'mixture' of absolute and relative velocities.
We already have at our hand the interpretation of the special case of co-moving source and observer. How can we go from this specific interpretation to a general interpretation?

After a considerable effort, a general formulation of the new theory was discovered.

Source in absolute motion and observer at absolute rest

Let us first consider the simple case in which only the source is in absolute motion, with the observer at absolute rest. The effect of absolute motion of a light source is to create an apparent change in the *past* position of the light source as seen by an observer at absolute rest.

Assume an observer that is at absolute rest and an absolutely moving source. The source was at distance D from the observer, *at the moment of emission*.

$$D' / c = \Delta / V = (D - D') / V$$

□ $D' = D \,.\, c / (c + V)$

□ $dD' / dt = V' = (dD/dt) \,.\, [\, c / (c + V) \,] = V \,.\, [\, c / (c + V) \,]$

where V' is the velocity of the apparent source.

$V' = V \,.\, [\, c / (c + V) \,]$, for a light source absolutely moving away from an observer that is at absolute rest

$V' = V \,.\, [\, c / (c - V) \,]$, for a light source absolutely moving towards an observer that is at absolute rest

The above equation shows the relationship between the velocity (V) of the real source and the velocity (V') of the apparent source.

The apparent source is not moving towards an observer with the same velocity as the real source.
This has implications on Doppler effect of light. *The Doppler shift for a light source moving absolutely away from a stationary observer will be 'less red' ; and it will be 'more blue' for a light source moving towards an observer. This means that the whole Doppler frequency change will shift towards blue, i.e. more blue than classical prediction, which assumes a medium for light transmission.*

Therefore, to get the Doppler shift due to motion of the source, we substitute V' for V in the Doppler shift formula derived in the section ahead for a stationary source and a moving observer, assuming that that analysis is the same for a moving source and stationary observer, according to Galilean relativity.

From the above derivation, a new theory of light speed is:

The (group) velocity of light is c relative to the apparent source.

The group velocity of light relative to an observer is equal to

$$C_O = c + V' = c + V \,.\, [\; c / (c - V)] = c^2 / (c - V)$$

relative to an observer that is at absolute rest, in the case of a light source moving with an absolute velocity V towards the observer. For a light source moving away from the observer

$$C_O = c - V' = c - V \,.\, [\; c / (c + V)] = c^2 / (c + V)$$

In this case also the phase velocity of light does not depend on the velocity of the source.
In the section ahead we will see that motion of the observer does not change the phase velocity of light: both a stationary and a moving observer see a phase point simultaneously. Therefore, the same should be true for a moving source (after replacing it with an apparent source and assuming Galilean relativity). Motion of the source should not affect the phase velocity of light.
Many experiments and observations failed to detect any dependence of the speed of light on the speed of its source. These include: the Albert Michelson moving mirror experiment, the Q. Majorana moving mirror and moving source experiments, experiments using sun light and star light (Tolman, Miller,), experiments using elementary particles (such as positron in annihilation in flight) moving with speeds comparable to the speed of light as sources of radiation. There is also the de Sitter's binary star argument.

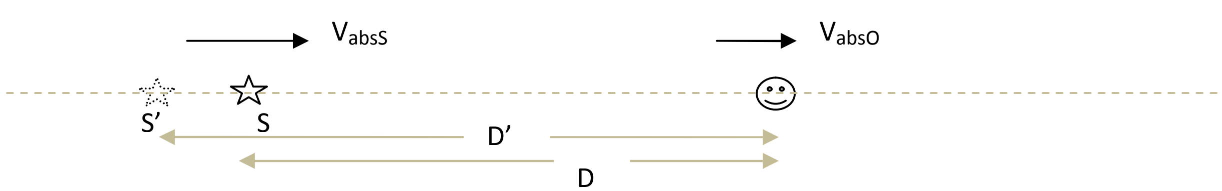
Now we can see why no dependence of the velocity of light on the velocity of its source was ever detected. For a light source moving away from an observer at rest,

$$\tau = D' / (c - V') = [D . c / (c + V)] \;/\; [c - V . c / (c + V)] = D/c$$

Although the source is moving away from the observer, it still takes the same amount of time for the light to be observed if the source was at rest relative to the observer.

Thus the new theory is a fusion of the absolute space (ether) and emission theory (and Einstein's light postulate).

<u>Both source and observer in absolute and relative motion</u>



From previous analyses

$$D' = D . c / (c - V_{absS}) \quad □ \quad dD'/dt = V' = dD/dt \;.\; c / (c - V_{absS}) = V . c / (c - V_{absS})$$

where V is the source observer relative velocity.
But

$$V = V_{absS} - V_{absO} \;, \quad \text{for} \quad V_{absS} > V_{absO}$$

The time delay τ between emission and observation of light is:

$$\tau = D' / (c + V')$$

(the plus sign is because the source and observer are approaching each other)

Substituting the previous values for D' , V' and V,

i.e. $D' = D \cdot c / (c - V_{absS})$, $V' = V \cdot c / (c - V_{absS})$, $V = V_{absS} - V_{absO}$

we get

$$\tau = D / (c - V_{absO})$$

We see that the (absolute) velocity of the source V_{absS} does not appear in the above equation.

We can determine the velocity (C_O) of light relative to an observer as follows.

$$C_O = c + V' = c + V \cdot c / (c - V_{absS}) = c + (V_{absS} - V_{absO}) \cdot c / (c - V_{absS})$$

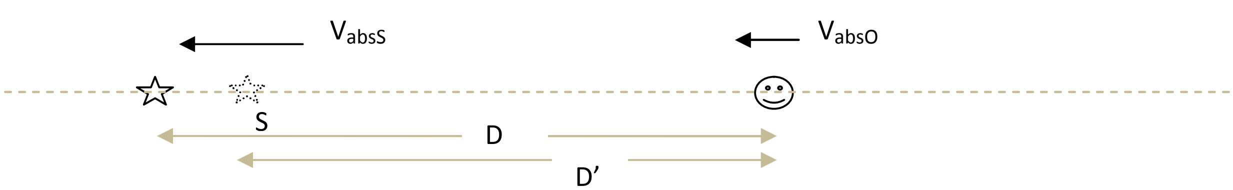
$$= c \cdot [(c - V_{absO}) / (c - V_{absS})]$$

We see that this result is distinct from ($c - V_{absO}$) , which is the velocity of light relative to the observer in ether theory, where V_{absO} is the velocity of the observer relative to the ether.

The general formula will be

$$C_O = c \cdot [(c \pm V_{absO}) / (c \pm V_{absS})]$$

Let us consider a case in which the observer's absolute velocity is directed towards the source and the source and observer are receding away from each other.



In this case

$$D' = D \cdot c / (c + V_{absS}) \quad \Box \quad dD'/dt = V' = dD/dt \cdot c / (c + V_{absS}) = V \cdot c / (c + V_{absS})$$

where V is the source observer relative velocity.

But

$$V = V_{absS} - V_{absO} \quad , \quad \text{for} \quad V_{absS} > V_{absO}$$

The time delay τ between emission and observation of light is:

$$\tau = D' / (c - V')$$

(the minus sign is because the source and observer are receding away from each other)

Substituting the previous values for D' , V' and V,

i.e. $D' = D \cdot c / (c + V_{absS})$, $V' = V \cdot c / (c + V_{absS})$, $V = V_{absS} - V_{absO}$

we get

$$\tau = D / (c + V_{absO})$$

The above analysis can be applied to any combination of magnitude and direction of source and observer absolute velocities, with the source and observer moving *directly* (radially) towards each other or receding directly away from each other, with no transverse component of their relative velocity.

In general,

$$\tau = D / (c \pm V_{absO})$$

We see that the (absolute) velocity of the source, V_{absS}, does not appear in the above equation.

From the above equation we see that the velocity of light as determined experimentally (D/τ) is

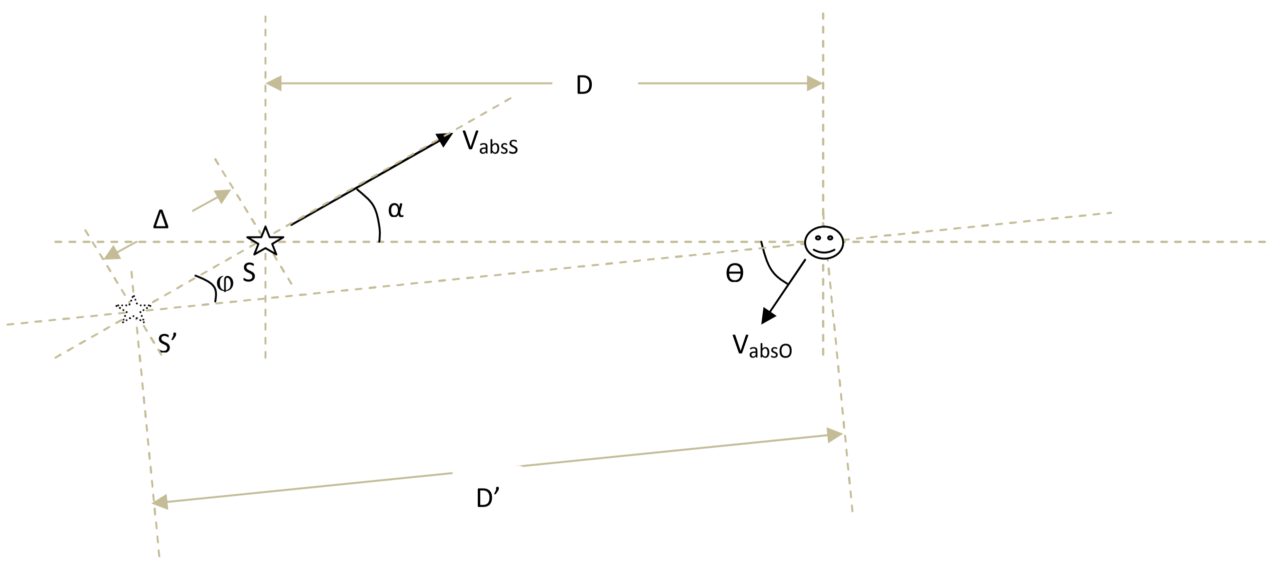
$$D/\tau = c \pm V_{absO}$$

We see that the measured speed of light is independent of the absolute velocity of the source V_{absS}, which is in agreement with experiments and observations.

The (*group*) velocity of light, however, depends on the absolute velocity of the observer V_{absO}.

Transverse relative motion between source and observer

In the preceding section, the source observer relative velocity was assumed to have no transverse component. The following figure shows both radial and transverse relative velocity components.



$$(\Delta \cdot \cos\alpha + D)^2 + (\Delta \cdot \sin\alpha)^2 = D'^2 \quad \ldots\ldots\ldots\ldots\ldots (1)$$

$$\Delta / V_{absS} = D' / c \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2).$$

$$V = V_{absS} \cdot \cos\alpha + V_{absO} \cdot \cos\Theta \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

where V is the source observer relative velocity.

Determine D’ and Δ from the first two equations. From the equation for the expression of D’ in terms of D, determine the expression for V’ in terms of V (by differentiating both sides). V will have radial and transverse components. Then determine the time delay between emission and observation as:

$\tau = D' / (c + V'_r)$, where V'_r is the radial velocity component of the apparent source.

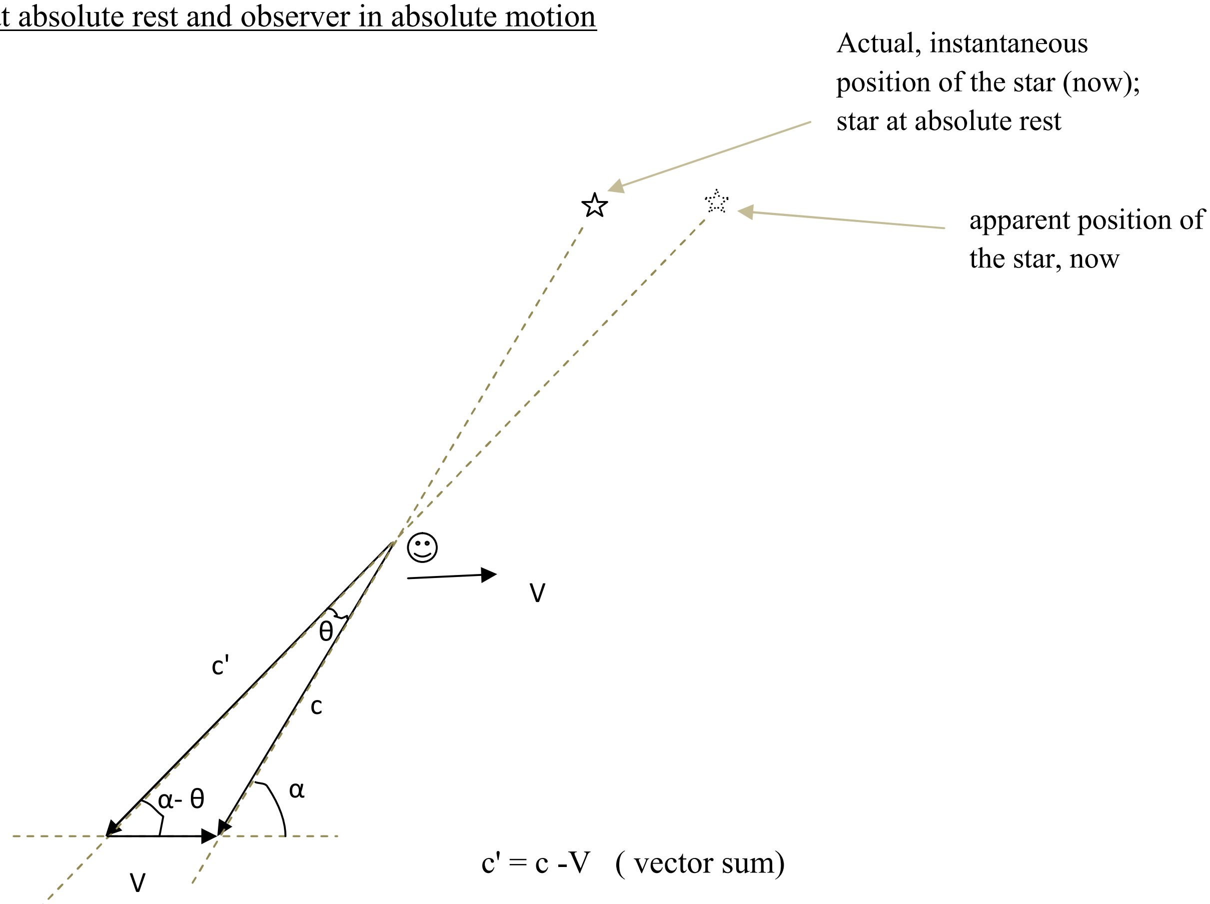
Stellar aberration

The phenomenon of stellar aberration, as observed from the earth, involves the absolute and relative velocities of both the star and the earth. We are certain that the earth is in absolute motion (390 Km/s), but the stars are also most probably in absolute motion.

In this section, however, we analyze the phenomenon of stellar aberration by assuming two simple cases:

- star in absolute motion and observer at absolute rest
- star at absolute rest and observer in absolute motion

<u>Star at absolute rest and observer in absolute motion</u>



$$(\sin\theta)/V = \sin(180-\alpha)/c' = \sin(\alpha-\theta)/c \quad \text{and} \quad \sin\theta \approx \theta \text{ (for small angle } \theta\text{)}$$

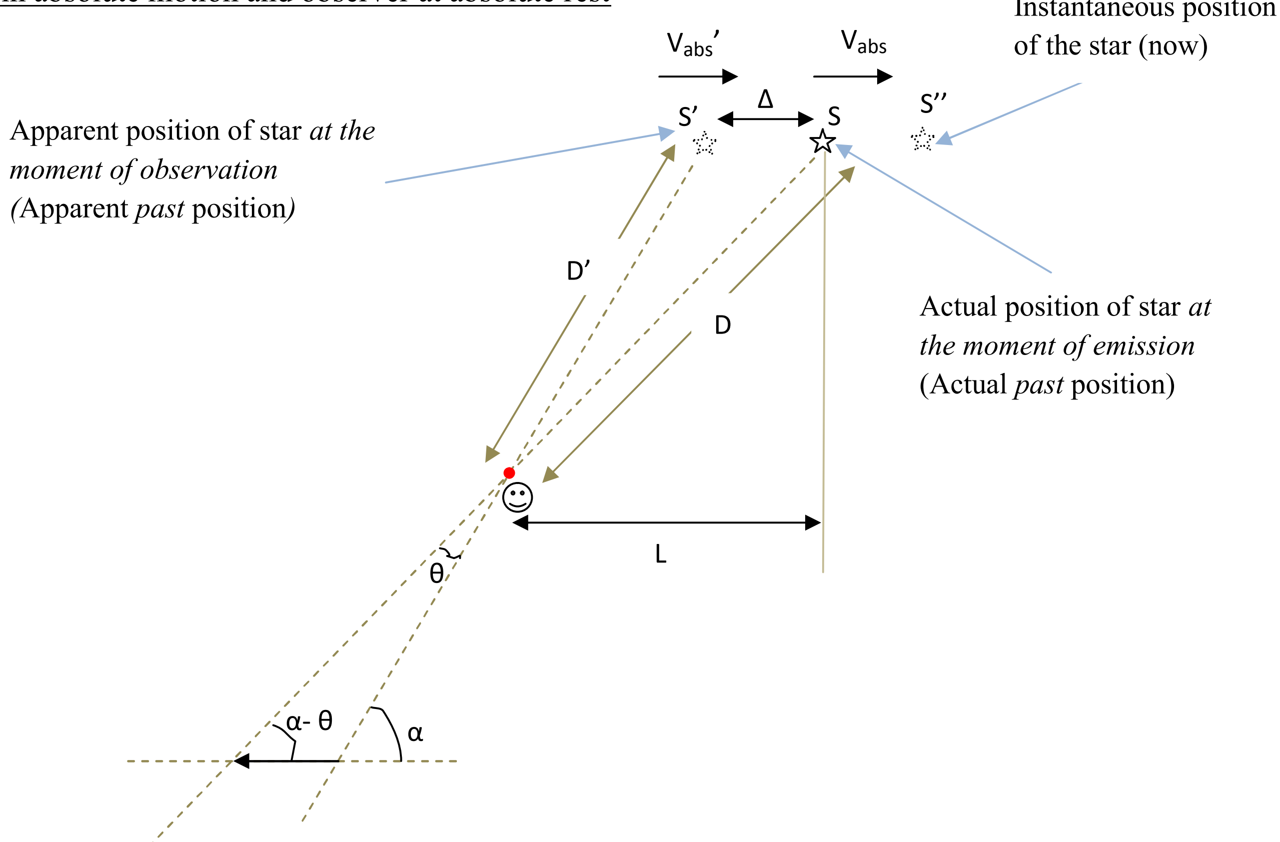
$$(\sin\theta)/V \approx \theta/V \approx (\sin\alpha)/c \quad \square \qquad \boxed{\theta = (V/c)\,.\,\sin\theta}$$

This is the kind of aberration known as Bradley aberration. In this case, aberration is due to the difference between the actual (instantaneous) and apparent position of the star, caused by the motion of the observer. In this case star light aberration is an apparent change of *current* (instantaneous) position of the star. This is only an illusion, like a man running in rain with rain drops appearing to fall in slant path.

Note that, however, in the aberration observed by Bradley the star itself is not necessarily at absolute rest. The effect of absolute motion of the observer is 'superimposed' on the effect of absolute motion of the star. Quantitative treatment of this should not be difficult based on the discussions made so far.

Note that the change of position of the star due to observer's motion is only an illusion. It doesn't mean that the light rays are coming from direction of the apparent star position. The light rays still come from the real source position. This interpretation will be applied to the discussion of the speed of gravity, in the last section of this paper.

Star in absolute motion and observer at absolute rest



$$D' / c = \Delta / V_{abs} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$
$$D'^2 - (L - \Delta)^2 = D^2 - L^2 \quad \ldots\ldots\ldots (2)$$

From the above two equations, D' and Δ can be determined (it is a lengthy formula), and then the angle of aberration θ can be determined. Note that angle θ is due to a difference in the actual past position of the star and its apparent past position, as seen at the time of observation. Unlike conventional explanations, the current (instantaneous) position of the star has no role in the explanation of stellar aberration.

For better clarification, suppose that the star is one light year away from the observer. Actually, physically the star emits light from position S . The observer sees the light after one year. It appears to the observer that the star emitted light from position S' *one year ago*, and not from position S. The current (instantaneous) position S'' of the star will have no relevance. For the case of an absolutely moving star, light aberration is an apparent change of the ***past*** position of the star. Although the star *actually* emitted light from position S one year ago, it appears to the observer, at the time of observation (i.e. after one year), that the star emitted light one year ago from position S', and not from position S.

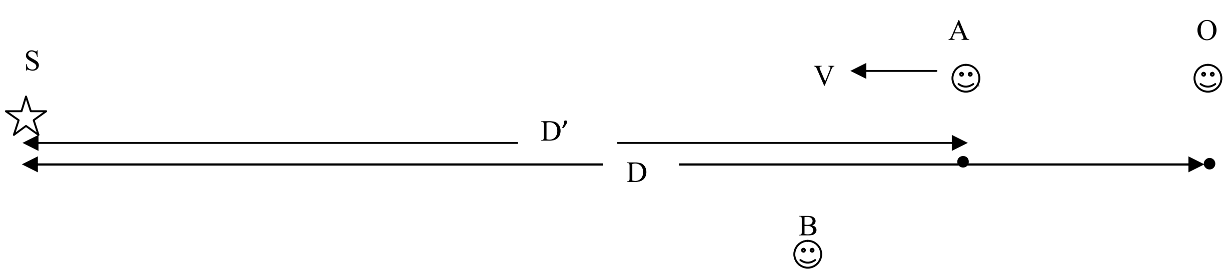
(In the case of absolutely moving observer and star at absolute rest (preceding section), light aberration is an apparent change of ***current*** (instantaneous) position of the star) .

This kind of star light aberration is due to the star's absolute motion. Therefore, even if an observer is at absolute rest, the observed position of stars may not be their actual *past* position. Theoretically, it is possible to know if a star is in absolute motion or not, and its absolute velocity. If the position of the star appears to change as the (stationary) observer changes his/her distance from the star, then the star is known to be in absolute motion. If the star is at absolute rest, then its position will not change apparently as the observer distance decreases or increases.

Interpretation of Einstein's light postulate: Relativity of electromagnetic waves

Imagine an observer moving towards or away from a light source that is at *absolute rest* [7]. Maxwell's equations predict that the speed of light should always be the same, whether the observer is at rest or in motion relative to the source, as interpreted by Einstein as the light postulate. Such a conclusion comes from the non-existence of the ether. But how can two observer measure the same speed of the same light beam, coming from the same source?

Einstein was right when he called the light postulate a postulate. There is no proof of it but only an interpretation. SRT was Einstein's interpretation of the light postulate. This paper proposes an alternative interpretation.



Assume an absolutely stationary light source S and two observers, observer O who is also at rest and observer A who is moving towards S. Assume also that there is a third stationary 'observer' B. Observers O and A report to observer B the time they received a light pulse. Suppose that at an instant of time, S is emitting a short light pulse while observers O and A are at the same distance D from the source, but with observer A moving with velocity V towards S at that instant of time. Observer O will obviously receive the light pulse after a time delay of D/c. Straight forward thinking tells us that observer A should detect the light pulse earlier than observer O, because A is moving towards S.

For light, however, this should not be the case because it would violate the constant light speed postulate implied by Maxwell's equations and the non-existence of the ether. Both observers O and S should receive the light pulse simultaneously, and this is the new interpretation of Einstein's light postulate and Maxwell's equations. It is as if the light slows down for observer A. This is the only way a third stationary 'observer' B can account for this. Let us call the velocity of light relative to its source for observer A as c'.

During the time (D/c) that the light pulse travels from S to O, observer A will also have advanced towards the source by a distance of V. D/c , relative to O.
If we postulate that the time delay for both observers is the same, then

$$\text{time delay for O} = \text{time delay for A}$$
$$D/c = (D-V.D/c)/c'$$

From which,

$$c' = c-V$$

Note that c' is the velocity of light relative to its source, for observer A. Therefore, 'observer' B predicts the velocity of light relative to observer A as the sum of c' and V.

$$\text{Velocity of light relative to observer A} = c' + V$$

But c' = c-V (previous equation). So substitute in the above equation

$$\text{Velocity of light relative to observer A} = c' + V = (c-V) + V = c$$

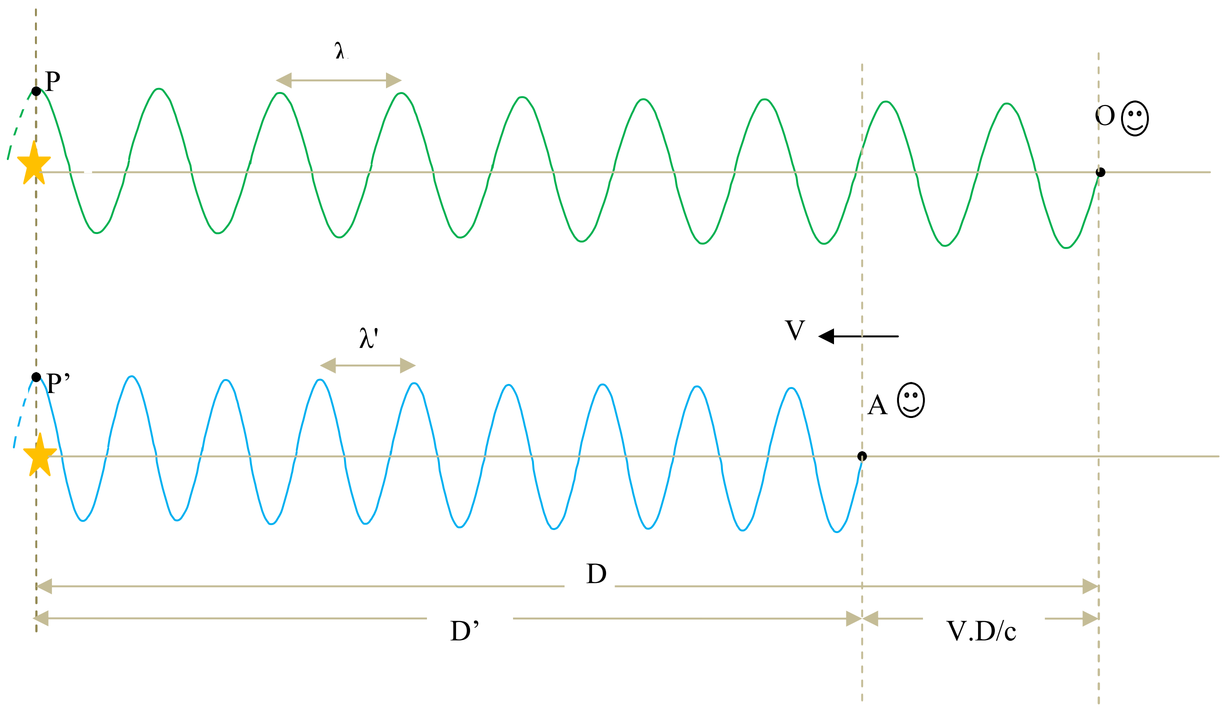
Therefore, the velocity of light relative to observer A is still equal to c. Even though observer A is moving towards the light pulse, light will not go faster than c relative to him/her. The velocity c' is an apparent velocity and is not a physically accessible (measurable) quantity.

A similar analysis can be done for an observer moving away from the source.

Suppose that, instead of a short light pulse, the source emits a sinusoidal continuous light wave.

As before, assume that observers O and A are at the same distance D from the source S, at an instant of time. Assume also that observer A is moving towards S with velocity V and source S is just emitting a peak phase point P on the wave. Therefore, both observers will detect the peak point P simultaneously.

The below diagram is a frozen or snapshot pictures of the wave as seen by observer O (green wave) and by observer A (blue wave). We see that the wave should spatially be compressed towards its source for observer A, if observer A is to see peak point P' at the same instant observer O is seeing peak point P. Peak point P on the green wave for observer O corresponds to peak point P' on the blue wave for observer A.
From the below diagram, the number of frozen wave cycles (n) in the space between stationary observer O and the source is equal to the number of frozen wave cycles (n) in the space between observer A and the source.



So we see that observer A sees a Doppler blue shifted form of the wave seen by observer O. We will determine the Doppler wavelength and frequency shift.

$$n.\,\lambda - n.\,\lambda' = V.\ D/c$$
$$n\,(\lambda - \lambda') = V\,.\,D/c$$

But, $n = D / \lambda$

Therefore,

$$(D/\lambda)\,(\lambda - \lambda') = V.\,D/c$$

From which,

$$\lambda - \lambda' = \lambda\,.\,V / c$$
$$\Delta\lambda = \lambda\,.\,V / c \quad and \quad \lambda' = \lambda\,.\,(c - V) / c$$

The Doppler frequency shift :

$$f' = c / \lambda'$$
$$= c/\lambda\ .\ c / (c-V) \qquad \text{(substituting for } \lambda' \text{ from above equation)}$$
$$= f\ .\ c / (c - V)$$

And

$$\Delta f = f' - f = f\ .\ V / (c - V)$$

In Doppler effect of sound or water waves, wave length is fixed and is independent of the observer's velocity, and the velocity of the wave will be $c_s \pm V$ relative to the observer, where c_s is the velocity of the sound or water wave and V is the velocity of the observer, both relative to the medium. Unlike the Doppler effect of sound and water waves, in Doppler effect of light, the wavelength changes and the speed remains constant. The new interpretation is restated as follows.

The apparent *phase* velocity c' of light relative to the source changes by the same amount of the source observer relative velocity V so that the velocity of light is always constant c relative to the observer. For

an observer moving directly towards a light source at absolute rest, the light wave contracts towards the source so that the apparent (phase) velocity c' of light relative to the source will be $c\text{-}V$. The velocity of light relative to the observer will be $(c\text{-}V) + V = c$. The velocity c' is an apparent velocity because it is not a physically measurable velocity. For an observer moving at constant velocity directly (radially) away from a light source, the apparent velocity c' of light relative to the source will be $c + V$, so that the velocity of light relative to the observer will be $(c+V) - V = c$.
The consideration of the Doppler effect of light and the light postulate (Einstein's thought experiment: 'chasing a beam of light') gave a hint on the correct interpretation of the light postulate.

The Doppler frequency and wavelength shifts derived above apply in Galilean space, so motion of the observer is equivalent to motion of source. In the case of absolute space, the same formula applies for a source that is at absolute rest and an observer in absolute motion. For a source that is in absolute motion, however, these formulae are modified (to be discussed in a section ahead).

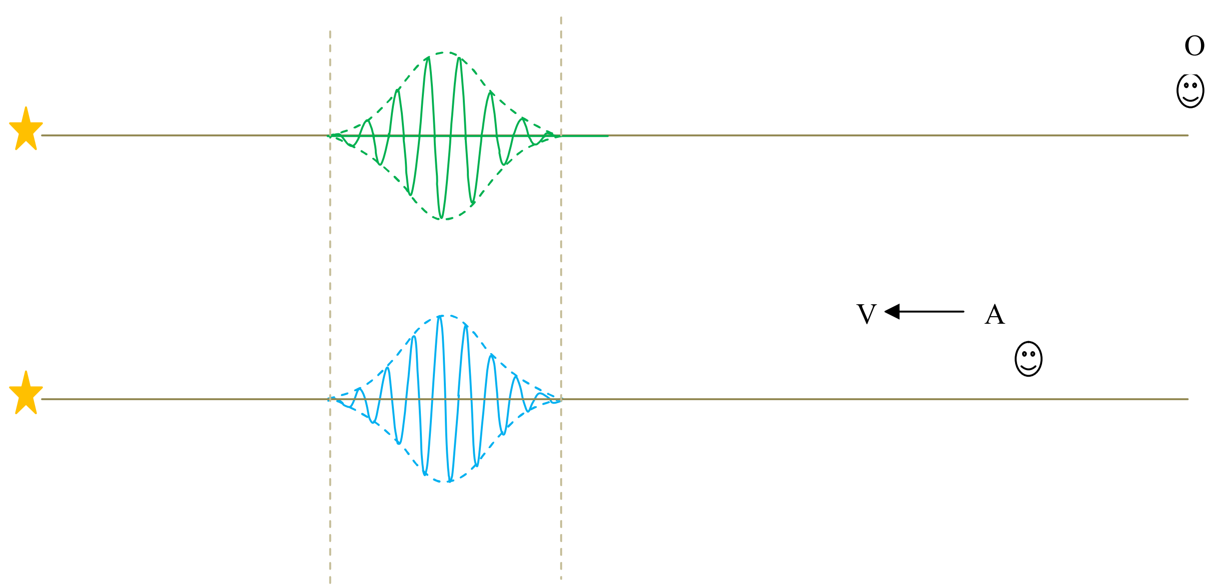
Constant phase velocity and variable group velocity of light - a new theory

In the preceding section a theory which can successfully interpret the light postulate was proposed. This is a great success because we didn't resort to any such extraordinary claims as 'length contraction' and 'time dilation'. It was shown that frequency and wavelength change for an observer moving relative to a light source that is at absolute rest, such that the speed of light is always constant relative to an observer.

$$f \cdot \lambda = c = f' \cdot \lambda'$$

However, the above proposed theory is still counterintuitive. Logically, an observer moving towards a light source should detect a light pulse (or a peak point, as in our previous discussion) earlier than a stationary observer. The hypothesis that the two observers O and A (refer to preceding section) detect a light pulse (or peak point P) simultaneously is not only counterintuitive but also is not in accordance with experiments and observations.
Should we discard the new theory then? But we have successfully interpreted the light postulate with it! Therefore, we should keep the new theory and try to reconcile it with logic and observations.

It took me more than one year to discover the missing idea. The 'new' idea is not really new : *phase velocity and group velocity*.



Observer A who is moving towards the light source should logically detect the light pulse earlier than the stationary observer O. However, observer A should observe a spatially compressed form of the wave observed by stationary observer O, so that the phase velocity is always constant c relative to the observer. The assertion made in the previous section applies to phase velocity, not to group velocity. Both observers O and A detect a phase point simultaneously, *if the wave was a continuous one*.

Here is the distinction:

Even though the (sinusoidal) waves are compressed, the envelop or the group is not compressed.

Note the slight compression of the blue sinusoidal waves as compared to the green sinusoidal waves, but that the two envelopes have the same width, in the figure above.

One implication here is that there is no conservation of the number of wave cycles in an envelope ?? (This might be a problem?). This may be counterintuitive. But at least we also know that any waveform can be seen as a Fourier series, containing sinusoidal waves at different frequencies, extending from minus infinity to plus infinity, in time. But a photon can also be seen as a product of a sine and a Gaussian pulse.
Thus, as the observer A moves towards the light source, the phases will be spatially compressed, but the envelope is unchanged, i.e. not compressed.
In a previous theory I proposed[1], both the sinusoidal wave and the envelop were postulated to be compressed, and this had the above mentioned counter intuitive implications which were not in agreement with experiments and observations.

For the stationary observer O, the phases are at rest relative to the envelope. However, for observer A, the phases are moving relative to the envelope.

It is the velocity of the phases which remains constant relative to the observer (and independent of source velocity), and not the velocity of the envelope (the group). The velocity (c') of the phases apparently changes relative to the source, so that their velocity relative to the observer remains constant (*c*), i.e. c' + V = c (vector, algebraic sum).

The group velocity is 'ballistic' and not constant *relative to the observer.*

As determined in the preceding section, the Doppler frequency shift observed by observer A is:

$$\Delta f = f' - f = f \,.\, V / (c - V)$$

Similar analysis can be done for an observer moving away from a light source.

Therefore, a complete and successful alternative interpretation of Einstein's light postulate has been developed. The constant c in Maxwell's equations has been interpreted

1. as a phase velocity relative to an observer
2. as group velocity of light relative to a source at absolute rest

Assume a source at absolute rest, to avoid the 'complications' of a moving source.
The group velocity is:

$$c = D/t$$

where *D* is the distance between source and observer *at the instant of observation* and *t* is the time elapsed between emission and observation.
The phase velocity is:

$$c = f.\lambda$$

The findings are summarized as follows:

The phase velocity of light is constant, independent of the velocity of the source and of the observer.

The group velocity of light is variable; it varies with the absolute velocity of the observer and varies with the absolute velocity of the source. However, for a moving source the measured group velocity appears to be independent of the source velocity. This has been shown to be due to the apparent change in source position which exactly cancels the effect of variable group velocity, as already shown.

The group and phase velocity of light is equal to c for (absolutely) co-moving source and observer.

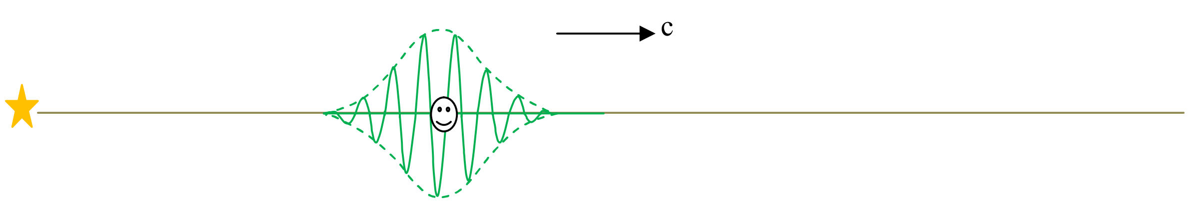
The group velocity of light is c relative to the apparent source, where c is the velocity of light.

The group velocity light reflected from a mirror is always equal to the velocity of the incident light, as seen by an observer at rest relative to the mirror, irrespective of the motion of the mirror.

One experimental evidence for the variable group velocity of light (varying with observer's absolute velocity) is Ole Roamer's observation that the eclipse time is longer when the earth is moving away from Jupiter than when it is moving towards Jupiter, by about 22 minutes. This can be seen as the effect of absolute motion of the observer.

A new interpretation of Einstein's light speed thought experiment

Imagine a light source that is at absolute rest and an observer moving away from the source at the speed of light, as Einstein imagined in his thought experiment. Assume that the observer was at the source position but moving away at the speed of light at an instant of time t=0. Assume that the source emits a light pulse at this same instant of time.



According to the new theory, the phases always go past the observer at the speed of light, and this was what Einstein postulated. But the envelop will always be at rest ('frozen') relative to the observer. Einstein (and no one else, I far as I know) never thought of such a possibility.

Note that if the observer is moving away at exactly the speed of light from a source that is at absolute rest, the wavelength will be two times the wavelength measured if the observer was at absolute rest. (Refer back to the derived formula for Doppler effect)

Longitudinal and Transverse Doppler effect

<u>Longitudinal Doppler effect</u>

Source at absolute rest and observer in absolute motion away from source

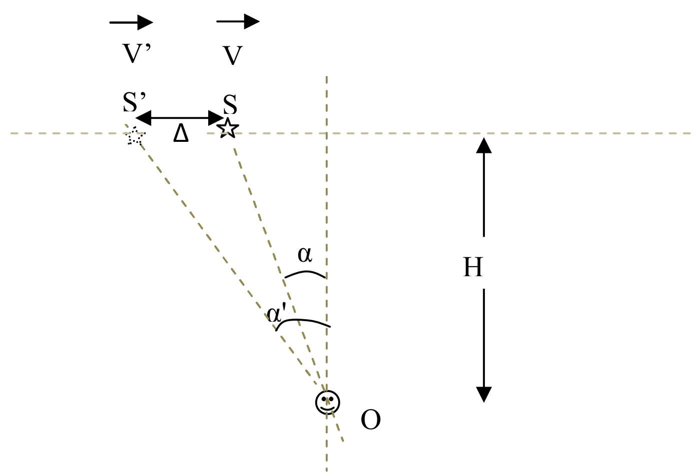
$\lambda_r = \lambda_0 (c+V) / c$, where λ_r and λ_0 are received and emitted wavelengths, respectively.

$f_r = f_0\, c/(c+V)$

Source in absolute motion away from observer and observer at absolute rest
$V' = V.\, c / (c + V)$, where V and V' are real source and apparent source velocities, respectively.
Formula for Doppler shift in Galilean space: $\lambda_r = \lambda_0\, (c+V) / c$
Using V' instead of V :
$\lambda_r = \lambda_0\, (c+V') / c = (c + 2V) / (c + V)$ and $f_r = f_0\, (c+V) / (c+2V)$

<u>Transverse Doppler effect</u>
We know that in Doppler effect of sound waves, there is no change in frequency or wavelength of light emitted at the point of closest approach, in the transverse (ninety degree) direction.

Next we see the approach in the determination of Doppler shift.



$\lambda_r = \lambda_0\, (c - V\sin\alpha) / c = \lambda_0\, (c - dD/dt) / c$ (in Galilean space; no transverse Doppler effect)

$\lambda_r = \lambda_0\, (c - V'\sin\alpha') / c = \lambda_0\, (c - dD'/dt) / c$ (in absolute space)

But, $D'/c = \Delta / V$ $\Box$ $D' / c = [\, (D'^2 - H^2)^{1/2} - (D'^2 - H^2)^{1/2}\,] / V$
And, $D = H / \cos\alpha$ $\Box$ $dD/dt = H \sin\alpha / (1 - \sin^2\alpha)$

First dD'/dt is determined in terms of dD/dt. Then it is possible to determine λ_r in terms of α. From this we can determine λ_r for any angle α. Thus we can, for example, determine the Doppler frequency shift for light emitted at the nearest approach, i.e. $\alpha = 0$

We will not attempt to show the final solution here, which may be a lengthy formula. This may require expansion of the terms under square root.

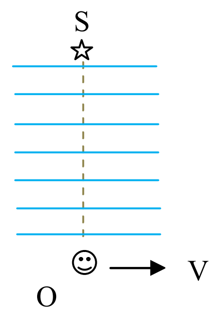
Next a qualitative explanation will be presented.

Light received at the moment of closest approach

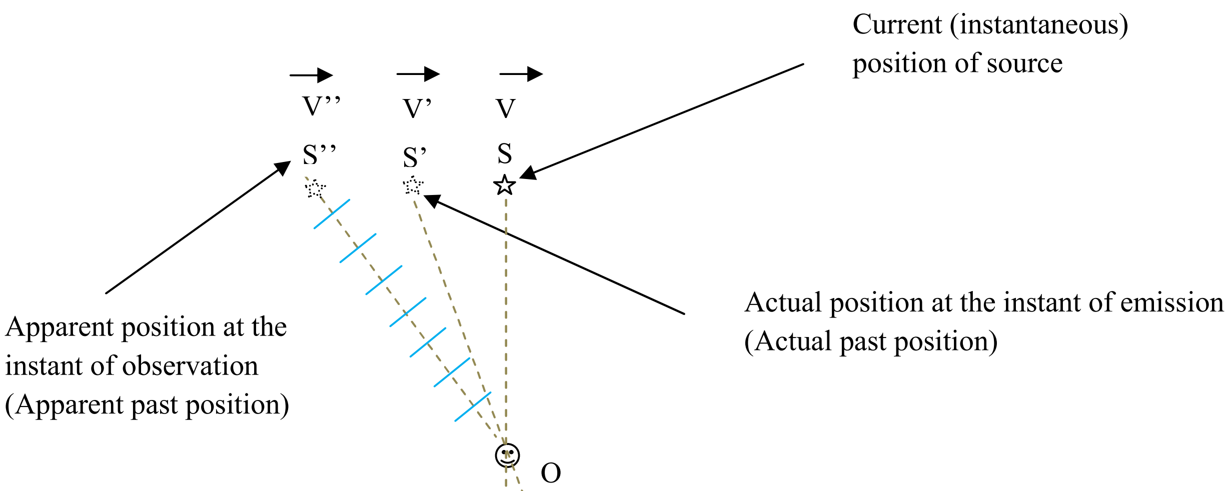
Only a qualitative explanation has been presented and the quantitative analysis can be done based on the discussions so far. It will be presented in the next version of this paper.

Source at absolute rest and observer in absolute motion

From the figure below (parallel wave fronts, for simplicity) we see that transverse motion of the observer will have no effect on the phase velocity and hence on the wavelength and frequency of light seen by the observer. The phases will always go at *c* past the observer. No transverse Doppler effect (TDE).



Source in absolute motion and observer at absolute rest



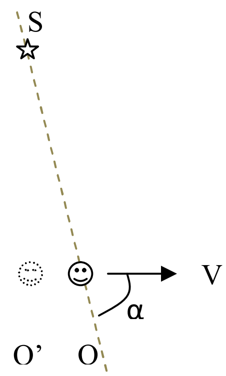
The source position now (at the moment of observation) is at S. But the source was at position S' at the moment of emission. The apparent position of the source at the moment of observation is at S'' as seen by the observer. i.e. it appears to the observer that the source emitted the light from position S''. Therefore, light received at the moment of closest approach will be blue shifted. But sound received at the moment of closest approach (for a moving source and stationary observer) is also Doppler positive shifted in frequency (increased in frequency). The distinction for light is that the frequency is 'more blue' than classical prediction.

Light emitted at the moment of closest approach

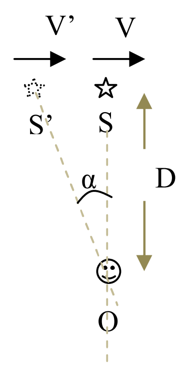
Source at absolute rest and observer in absolute motion

Light emitted at the instant of closest approach will be received after a delay of time. If the observer continues to move in the same direction, he /she will see, obviously, a red shifted light, as shown below.

The Doppler frequency and wavelength shift is already discussed in a previous section. Only the radial velocity component of the observer's velocity will result in a Doppler shift.

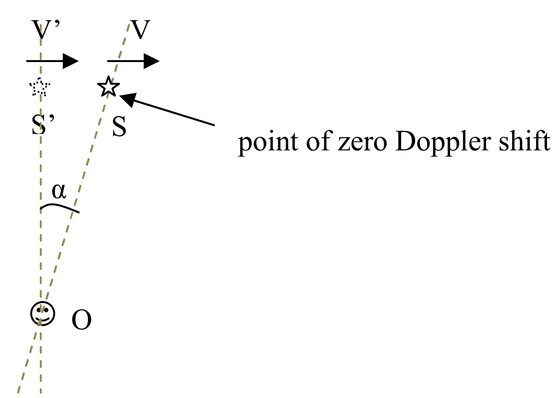


<u>Source in absolute motion and observer at absolute rest</u>



The source emitted light from point S. The observer receives the light after some delay. At the moment of observation, it appears to the observer that the light *was* emitted from point S', and not from point S. This effect has been explained thoroughly so far. Therefore, light emitted at the moment of closest approach will also be blue shifted.

At what position of the source will the observer then detect zero Doppler shift, for the case of an absolutely moving source and an observer at absolute rest ? The point of zero Doppler shift is ninety degrees for sound .Sound produced at the moment of closest approach will have zero Doppler shift. This point of zero Doppler shift for light is however is shifted to the right, as shown below.



Although the source emitted light from point S, it appears to the observer (at the moment of observation) that the source emitted light from point S', which is at ninety degree position and hence zero Doppler frequency/wavelength shift. Therefore, light emitted from position S will have zero Doppler shift. It is possible to determine the angle α.

We see that the whole Doppler shift is shifted towards the blue, i.e. 'more blue' (or 'less red') than classical theory, which assumes a medium of transmission for light. This is because the apparent source velocity V' is higher than the real source velocity V, up to the point of zero Doppler shift, as the source approaches the observer, and V' is less than V as the source is receding away from the observer, from the point of zero Doppler effect onwards.

A new theory of static fields; near field, far field, phase velocity, group velocity

Apart from the paradoxical nature of the speed of light, another intimidating area of electromagnetism is the subject of static fields.

Coulomb's law of electrostatic field and Newton's law of gravitation imply instantaneous propagation. Such an assumption, however, does not seem intuitive. There are also other conceptual problems with the idea of instantaneous interaction. For example, it is assumed that motion (acceleration) of a charge causes electromagnetic radiation, which propagates at speed c . Therefore, motion of a charge would have two disturbingly separate effects:

- A test charge placed at large distance will feel the motion of the charge instantaneously
- An EM wave/radiation due to acceleration of the charge propagates at speed c, away from the moving charge

If information on the change of position of the charge is transmitted instantaneously, then what is the 'purpose' of the electromagnetic wave that propagates at speed c ? so on …

Apart from such conceptual difficulties, the idea of instantaneous propagation cannot also give complete explanation to experiments. For example, why does a high velocity electron bend less in a magnetic field than classical theory predicts ? This has been interpreted as 'relativistic mass increase' in Special Relativity theory, but I would say this is an extra ordinary claim.
On the other hand, experiments [5] have been performed that tentatively showed instantaneous propagation of static electric field of an electron beam.

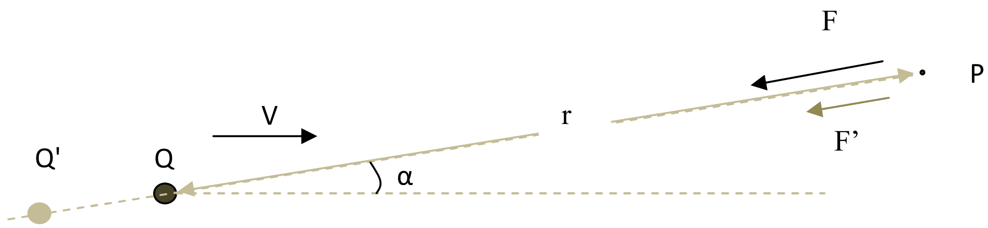
The speed of gravity is even less understood. What is the speed of gravity ? Infinite or finite ?
Some gravitational phenomena, such as perihelion advance, may hint on finite speed of gravity. On the other hand, observations during solar eclipse have been interpreted[6] as lack of gravity aberration.

The problem of radiation of electromagnetic waves is a related issue. No complete and clear picture of the process of radiation exists.

Such and such have been some of the confusions surrounding our understanding of the propagation speed of static fields.

In this paper a hypothesis on static fields is proposed, as follows.

Assume an isolated charge Q and an observer at point P, both at absolute rest and one light second apart .



The electric field at point P will be towards charge Q, from Coulomb's law.
Assume that the charge Q be suddenly accelerated forward and continues moving in that direction.

The puzzle is: will the value of the electric field at point P be updated instantaneously or with the delay of the speed of light? The conventional assumption is that the field at point P will change with a delay of light speed (one second). This assumption, however, is not in agreement with experiments [5]. But the assumption of instantaneous propagation also does not seem to provide a complete understanding and explain experiments, for example, 'relativistic mass increase' of the electron.

An odd nature of an isolated moving charge emerges from these considerations as follows:
Yes, the action of suddenly accelerating the charge Q will be felt instantaneously at point P, but the magnitude of the electric field changes relative to its value when the charge was stationary. The field 'contracts' towards the charge Q for a charge moving towards the observer and expanded for an observer moving away from it. For a charge moving directly (radially) towards an observer, the field will decrease giving the illusion that the charge is farther than it physically is. And the opposite effect for a receding charge. Only the radial component of the velocity has this effect. This is discussed in more detail in the section ahead:' Relativistic mass increase of the electron', from the perspective of a moving observer. According to the principle of relativity, the motion of the observer is equivalent to the motion of the source. Note that absolute velocity will have no effect for static fields because the group velocity is infinite, thus the principle of (Galilean) relativity can be applied. The proposed apparent expansion and contraction of the field is an interpretation of the constant phase velocity of light and also an alternative explanation to the 'relativistic mass increase' of the electron.

If we assume that the charge Q acquires a velocity V in zero time (only for simplicity; this is only theoretical and requires infinite acceleration), then, it appears to the observer that the charge Q jumped discontinuously to point Q'. Note again that only the radial component of V has effect. The magnitude of the electrostatic force will jump discontinuously (suddenly) from F to F'. The direction is always towards the charge. The magnitude is determined by the distance to point Q', not by the distance to Q. At the instant that charge Q accelerates from absolute rest to V, the change is felt *instantaneously* at point P. Real cases with finite acceleration can be understood based on this hypothesis.

The electrostatic field is given by:

$$F' = [\varepsilon_o \,.\, q1 \,.q2 \,. / r^2] * [1- V/c]^2 \quad \text{(for charge moving towards observer)}$$

$$F' = [\varepsilon_o \,.\, q1 \,.q2 \,. / r^2] * [1- V/c]^2 \quad \text{(for charge moving away from observer)}$$

This formula is explained in the section ahead. The V in the above formula should be replaced with V cos α , for the charge Q above.

The above theory seems to propose an instantaneous propagation of static (electric, magnetic) fields. But we also see the speed of light in the expression for F' as if the force propagated at the speed of light. These apparently conflicting features may be expressed as: *infinite group velocity and constant (light speed) phase velocity of electrostatic fields.*

There will be no radiation even if the charge accelerates. There is no radiation, no waves. The above theory applies to all static electric and magnetic fields.

The phenomenon of radiation

One of the areas of physics that have remained cloudy to this date is the phenomenon of electromagnetic radiation. The above assertion of infinite speed of Coulomb's field is in conflict with the conventional knowledge that electromagnetic wave/ radiation is caused by an accelerating charge. No radiation is caused by an isolated accelerating charge.

The theory of the phenomena of radiation is proposed as follows.
An isolated accelerating charge will not radiate electromagnetic waves. Electromagnetic radiation results only from two charges moving / accelerating relative to each other. EM radiation is only a result of charge separation. (Here I speculate that only a pair of *opposite* charges can radiate). EM radiation is a result of change in the *structure* of the field. A field moving as a whole will not radiate, even if accelerated; only a change in the structure of a field will cause radiation. Only a fluctuating or disturbed field radiates.

If charges +Q and –Q (close enough to each other) move rapidly *relative* to each other, with their motions limited to a region of space, an EM wave will be radiated. An observer at point P will receive a photon with a light speed delay after emission from the charge system. But how can we explain the EM radiation from the perspective of an observer at point P? When seen from point P, each of the two moving (accelerating) charges are no different from the isolated charge in the preceding section. The field at point P is only a superposition of the field due to +Q and -Q. Why then do the charges radiate, where as the isolated charge doesn't radiate even if it is accelerating? Why does the action of suddenly moving an isolated charge (previous section) be felt instantaneously at P where as the motion of the charge pair +Q and –Q above propagates only at the speed of light?

The root of the problem may be the long standing principle of superposition itself, i.e. the application of this principle in electromagnetism. The principle of superposition is known to apply correctly to classical, ordinary waves and fields. A subtle assumption is implicitly associated with the principle that the fields of the two charges remain *separate* and act independently on a third (test) charge at P. It is this assumption that may need to be changed.

To resolve this problem, we assume that the two fields from +Q and -Q merge into a *single* field. And if we can create a disturbance in this field, there will be a propagating wave/ radiation.
Now let us consider what happens when one or both charges move or accelerate within a limited region of space, continuously changing their separation. The observer at point P cannot identify +Q or -Q from the

charge system. He observes a single charge system and hence a single field.

Now, when the two charges *rapidly* move relative to each other, there will be a disturbance of the (single) field formed from the two fields. This disturbance will then propagate as an electromagnetic wave or radiation. Unlike the case of an isolated charge, the static field will be updated at all points of space with the delay of the speed of light. *The radiation is accompanied with updating of the static field values at all points of space.*

There is no way of disturbing the field of a single isolated charge. Moving or accelerating the charge just moves the field as a whole and does not create a disturbance. A minimum of two (opposite?) charges is required to create disturbance in electric field. Radiation occurs only when there is field disturbance in the reference frame of the source.

In the case of an isolated accelerating charge, there is no *disturbance* of the electric field. There is only a *moving* field with the motion of the charge. Let us take an analogy with water wave. Imagine water contained in a large tray. Does moving the tray as a whole create waves? No. Water wave will form only if we disturb the water, say by dropping a stone. In the case of water waves, it may be thought that acceleration or unsteady motion of the tray will create a disturbance. But we do not assume that this will also be the case for the electrostatic field. But, even for water, this cannot be interpreted as a wave; it is the whole water that is 'disturbed', there is no propagating disturbance/ wave, going from one point to another. Therefore, it is impossible to create radiation with a single isolated charge.

In the case of two charge system, it is possible to easily create disturbance of the field by *rapidly* moving or accelerating the charges relative to one another. It is charge separation that causes electromagnetic waves and radiation. The usual picture of an accelerating electron with wiggling emanating fields to explain radiation may be wrong. If the speed of propagation of static fields is proved to be infinite (with additional experiments), then the current understanding of radiation of electromagnetic waves will be wrong.

Whenever talking about electromagnetic radiation, we assume the *source* of the radiation. A source is an entity. In the above two charge system, how can we define/ identify the source? If the two charges are to form a single source, then we have to make some assumptions. For an observer at point P, the EM wave/ radiation comes from the source. The two charges act as a single source. Therefore, it would be impossible to know or to assume from which charge the radiation originated. The wave/radiation originates from the *source*.

For this, the speed of propagation of the wave needs to be nearly infinite in the vicinity of the charges. The speed of propagation gradually reduces to the speed of light in the far-field region. This defines the source. *The source will then be a limited region of space containing the charges, to which the motion of the charges is limited.* Therefore it would be wrong to think of whether one or the other charge caused the radiation. Note that if we assumed light speed propagation in the vicinity of the charges, it would be impossible to define the source as an entity. For example, we would not be able to talk about motion (velocity) of the source. There would be no distinction between the motion/ acceleration of the charge which is the cause of the radiation and the motion of the source (for example when talking about whether the speed of light depends on the velocity of the source). Therefore, the source will be at absolute rest if the charges move / accelerate within a region of space which is stationary relative to an object that is at absolute rest. i.e. if the average position of the charges is at rest relative to a reference object that is at absolute rest. Remember that a source has already been defined as a limited *region of space* containing the charges and their motion. The size of the source (size of space) depends on the frequency and amplitude of oscillation/ displacement of the charges.

For low frequency oscillations, the near-field region, which is the source, will be large. For high frequencies, the size of the source will be small.

We can identify three regions: near field, mid field and far field.

An observer in a far field region observes the wave/radiation arriving from the direction of the source. He measures the speed of propagation to be equal to the speed of light. As he moves towards the source, he enters the mid-field region where the speed of propagation is much greater that the speed of light and much larger wavelengths. As he moves closer, he enters the near field region where only pulsating fields can be observed. The speed of propagation here is nearly infinite, or more accurately, we may assume that there is no propagation in this region. Since there is no propagation, the observer cannot say the wave arrived from any particular direction. There will be only a pulsating field. This is the region we call the source.

1. *The space surrounding a source of EM wave is divided into three regions: near field, mid field, and far field regions*

2. *The phase velocity of EM wave is constant (the same) in all regions*

3. *The group velocity of the EM wave is nearly instantaneous in the near field region and is equal to $c \pm V'$ in the far field region, where V' is the velocity of the apparent source.*

With the above hypotheses the following experiments and observations may be explained. The isolated charge and two-charge system examples are ideal and reality is a continuum between these. For example, practically there can be no charge that is absolutely isolated from other charges. A rule of thumb will be to consider the charge as isolated if there will be no appreciable radiation and to consider the charge as part of an EM radiation source if there is radiation, such as an electron jumping between orbits in an atom or the electrons in a radio transmitter antenna.

Relativistic 'mass increase' of the electron:
Since the electrons in the 'relativistic mass increase' experiment are considered as isolated charges, the apparent contraction or expansion of the electrostatic or magneto-static field can explain the apparent 'mass increase' of the electron. The justification for an assumption of isolated charge is that practically there will be no radiation due to an electron moving in the accelerating electric field or in the deflecting magnetic field. This experiment is also explained from the perspective of a moving test charge (next section).

Measuring Propagation Speed of Coulomb's Field, A. Calcaterra, et al
Again we consider the electrons in the electron beam as isolated charges.

Relativistic 'mass increase' of the electron

In our previous discussions, we hypothesized that the light wave apparently contracts towards or expands away from the source, for an observer moving towards or away from the source, respectively. If we interpret this also to mean that static fields expand or contract relative to their sources (charges) for an observer moving relative to the charge, then this will lead to modification of Coulomb's law and hence may account for the observed apparent increase of mass of relativistic electrons.

Velocity dependent version of Coulomb's law has been proposed by some authors also [1,2].

Let us review the previous concept of contracting and expanding wave/field for light. We will then interpret this for electrostatics.
Suppose that there are two observers, O and A , moving towards a light source S.

We already postulated that the phase velocity of light is constant, independent of the velocity of the source and the velocity of the observer.

Suppose that observers O and A were initially at the same distance D from the source, but observer A moving with velocity V towards the source. Assume that at this instant the source was just transmitting a peak point of a sinusoidal wave. The postulate of constancy of *phase* velocity requires that both observers should detect the peak phase point simultaneously. The wave apparently contracts towards the source, so that the phase velocity is always constant relative to the observer.

During the time that the peak point travels from source to observer O, observer A will have moved towards the source by distance Δ .

$$D/c = (D-D') / V \quad \Rightarrow \quad D = (c / (c - V)) . D'$$

For the moving observer, the wave contracts by an amount of $\Delta = D - D'$

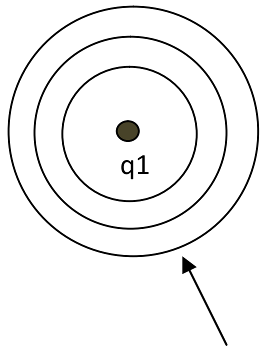
If we apply this interpretation to static electric and magnetic fields also, we will get modified velocity dependent Coulomb's and Biot-Savart laws.

Coulomb's law is written as

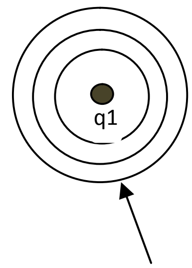
$$F = \varepsilon_o . q1 * q2 / r^2$$

If q1 and q2 are at rest relative to each other, then Coulomb's formula applies correctly.

Now assume that q1 remains stationary and q2 is moving *directly* towards q1 with velocity V.
As 'seen' q2, the electric field of q1 appears to contract towards q1 itself. This means that equal potential lines drawn around q1 now appear to have contracted towards q1, as 'seen' by q2.



Equi-potential lines of q1 as 'seen' by q2, when they are at rest relative to each other



Equi-potential lines of q1 (contracted) as 'seen' by q2, when q2 is moving towards q1

The moving charge q2 will now experience less electric field of q1. Moving charge q2 will experience the same electric field as stationary charge q3 that is at distance *r* from q1, where, from the equation (see above),

$$D = (c / (c - V)) . D'$$

$$r = (c / (c - V)) . r' \quad \text{(substituting r for D and r' for D')}$$

Coulomb's law:

$$F = \varepsilon_o . q1 * q2 / r^2$$

Substituting $r = (c / (c - V)) . r'$

$$F = \varepsilon_o . q1 * q2 / [(c / (c - V)) . r']^2$$

$$\boxed{F = [\varepsilon_o . q1 .q2 . / r'^2] * [1- V/c]^2}$$

where r' is the current, instantaneous position of q2.

We see that as the velocity of q2 approaches the speed of light, the electrostatic force will diminish towards zero. This might account for the 'relativistic mass increase' of the electron.
Therefore, Coulomb's force will decrease by a factor of $[1 - V/c]^2$, for a charge moving with velocity V

towards another charge.

If q2 is moving away from q1, the electric field will increase, as compared with the prediction of Coulomb's law. The electric field experienced by moving charge q2 is equal to the electric field experienced by stationary charge q3 that is at distance *r* from q1. In this case, the equi-potential lines around q1 appear to have expanded away from q1, as seen by q2.

In this case,

$$r = (c / (c + V)) . r'$$

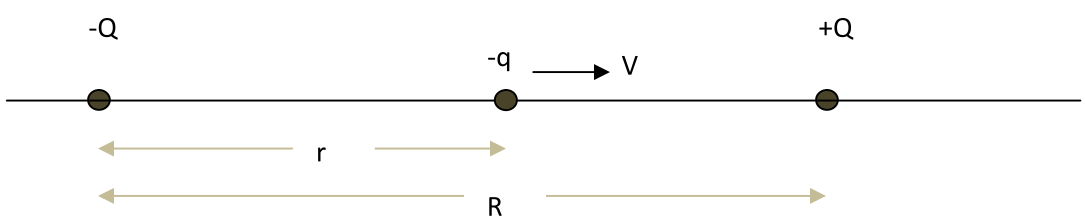
Substituting in coulomb's formula

$$\boxed{F = [\varepsilon_o . q1 .q2 . / r'^2] * [1 + V/c]^2}$$

The transverse component of the velocity of q2 will not have the contraction or expansion effect discussed above; only the radial component of the velocity of q2 has such effect.

What has been proposed for electrostatic fields applies also for static magnetic fields also.

The application of the above theory may explain the observed apparent mass increase of relativistic electrons. In actual experiments, the electron is emitted from a cathode and accelerated with an accelerating voltage, then the electron is delivered to a magnetic field. Since analysis of the actual experiment may be more complicated, we see only a simple case of a charge accelerating between two charges. The two charges +Q and -Q create the accelerating electric field, where as -q is the electron.



The electron accelerates from -Q towards +Q, under the action of the electric field created by -Q and +Q

The total electrostatic force on the electron will be:

$$F = [\varepsilon_o . Q .q . / r^2] * [1 + V/c]^2 + [\varepsilon_o . Q .q . / (R-r)^2] * [1 - V/c]^2$$

$V = dr/dt$

But, $F = m_e\ a = m_e\ dV/dt = m_e\ d^2r/dt^2$

After substitutions, we get:

$$m_e\ d^2r/dt^2 = \varepsilon_o Q q \left[1/r^2 \ . \ (1 + 1/c \ . \ dr/dt)^2 + 1/(R-r)^2 \ . \ (1 + 1/c \ . \ dr/dt)^2 \right]$$

which is a non linear differential equation.

The force experienced by the electron in the magnetic field can be determined in a similar way.

We see that both the electron acceleration and deflection are different from what the classical theory predicts. A numerical solution for the resulting non-linear differential equations might explain the apparent mass increase of the electron.

In the above discussion, we can equivalently consider q2 to be stationary and q1 to be in motion, with the same observed effect. This is according to the principle of Galilean relativity. Since electrostatic fields have infinite group velocity, absolute motion of the charge is irrelevant (has no effect).

Light speed measurement experiments

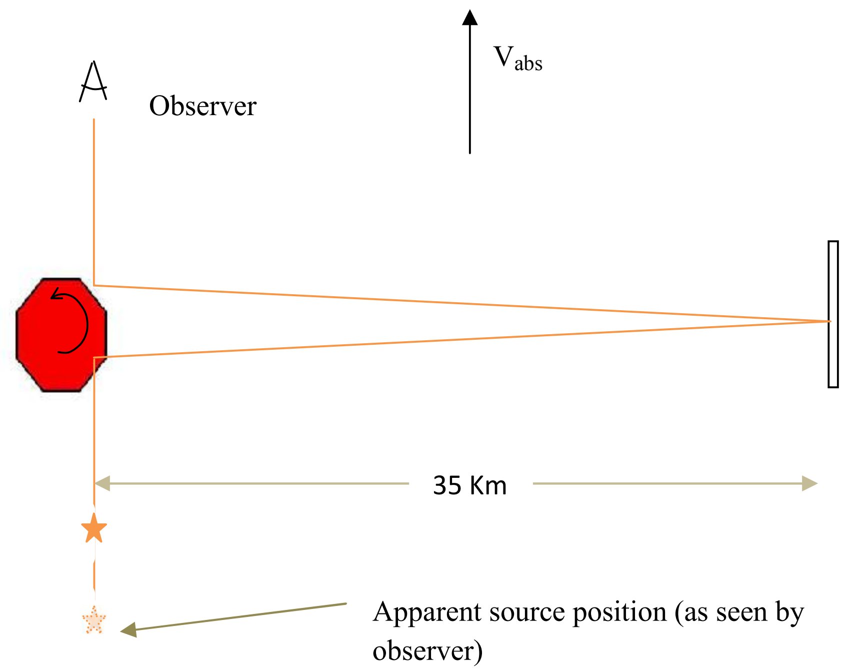
The speed of light has been measured with increasing accuracy by Ole Romer, Bradely, Fizeau, Foucault and Albert Michelson, from observation of astronomical phenomena and by terrestrial experiments. Modern experiments use optical cavity resonators, microwave interferometer and laser methods. The currently accepted value is 2.99792458×10^8 m/s.

Apparently, no variation in the speed of light has ever been detected with different orientations of the measuring apparatus relative to the orbital velocity of the earth.

Let us consider the Albert Michelson rotating mirror experiment.

As discussed so far, the source apparently shifts relative to the observer due to absolute velocity of the earth in space (about 390 Km/s). We see that this apparent shift of the position of the source relative to the observer does not affect the result of the experiment. The time taken by the light beam to move from the rotating mirror to the distant mirror and back to the rotating mirror, as 'seen' by the observer, is not affected by the absolute velocity of the earth. What is affected by absolute velocity of the earth is the total time taken for the light beam to go from the source to the observer. One may think of this as actually, physically changing the distance between the source and the observer (change distance of source from rotating mirror), which will not change the result of the experiment, obviously: the measured speed of light.

The same applies to optical cavity resonators and microwave and laser interferometer methods. The change in path length of the wave from source to detector due to absolute motion does not affect the result of such experiments. The *apparent* change of the position of the microwave source does not affect the frequency of a resonant cavity, just as *actually* changing the position of the source does not, in principle, affect the experiment .The frequency and the wavelength of light emitted by a source is not affected by an apparent or actual change of the position of the source.



A different method was used by Rosa and Dorsey in 1907 .They measured vacuum permittivity ε_0 and vacuum permeability μ_0 from which the speed of light can be computed from the equation $c^2 = 1 / \varepsilon_0 \mu_0$. The result obtained was within 0.00005 % of the currently accepted value. This is an important experiment that shows that vacuum permittivity and vacuum permeability, and hence the vacuum *phase* velocity of light relative to any observer, are not affected by absolute motion. This can be another experimental evidence confirming Einstein's light postulate.

Absolute space is defined or 'fixed' by massive cosmic objects.

This paper proposes that absolute motion exists but that the ether does not exist. Then, if space is empty, relative to what is absolute motion defined ? It is proposed that cosmic massive objects define or 'fix' (absolute) space. This should not be interpreted as 'gravitational ether drag'. No ether exists.
Imagine a universe with only two objects: a massive cosmic object (such as the sun) and a comet with a a mass of 10,000 Kg. Suppose that they are in motion relative to each other, and near to each other. Now, which is moving and which one is stationary? According to this paper, the sun is at absolute rest (mass= 1.988×10^{30} Kg !) where as the small object is in absolute motion. Massive objects define absolute space in their vicinity, with its influence diminishing with distance. The absolute velocity of any small object is defined as its motion relative to the cosmic massive object. According to SRT, both objects can claim to be moving and this is wrong and the source of confusion.

In free space (space without matter), absolute motion does not exist. Galileo's principle of relativity, emission theory, Coulomb's law, Newton's law of gravitation hold as they are in such a space. For example, the electrostatic field of a moving charge is directed towards the instantaneous position of the charge.

In absolute space (near massive cosmic objects) absolute motion exists. Massive cosmic objects define or 'fix' the space in their vicinity. According to the new interpretation of absolution motion of a light source, therefore, there will be no apparent change of position of light source in free space, i.e. there will be no ‘aberration’ for co-moving source and observer. Note that the new theory proposed in this paper means that aberration exists for source and observer co-moving absolutely in space, i.e. even with no relative motion between source and observer.

Imagine that the earth is moving in free space, isolated from all effects of the sun, planets, the stars, the galaxies. If we did a modified Michelson-Morley experiment (capable of detecting absolute motion) on such an earth, then we would get null result. But if we moved the modified MM device relative to (on) the earth with velocity V, we would get a corresponding fringe shift, because of the absolute space defined by the earth. What if the modified MM experiment was done at far away from the earth ? We move the modified MM device (one with two coherent light sources in place of the forward and lateral mirrors) far away from the earth and any cosmic object, but at rest relative to earth. Obviously, there would be no fringe shift. Next we move the device so that its velocity relative to the earth is V. In this case, a much smaller fringe shift will occur (less than fringe shift detected when the experiment was done on the earth) and if the device is sufficiently far from the earth, no fringe shift will occur at all, even with large velocity of the device relative to earth.

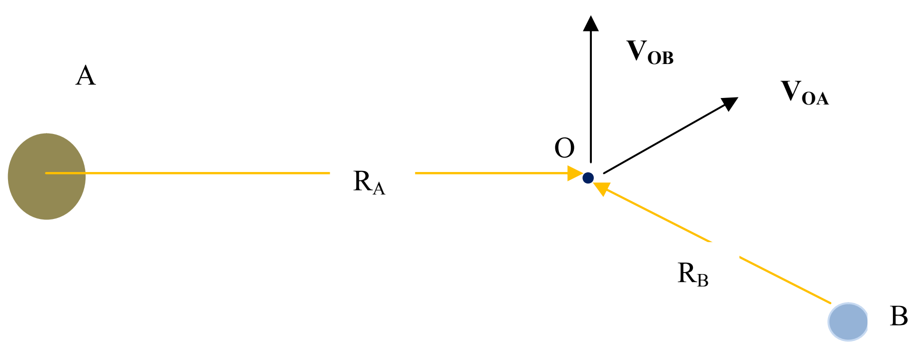
Therefore, the absolute velocity of the device will be equal to its velocity relative to the earth on the surface of (or near) the earth. As distance from earth increases, the absolute velocity continuously diminishes even if the relative velocity was kept constant. Imagine the modified MM device mounted on a space ship launched from the earth, with constant velocity relative to the earth. As the space ship gets farther and farther away from the earth, the fringe shift diminishes continuously. Remember that so far we have been talking about a hypothetical earth which is in free space.
Next we do the thought experiment on the real earth, which is in the solar system. If we do the experiment with our modified MM device (stationary on earth), then a fringe shift will occur, corresponding to the absolute velocity of the earth, which is 378 Km/s as measured in Silvertooth’s experiment. If the device is moved relative to the earth, on or in the vicinity of the earth, additional (positive or negative) fringe shift will be observed, superimposed on the fringe shift due to the 378 Km/s absolute velocity.

The absolute velocity of a body is the vector sum of all of its weighed velocities relative to cosmic massive objects in the universe.

A and B are massive cosmic objects (see next figure), with relative velocity V_{BA} . O is an object (an MM device) whose absolute velocity is to be determined, with velocity V_{OA} relative to A and with velocity V_{OB} relative to B.

Object O is far away from A and B. So its absolute velocity should be attenuated in inverse proportion to the square of the distance from each object.

(The relative velocity of A and B can be obtained from V_{OA} and V_{OB})



$$\mathbf{Vabs} = M_A(K / R_A^2)\, \mathbf{V_{OA}} + M_B\, (K / R_B^2)\, \mathbf{V_{OB}} \quad \text{(vector sum)}$$

where K is some constant. Gravitational constant ?

The more massive object (A or B) has more influence on determining the absolute velocity of O. Also the nearer O is to one or the other massive object, the more the influence of that object will be.

Therefore, the absolute velocity (378 Km/s) of the earth as detected in the Silvertooth experiment is theoretically the resultant sum of all ‘inverse square distance and mass weighed’ velocities of the earth relative to all cosmic objects in the universe. Cosmic objects with bigger masses and near to the earth will have more influence.

This theory will solve the centuries old perplexing paradox:

Relative to what is the absolute velocity of a body determined?

The proposed answer:

Relative to all matter in the universe.

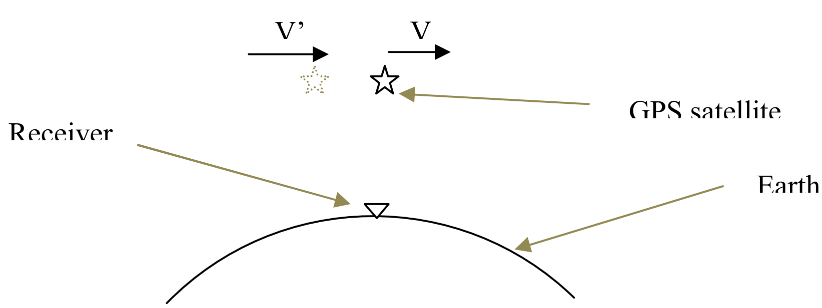
The absolute velocity of a body is determined in an analogous (similar?) way to the determination of gravitational force acting on a body.
The Hafele Keating experiment and GPS correction may be explained by this theory.

The speed of light is unaffected by massive cosmic objects; Explanation of star light bending near the sun, Hafele Keating experiment and the GPS correction.

The bending of star light near the sun has been considered to do with the mass of the sun. An alternative explanation[8] has been proposed for the bending of light near massive objects. It is proposed that the effect is not due to the mass of the sun, but due to its size. The speed of light is not affected by massive objects and is the same constant c in empty space, everywhere in the universe. I propose that the Rosa and Dorsey experiment (1907) be repeated at different distances from the Earth or the Sun to see if there is any effect on vacuum permittivity and permeability, to see if the speed of light is affected by massive cosmic objects.

The ‘time dilation’ and ‘GPS correction’ effects may be explained by the theory introduced in this paper.

The apparent increase of the rate of an atomic clock on the GPS satellite can be explained. Suppose that the Earth is at absolute rest, for simplicity, with the GPS satellites orbiting around the Earth. The absolute velocity of the satellite would then be the same as the velocity V of the satellite relative to the Earth.



From our previous discussions, we know that V’ > V for an approaching satellite and V’< V for a

receding satellite, relative to the receiver. This means that the whole received frequency will shift towards the blue as compared to classical values. Therefore, it appears as if the rate of the clock on board the satellite has increased.
It is true that this effect changes with altitude even if V is kept constant. At higher altitudes, absolute space is 'thinner' when compared with that near the Earth's surface. For the same velocity V, the velocity V' of the apparent source will be higher at lower altitudes than at higher altitudes. This means that there is more blue shift at lower altitudes and hence more observed 'increase in GPS clock rate'.

The effect is due to absolute velocity. Altitude has effect only if the satellite is moving relative to the earth (i.e. absolute velocity). It follows that there will not be any such effect on a clock on a satellite at the Geosynchronous orbit.

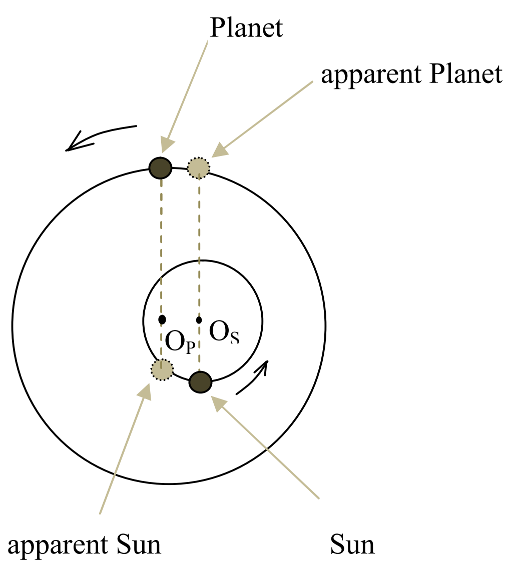
So we have seen that the 'clock rate' effect is due to modification of Doppler formula for a source that is in absolute motion. But we are not excluding the possibility that absolute motion may also have real effect on the atomic clock itself. It is possible to think of a hypothetical clock (for example, two transponders mounted on a GPS satellite, emitting light between each other.)

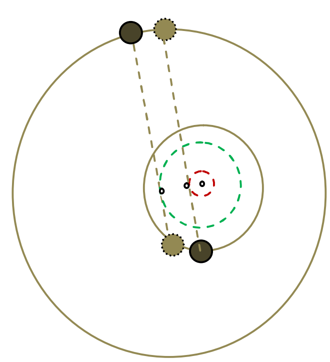
Evidence that the speed of gravity is equal to the speed of light. The speed of gravity need not be infinite.

Tom Van Flandern argued that [6] planetary orbits would be unstable if the speed of gravity is finite, and he set a lower limit of 2×10^{10} c on the speed of gravity. In this paper, however, finite speed of gravity is favored because it can explain Mercury perihelion advance. It will also be shown that the speed of gravity need not be infinite (as argued by Van Flandern) and that it is possible to explain stable planetary orbits and observations during solar eclipse by using finite speed of gravity and it will be shown that the 'speed' of gravity is in fact equal to the speed of light.

In this section we apply the Apparent Source Theory to gravity to explain gravitational phenomena. It is found that observations show light speed propagation of gravity, not instantaneous propagation. Our usual analogy between electrostatic fields and gravity may be wrong. Even though we show that the speed of gravity is equal to the speed of light, it is unclear what is propagating in the case of gravity.

Let us assume that the sun-planet system (the bary-center) to be at absolute rest.





The usual fallacy is to think of the sun and the planet to be on opposite sides of a single bary-center, which implies unstable orbit because of a non central force component.

In the figure, two bary-centers, O_S and O_P , are shown. O_S is the bary-center for the Sun and the *apparent* planet (Jupiter), and O_P is the bary-center for the planet and the *apparent* Sun. We see that the real Sun and the real Jupiter are never on opposite sides of a single bary-center.

The above explanation is not accurate, though. With a little thought we can see that *the orbits* of the Sun and Jupiter revolve around a single common bary-center (right figure). Therefore, it is not the Sun and the Jupiter themselves, but the *centers* of their respective *orbits*, that should be thought as revolving around the common bary-center. O_S and O_P (shown in the figure) are just the instantaneous bary-centers. The figure on the right shows a more accurate representation. The red dashed circle is the locus of the Sun-apparent Jupiter bary-center, and the green dashed circle is the locus of Jupiter-apparent Sun bary-center. These two bary-centers revolve around the bary-center of the system. Note that the orbits shown are the instantaneous 'orbits' . Since the two bary-centers are continuously changing, the planet and the Sun will stay in the orbit shown in the figure only for a moment, i.e. the planet and the Sun move in continuously changing orbits.

With this scheme, the orbits would be 'complex' but stable, even if we assume a finite speed of gravity. Such a 'complex' orbit may account for the perihelion advance of Mercury and 'elliptic' orbits. We know that Newton's law doesn't predict perihelion advance for one sun one planet system (Sun-Mercury system).

This theory is a fusion of ether theory and emission theory, for gravity.

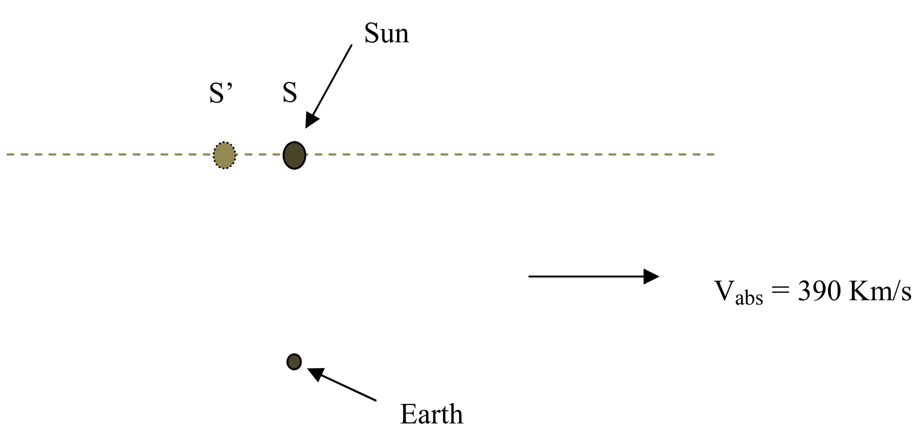
Evidence that the 'speed' of gravity is equal to the speed of light.

The following are quotes taken from Tom Van Flandern's paper[6]

" …. The earth accelerates towards a point 20 arc seconds in front of the visible sun ... In other words, the acceleration now is towards the true, instantaneous direction of the Sun now, …"

" … Why do total eclipses of the Sun by the Moon reach maximum eclipse 40 seconds before the Sun and Moon's gravitational forces align ? … "

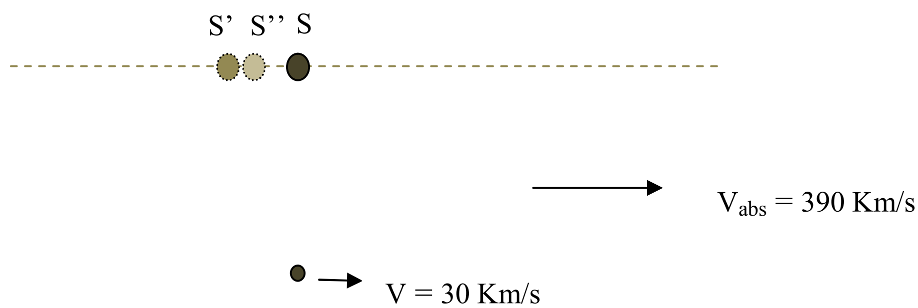
The new interpretation of absolute motion proposed in this paper turns these observations into evidences showing that gravity 'propagates' at the speed of light. Note that, as explained already, there is only apparent propagation. The effect is as if there was gravity propagation at the speed of light, but there is no actual propagation in static fields.



Assume that the Sun and the Earth move absolutely as shown above, with no relative motion between them. The amount of apparent change of the Sun's position is determined by the absolute velocity (390 km/s) , the Earth-Sun distance and the speed of light. The light rays are coming from the direction of the apparent Sun (S').

Assume now that we measure the direction of Sun's gravity at the same time and it also pointed towards the apparent Sun (S'). What do we conclude ? We conclude that the speed of gravity is equal to the speed of light.

In the above argument, we assumed that the Earth is not moving relative to the Sun. Now we consider the Earth's motion relative to the Sun (30 km/s) .



The sun will now appear to be at position S'', due to earth's *relative* motion. However, this does not mean that the light rays are coming from the direction of S''; it is only an illusion. The light rays still come from the direction S'. It appears to a person running in the rain as if the rain droplets are falling at an angle. We know that this is only an illusion.

The mistake in Van Flandern's argument is that it considered point S' to be the true, instantaneous position of the Sun. Such mistake is committed in all arguments based on the principle of relativity, which denies the absolute motion of the solar system in space (390 Km/s). The position of the Sun at the instant of light emission is S. We consider this also to be the instantaneous, true position of the sun because the Earth and the Sun are moving together. Such an interpretation is distinct from the ether or classical absolute space theory. This is an application of the fusion of the ether and emission theories to gravitation.

" …. The earth accelerates towards a point 20 arc seconds in front of the visible sun ... In other words, the acceleration now is towards the true, instantaneous direction of the Sun now, …"

This observation shows that gravity is also directed towards S', showing that the speed of gravity is equal to the speed of light. One may ask : why does gravity also not act towards S'' then ? We have already said that, even for light, the effect of observers motion on light is only an illusion and not real. If one measured the electric fields of the light waves, they would be perpendicular to the line connecting the Earth with point S', and not to the line connecting the Earth with point S''. The motion of the observer relative to the Sun does not change the directions of the electric and gravitational force vectors.

The absolute motion of a light source has real effect. The effect of (absolute or relative) motion of an observer, however, is only an illusion.

Thus, if the 'speed' of gravity was different from the speed of light, the Earth would accelerate towards a point <u>different from</u> ' a point 20 arc seconds in front of the visible sun'.

Does a Gravitational Field Continuously Regenerate, or is it " Frozen" (Tom Van Flandern [6])

A confusion may arise when talking about the speed of gravitational and electrostatic fields, because there is no changing field and hence no wave propagation implied by Maxwell's equations. There are problems with this view, however, as argued by Tom Van Flandern.

" It seems impossible to conceive of a static field with literally no moving parts as capable to transferring momentm. …"

" …. The propagation speed of the entities carrying momentum give rise to aberration …"

" So are gravitational fields for a rigid, stationary source frozen, or continuously regenerated ? Causality seems to require the latter. If such fields are frozen, then what is the mechanism for updating them as the source moves, even linearly ? …"

The word 'frozen' is not an appropriate word for fields. A more appropriate word is 'instantaneous propagation'.

Even though observations show that the speed of gravity is equal to the speed of light (with the new interpretation already introduced), it is not clear what is 'speed' as applied to gravity. If gravity is a static field, then what is propagating?

This is not the case for electrostatic fields. Experiments[5] show that the propagation speed of Coulomb's force is infinite.

Conclusion

The real nature of the speed of light has remained a mystery ever since the historical Michelson-Morley experiment. There are numerous and divergent empirical evidences that have accumulated during the last century which have defied any natural and complete explanation by the known theories of light speed. The new theory proposed in this paper can explain all or most of the experiments and phenomena related to the speed of light. A few pieces of idea(s) have been proposed that can resolve many of the contradictions. 1. The speed of light is constant relative to the apparent source. The effect of absolute motion of a light source is to create an apparent change of its past position 2. The phase velocity of light is always constant, where as the group velocity is variable 3. Massive Cosmic objects 'fix' the space in their vicinity.
The confusions in physics of the last century were the cost of denying the validity of absolute motion.

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

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