A novel solution to the century old light speed paradox; divorce of the light postulate from special relativity; relativity of electromagnetic fields.

Predicts transverse Doppler effect and stellar aberration in both reference frames

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Abstract

From elementary algebra and common sense, we know that $C + V \neq C$, given that V is different from zero. Yet we have lived with one of the daunting paradoxes in the history of science "$C + V = C$", for more than one hundred years, where C is the speed of light and V is the velocity of an observer. All known experiments, including those performed to disprove it, confirmed it. Over a period of one hundred years, the scientific community has exhausted on three theories to define and resolve this paradox: the ether theory, the emission theory and special relativity. The former two have long been rejected decisively. The majority of the scientific community assumes that this paradox has already been resolved by special relativity. Yet scientists outside the mainstream thought have always realized that relativity is not a true theory of nature, and thus looking back to the long rejected ether and emission theories. Special relativity has remained counterintuitive since its inception and has resulted in many unsolved paradoxes, creating many more paradoxes than it solved. The scientific community has been stuck in relativity for over a century because of three factors: 1. The lack of any alternative theory that could explain the long standing problems of reference frames and solve the light speed paradox and the apparent success of special relativity in resolving these paradoxes 2. The subtly unquestioned (yet false) bond between special relativity and the light postulate, which made relativity undefeatable 3. And the firm experimental foundation of the light (the second) postulate. Because of the perceived (and stated) link between the light postulate and special relativity, most attempts to disprove relativity focused on disproving the light postulate, and hence failed. No one ever thought of the possibility that the light

postulate could be correct and relativity wrong. Therefore, a scientist who disliked Einstein's relativity theory automatically rejected the light postulate. This paper introduces a new way to resolve the light speed paradox and hence divorcing Einstein's light postulate from his theory of special relativity. The light wave contracts towards (or expands away from) the source depending on the relative velocity V of the source and the observer so that the speed of light is always equal to C relative to the observer. The apparent velocity (C') of light relative to the source changes so that the speed of light relative to the observer is always equal to C, i.e. $C = C' \pm V$ (vector sum/difference). This theory is self evident as it is an immediate consequence of the well established facts: constancy of the speed of light and Doppler effect of light, in which *wavelength changes and speed of light remains constant*.

Introduction

From elementary algebra we know that $C + V \neq C$, given that V is different from zero. Yet we have lived with the paradox "$C + V = C$" for more than one hundred years, where C is the speed of light and V is the velocity of an observer. Many known attempts and experiments have been made by scientists to disprove this equality; yet all experiments, including those performed by themselves, confirmed it. Not a single experiment so far showed any dependence of the speed of light on the speed of its source.

Over a period of more than one hundred years, the scientific community has exhausted on three theories to resolve this paradox: the ether theory, the emission theory and special relativity. The former two have long been rejected decisively, but many scientists today are looking back to them because Einstein's relativity has remained counterintuitive and has been a source of many unsolved paradoxes. Despite this, relativity has remained a mainstream science to this date because the majority of the scientific community assumes that the light paradox has already been resolved by special relativity.

Many attempts and experiments that had been performed to disprove relativity had failed to disprove it. Why did they fail?
In the next sections the reasons for these failures will be discussed and a new theory that will resolve the light paradox and hence divorce the light postulate from special relativity will be presented.

Discussion

As we know, the whole story of relativity theory begins with the light speed paradox, "relative to what is the speed of light equal to C ? ".
Einstein's genius provided a radical and correct proposition, the light postulate:
" the speed of light must be the same for all observers"
With this hypothesis, Einstein was able to include (the invariance of) the speed of light into Galileo's invariance principle, the invariance of the speed of light in all inertial reference frames.
Then, logically, he would ask:
" how can the speed of light be the same for all observers ? "
To this problem, his hypothesis was, inappropriately:
"space and time must be relative", then jumping to
"not only space and time but also mass must be relative"
The last two hypotheses, however, were inappropriate and have created many more paradoxes than they solved.
Therefore, the theory we now know as special relativity is a bond between the light postulate and the speculation of relativity of mass, length and time.

The scientific community has been stuck in Einstein's relativity because of two factors:

1. There has been no alternative theory that could explain the long standing problems of reference frames and solve the light speed paradox
2. Einstein's relativity was bonded to his postulate of constancy of the speed of light, which has been confirmed repeatedly by the many well known experiments. It was this false (but subtly unquestioned) bond between the two that made Einstein's relativity undefeatable.

The light postulate has always been perceived as an inseparable part of special relativity theory because

1. Special relativity (relativity of mass, length and time) was historically an immediate consequence of the light postulate (and of course of the first postulate). It has always been perceived to be its logical consequence also.
2. Special relativity solved the existing paradoxes with apparent success
3. Both were publicized in a single paper, simultaneously, and by the same person Einstein.

Therefore, no one thought of the possibility that part of Einstein's proposal could be right (the light postulate) and part of it wrong (relativity of mass, length and time). Proponents of relativity accepted both with no attention to the internal consistency of the theory and 'anti-relativists' rejected both without considering the possibility that the light postulate could be correct, despite the many experiments confirming it.
Thus no one questioned the internal link within the theory.
(One can guess that if the light postulate was proposed earlier than special relativity, perhaps by another scientist other than Einstein, this link would have been subjected to examination and special relativity might have been rejected early. But proposal of the light postulate in isolation without stating its implication might be thought of as unrealistic)

Once Einstein proposed his radical special relativity theory (as consisting of the two postulates and the relativity of mass, length and time), the theory diverted the attention of the physics community to itself and it became the subject of physics, whether by acceptance or by rejection.
Before Einstein's proposal the physics community worked on the puzzle:
" if the speed of light is C (as in Maxwell's equation), relative to what is it constant "
Once Einstein proposed his relativity theory (the two postulates and relativity of mass, length and time) as a solution to this puzzle and the existing problem of reference frames, the majority of the physics community never raised this puzzle again. This was because, for those who accepted special relativity, the light postulate solved it (of course correctly), but those who rejected special relativity rather worked on how relativity could be wrong or on the already existing emission or the ether theories. They rejected the light postulate, not only because it was counterintuitive but mainly because of its immediate perceived (and stated) implication: special relativity. Thus the link between the light postulate and special relativity was shielded from inspection in a subtle manner, making it unlikely for anyone to think of divorcing the two.

If the 'anti-relativist' physics community restarted working on the original light speed puzzle (" relative to what is the speed of light constant ?"), by rejecting all of Einstein's proposals, they would rediscover the light postulate already proposed by Einstein, but then this would be perceived as the confirmation of special relativity because the light postulate and special relativity were always perceived as one. The whole scenario was such that it was almost unlikely to accept the light postulate and reject relativity, or to reject the whole theory (the two postulates and special relativity) and restart working on the original light speed puzzle and make any progress, because of the trap of relativity. Thus Einstein's genius provided us his

correct and crucial light speed postulate by which we were bound to accept his wrong relativity theory for a whole century.
Thus most of the attempts to disprove special relativity focused on disproving the light postulate. But the firm experimental foundation of the light postulate made attack on relativity difficult. Therefore, all those attempts that were made to disprove relativity by rejecting the light postulate followed the wrong strategy. The light postulate has been the single crucial part of relativity which kept the whole relativity theory (both special and general) in science for over a century.

Therefore, it seems that, after Einstein's proposal the course of physics during the last century was almost unavoidable.

Einstein's relativity is a false theory married to his correct light speed postulate and his correct notion of motion and space. Although the principle of relativity was introduced by Galileo, Einstein made it even more clear by explicitly denying the existence of an objective absolute space or the ether and by proposing the light postulate.

I was one of those who disliked Einstein's relativity because of its counter intuitive nature. I have been swinging between the three theories (with emission theory by far the most favoured and relativity by far the least), shifting from one theory to the other as I always hit the wall in one theory. I followed the same wrong strategy of attacking the light speed postulate and finally gave up, accepting the constancy of the speed of light after a considerable resistance and after reading the many historical experiments which always confirmed it , with the results of those known experiments giving me repeated blows on my resistance to the light postulate. After a break of despair, I came across an intuitive idea that finally led me to develop the theory presented in this paper and to follow the strategy of divorcing the light speed postulate from the theory of relativity of length, time and mass.

Therefore, accepting of Einstein's light speed postulate AND rejecting special relativity were the crucial steps in the development of the new theory proposed in this paper. The crucial question was : *how else* can the constancy of the speed of light be explained ?

The new solution

The solution proposed in this paper appears to be counterintuitive at first, but it is an immediate consequence of well established facts and principles in physics: constancy of the speed of light and Doppler effect of light, in which *speed of light remains constant and wave length changes.*

We start by accepting Einstein's light postulate as the correct solution to the light speed paradox.

The speed of light is the same for all observers moving relative to each other.

Then how else can the constancy of the speed of light be explained? How can two observers moving relative to each other measure the same speed of the *same* light beam?

While working on this puzzle, I got an intuitive hint which was key to arrive at the new solution to the paradox : *no two observers moving relative to each other observe the same beam in the same way.*

So we see a subtle wrong assumption in the above question:

' . . . two observers . . . *same* light beam '.

If the two observers observe the same light beam differently, there may be some possibility to solve the paradox. Observing the same speed of the same beam in the same way by two relatively moving observers is counterintuitive.

At least we can intuitively think that the wave will appear to be either spread over a larger space or be compressed into a smaller space as we move away or move towards the source respectively. We know this from Doppler effect *of light*. There is a fundamental difference between Doppler effect of sound and Doppler effect of light. In the case of sound speed changes while wavelength remains constant (for a receiver moving towards the source), where as for light *speed remains constant while wavelength changes.*

Now it is this idea that we have to develop.

Starting from this idea how can we solve the paradox? After repeated trials I arrived at the following simple solution.

Imagine (Fig.1) a stationary light source S emitting light pulses, and two observers, observer O and observer P at the same point (X=O=P) on the X-axis at $t = 0$.

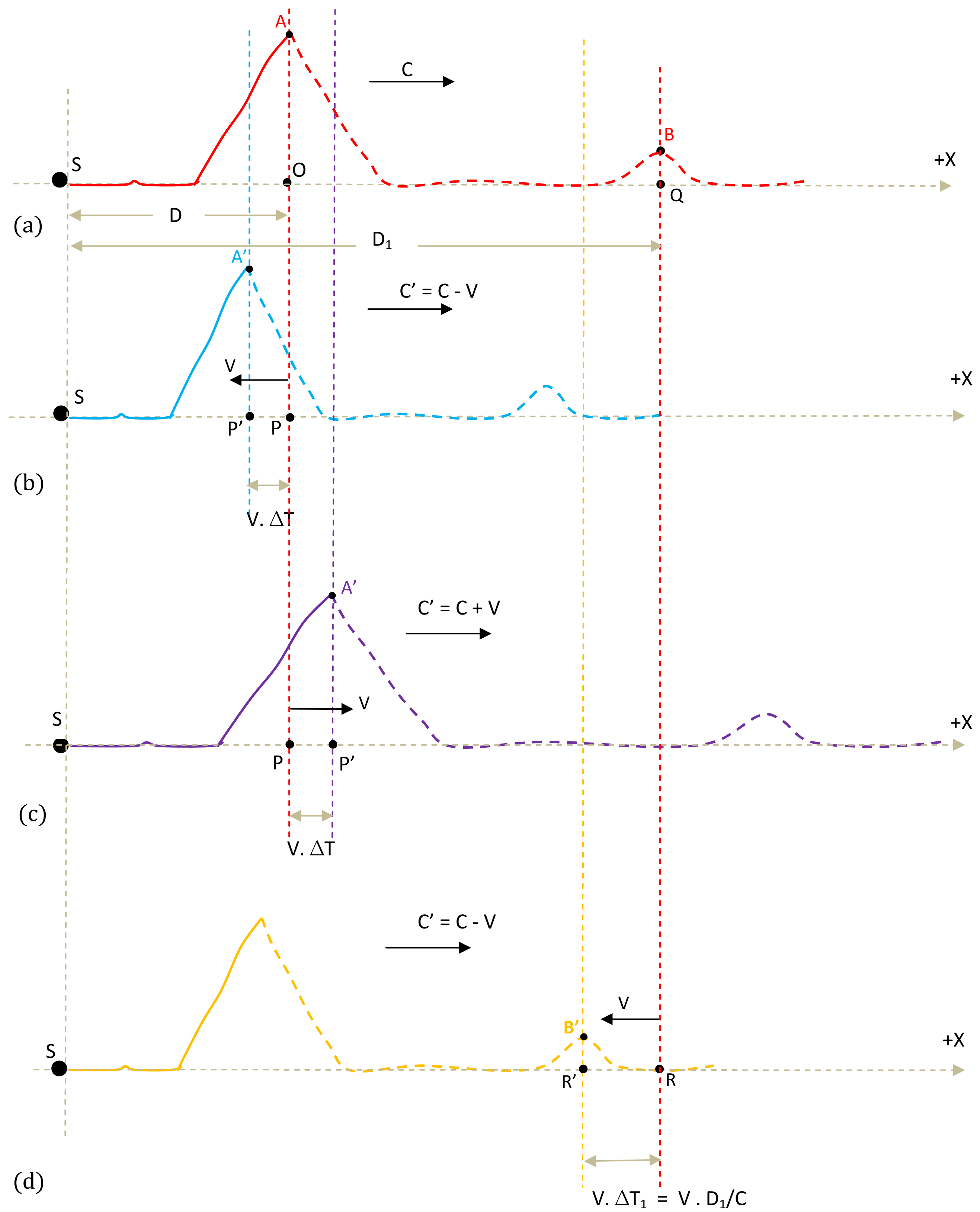
Both points O and P are the same point on the X-axis (they are named differently only for convenience). Suppose that at this instant (t=0) observer O is at rest relative to the source and observer P is moving with velocity V towards the source.
The new theory proposed in this paper states that the two observers O and P will not observe the same light beam in the same way. Observer O observes the red wave and observer P observes the blue spatially compressed wave.

The red diagram shown is the spatial distribution of the wave at an instant of time as observed by the stationary observer O (i. e the "snapshot" of the wave in space as taken by the stationary observer O, at an instant of time), the blue diagram is the wave as observed by observer P as he/she is moving towards the source with velocity V and the purple diagram is the wave as observed by observer P as he is moving away from the source with velocity V. The orange wave is the wave as observed by an observer R at point R (X=R=Q) moving towards the source with velocity V1.

We can obtain the diagram of the blue wave by compressing the red wave towards the source.

Therefore, the wave just gets compressed *back to its source*, as observed by the moving observer P. Thus, peak point A on the red wave for observer O corresponds to peak point A' on the blue wave for observer P. At t = 0, both observers O and P are at the same point (X=O=P) on the x-axis, but observer P is moving with velocity V to the left at this instant. Suppose that the light (EM) source is emitting the peak point A on the red wave at t = 0 as observed by observer O. After a delay of time ∆T, the peak point A will arrive at point X=O and be observed by observer O. During the same interval of time (∆T) that the pulse travels from the source to point O (observer O), observer P would have advanced to the left by an amount (V. ∆T), to meet the corresponding peak point A' on the blue wave.

After a delay of ∆T (at t = ∆T), observer O (at X=O) observes peak point A and observer P (at X=P') observes the corresponding point A' . Thus points A and A' are observed by observer O and observer P respectively, ***simultaneously***! Even though observer O and observer P are at different locations, they observe points A and A' simultaneously. (later it will be shown that the speed of the blue wave relative to the source is C – V, as shown in Fig.1).
Although slightly counter intuitive, this should not cause us much trouble because the two observers are observing different forms of the same wave anyway.



A
C
B
S
O
+X
Q
(a)
D
D1
A'
C' = C - V
V
S
+X
P'
P
(b)
V. ΔT
A'
C' = C + V
V
S
+X
P
P'
(c)
V. ΔT
C' = C - V
V
B'
S
+X
R'
R
(d)
V. ΔT1 = V . D1/C

Fig. 1

Therefore, **even if P is moving towards the source with velocity V, he/she will not observe peak point A' earlier than O observes the corresponding peak point A !** Observer O and observer P observe peak points A and A' respectively, at different points X=O and X=P ' respectively, **simultaneously !** ***Thus both observers observe the velocity of light to be the same!*** (The proof for this will be shown later). This satisfies the requirement of the light postulate.

The amount by which the wave gets compressed back to the source (as observed by observer P) depends on the velocity V of the observer P and on the delay ΔT, and is equal to (V. ΔT). Note that ΔT always means the time it takes a point on the wave to travel from the source to the observer.

If different observers are moving towards the source with different velocities, each moving observer observes different (differently compressed) forms of the red wave. Here the red wave is the wave an observer at rest relative to the source observes and this wave is always the wave we compress (or expand) to obtain what any moving observer observers. Each moving observer observes 'his/her' wave which depends on his/her velocity. For example, assume a stationary observer Q at X=Q (Fig. 1a) and another observer R at the same location (X=R=Q) moving with some velocity V towards the source at point X=R (Fig.1d), at some instant of time t_o. Observer Q observes the red wave and observer R observes the orange wave. What observer R observes after a delay of time ΔT_1 (at $t = t_o + \Delta T_1$), at X=R', can be obtained, as before, by calculating V. ΔT_1 and compressing the red wave back towards the source by this amount, where ΔT_1 is the time delay of point B on the red wave to travel from the source to the stationary observer Q. Thus at the same instant that observer Q observes point B (at X=Q), observer R observes point B' (at X=R').

To clarify the discussions made so far in a different approach, next we determine what an observer P moving with velocity V towards the source, at distance D1 from the source, at an instant of time, will observe at that instant of time:

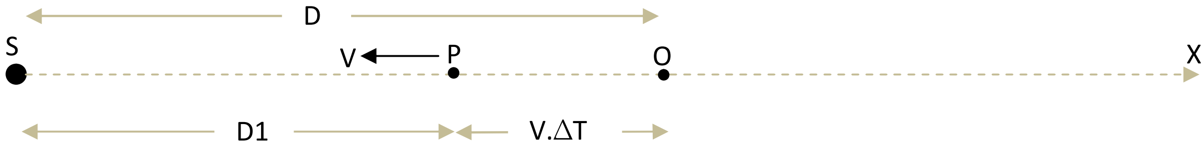


Fig.2

So the problem is to determine the distance D of a stationary observer O who is observing the same corresponding point on the red wave as observer P is observing on the blue wave, at that instant of time. From Fig.2 we can see that

$$D = D1 + V.\Delta T, \quad \text{but} \quad D = C.\Delta T, \quad \text{so}$$
$$C.\Delta T = D1 + V.\Delta T$$

From the above equation ΔT will be determined as:

$$\Delta T = \frac{D1}{C-V}$$

Therefore, distance D of the corresponding stationary observer O from the source will be:

$$D = C.\Delta T = \left(\frac{C}{C-V}\right).D1$$

Therefore, observer P at that instant of time will observe what a stationary observer O at distance D from the source is observing at that instant of time.

<u>Proof that observers O and P measure the same speed of light</u>

So far we postulated that observer O and observer P will observe corresponding points on the red and blue waves respectively simultaneously. Now we show how this leads to the conclusion that both observers observe the same speed of light.

Since observer O is stationary relative to the source, obviously he measures the speed of the red wave to be equal to C. Next we will determine what speed of the blue wave the moving observer P will observe (measure).

Peak points A and A' (Fig.1) arrive at points X=O and X= P' simultaneously, at $t = \Delta T$.

Thus the speed of the red wave relative to the source will be :

$$C = \frac{D}{\Delta T}$$

And the speed of the blue wave relative to the source will be:

$$C' = \frac{D - V\Delta T}{\Delta T} = \frac{D}{\Delta T} - \frac{V\Delta T}{\Delta T} = C - V$$

Therefore, the speed of the blue wave relative to the source is: $C' = C - V$

Now the relative speed between the blue wave and observer P will be determined as:

$$(C - V) + V = C$$

(the two velocities add because they are opposite in direction)

Therefore we have shown that even if observer P is moving towards the source with velocity V, he will still observe the velocity of the (blue) wave to be equal to C.

We see that the speed of the blue wave relative to the source decreases from C by the same amount of the velocity V of the observer P so that the relative velocity between the moving observer P and the blue wave is always equal to C.
This can be restated as:

Velocity of the (blue) wave relative to the source (C') +
Velocity of the observer relative to the source (V) = constant = C
(for an observer moving towards the source)

For example if the velocity of the observer is 0.9C towards the source, the velocity of the wave relative to the source will be equal to 0.1C .

Observer moving away from the source
All the discussions made so far assumed an observer moving towards the source. We can use the same basic approach to understand the case of an observer moving away from the source. Here we will not repeat every discussion made for the case of an observer moving towards the source; we discuss only on some aspects.
For the case of an observer receding away from the source (Fig. 1c), the wave just expands spatially away from the source (i. e with its end point at the source fixed), as observed by the moving observer P. In this case, as observer P is moving to the right with velocity V, in the same direction as the wave, he observes the purple wave (an expanded form of the red wave that the stationary observer O is observing).

As before, assume that at t=0 both observers O and P are at the same location (X=O=P), but observer P is moving away from the source with velocity V at this instant of time (t = 0). Suppose that at the same time t = 0 the source radiates the peak point A on the red wave as observed by observer O. The peak point A will be observed by O after some time delay ΔT. During this time, observer P will have advanced to the right by a distance of $(V. \Delta T)$ (Fig. 1c), where he/she meets (observes) the corresponding point A' on the purple wave.
Therefore, as before, although P is moving in the same direction as the wave, ***he will not observe peak point A' later than observer O observes peak point A, and both observe points A and A' respectively, simultaneously***. In this case also ***observers O and P observe the same speed of light.***

In this case of an observer moving away from the source, the speed of the purple wave (Fig.1) increases from C by the same amount of the velocity V of the observer, so that the relative speed between the purple wave and the observer is always equal to C, irrespective of the speed of the observer.

This can be restated as:

Velocity of the (purple) wave relative to the source (C') **−**
Velocity of the observer relative to the source (V)= constant = C

For example, if the observer is receding away from the source with velocity V=100C, then velocity of the purple wave relative to the source will be C' = 101C, so that the relative velocity between the observer and the purple wave will be: 101C− 100C = C.

The validity of the new theory

Expansion or contraction of the wave is not a mere speculation but is a direct consequence of the principle of relativity and our existing knowledge. Suppose that an observer is moving with velocity V towards a light source. The contraction of the wave towards the source for that observer becomes self evident from two well established principles and facts :

1. the speed of light relative to that observer is a constant C, irrespective of his velocity V
2. the wave length of the light changes (decreases) due to Doppler effect.

If an observer moves towards a stationary sound source, the wave length remains constant for that observer. But the speed of sound increases and will be $C+ V$, where C is the speed of sound relative to the medium (air) and V is the speed of the observer relative to the air. There will not be spatial contraction of the sound wave because the wavelength doesn't change. In the case of an observer moving towards a light source, since $C = f.\lambda$, the constancy of the speed of light requires a change in the wavelength of light, which has been confirmed experimentally [4], and this is due to contraction of the wave. To make this more clear, assume that there are n wavelengths (cycles) of the light wave in the space between a stationary observer and a light source, at an instant of time. Imagine another observer who is exactly at the position of the stationary observer at that instant of time, but moving towards the source with some velocity. Now, the wave length will be shorter for the moving observer. So all the cycles in the space between the source and the observer will have shorter wave lengths for the moving observer. Therefore, the number of cycles in the space between the moving observer (who is at the same point as the stationary observer, at this instant) will be greater than n. And hence contraction of the wave ! This is self evident!

Relativity of Electromagnetic Waves theory immediately follows from:

Doppler effect of light (in which speed remains constant while wave length changes)

AND

The constancy of the speed of light

Doppler effect of light and constancy of light are well established facts in physics, hence relativity of EM waves becomes self evident.

Some consequences of the new theory

According to the new theory proposed in this paper, there is no theoretical velocity limit to moving objects or observers. This is clearly in contradiction with special relativity. Thus theoretically it is possible to move at a velocity greater than the velocity of light. However, it is impossible to catch up with light because the relative velocity between any observer and light is always equal to C. The velocity of the light relative to the source (for that particular observer) will always be C+V, so that he will never catch up with the light beam. The apparent velocity of light *relative to the source* ranges from zero (for an observer moving towards the source with velocity C) to infinity (for an observer moving away from the source at infinite speed). However, remember that *the relative velocity between the observer and light* is always equal to C.

Doppler wavelength and frequency shift

Here we analyse the consequence of the new theory on Doppler shift (Fig.3).

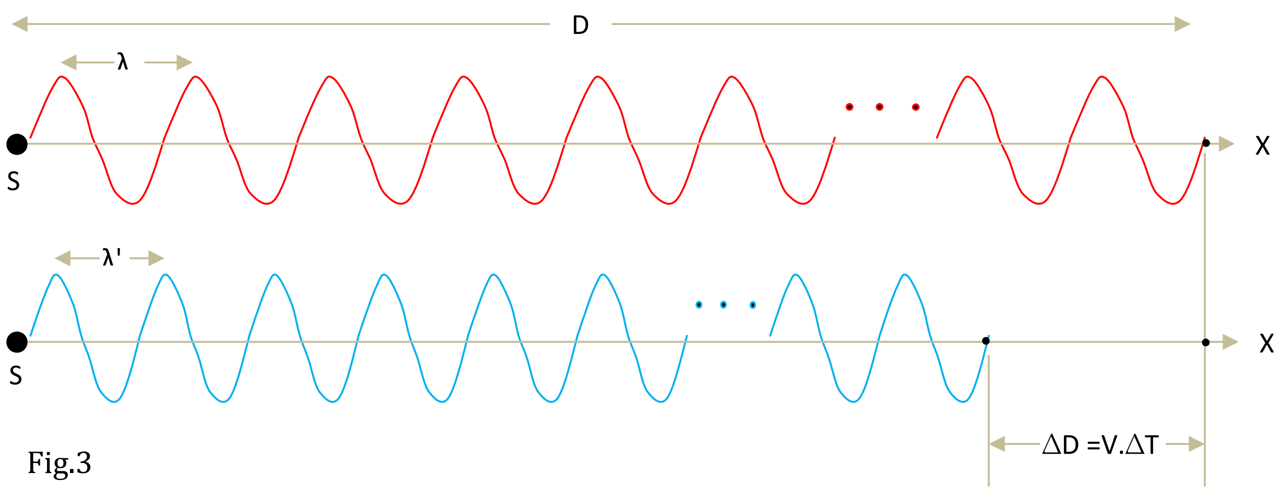


Fig.3

Suppose that the red wave is the wave as observed by a stationary observer and the blue wave is the wave as observed by an observer moving towards the source with velocity V. Therefore, the moving observer observes the blue wave, which is the compressed form of the red wave by an amount V. ∆T . Assume that there are 'n' wavelengths (cycles) of the red wave in the space between the source and the stationary observer, at an instant of time ; therefore, there will also be 'n' wavelengths of the blue wave, in the space between the source and the moving observer.

$$\Delta D = V.\Delta T, \quad \text{but} \quad \Delta D = n\,.\,\Delta\lambda\,, \quad \text{and} \quad \Delta T = \frac{D}{C} \quad \text{and} \quad D = n\,.\,\lambda$$

From the above we get $\Delta\lambda$ as:

$$\Delta\lambda = \left(\frac{V}{C}\right).\lambda \quad , \quad \text{where} \quad \Delta\lambda = \lambda - \lambda'$$

And λ' will be determined as follows:

$$\lambda' = \lambda - \Delta\lambda = \lambda - \left(\frac{V}{C}\right).\lambda = \left(\frac{C-V}{C}\right).\lambda$$

To determine f' in terms of f

$$f = \frac{C}{\lambda} \quad \text{and} \quad f' = \frac{C}{\lambda'}$$

$$f' = \frac{C}{\lambda'} = \frac{C}{\lambda\left(\frac{C-V}{C}\right)} = \frac{\frac{C}{\lambda}}{\frac{C-V}{C}} = \left(\frac{C}{C-V}\right).f$$

From the above,

$$\Delta f = f' - f = \left(\frac{V}{C-V}\right).f$$

For the case of an observer moving away from the source with velocity V, V will be substituted as negative in the above equations.

Transverse Doppler effect

In the discussions so far, the special case of an observer moving directly towards or away from a light source has been considered. In this section the case of an observer moving with velocity V relative to light source in the lateral direction will be considered (Fig.4).

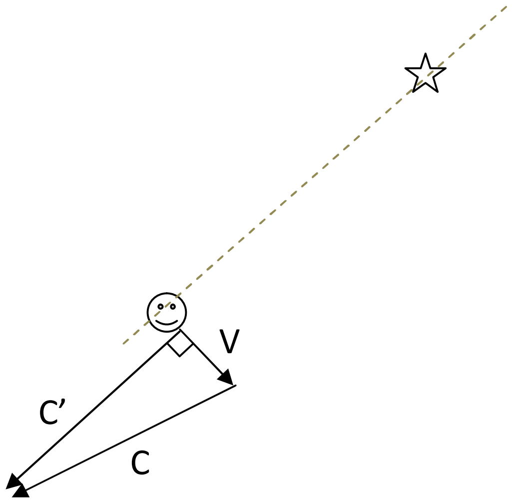


Fig.4

The apparent speed of light relative to the source (C') will be such that the speed of light relative to the observer is always equal to C.

The speed of light relative to the observer (C) = the apparent speed of light relative to the source (C') – the speed of the observer relative to the source (V)

$$C = C' - V \qquad \textit{(Vector difference)}$$

but $C'^2 + V^2 = C^2$

Therefore,

$$C' = (C^2 - V^2)^{1/2}$$

The apparent speed of light relative to the source (C') will decrease to be less than C so that the speed of light relative to the observer is always equal to C. This means that the light beam will be compressed back to the source, hence transverse Doppler effect.

From the previous section

$\Delta f = f' - f = \left(\frac{V}{C-V}\right) \cdot f$ (for an observer moving directly towards the source)

Since (from the previous section), for an observer moving towards the source,

$C' = C - V \quad \Rightarrow \quad V = C - C'$

Therefore,

$\Delta f = (V/C').f = (C/C' - 1).f$

Then we will derive the transverse Doppler frequency shift by substituting

$C' = (C^2 - V^2)^{1/2}$

in the above equation.

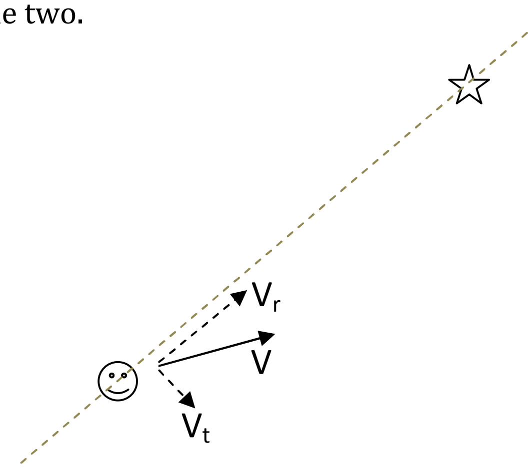
Therefore, the frequency shift due to transverse Doppler effect will be

$$\Delta f = [(C/(C^2 - V^2)^{1/2}) - 1] . f$$

where V is the transverse velocity of the observer relative to the source.

Note that, from the above equation, Δf is always positive, i. e the transverse (lateral) velocity of an observer always results in a positive Doppler frequency shift, i. e apparent increase of observed frequency .

For the general case of an observer moving at an arbitrary angle relative to the source, the frequency shifts due to longitudinal and lateral Doppler effects will be computed independently and the total Doppler frequency shift will be the sum (or difference) of the two.



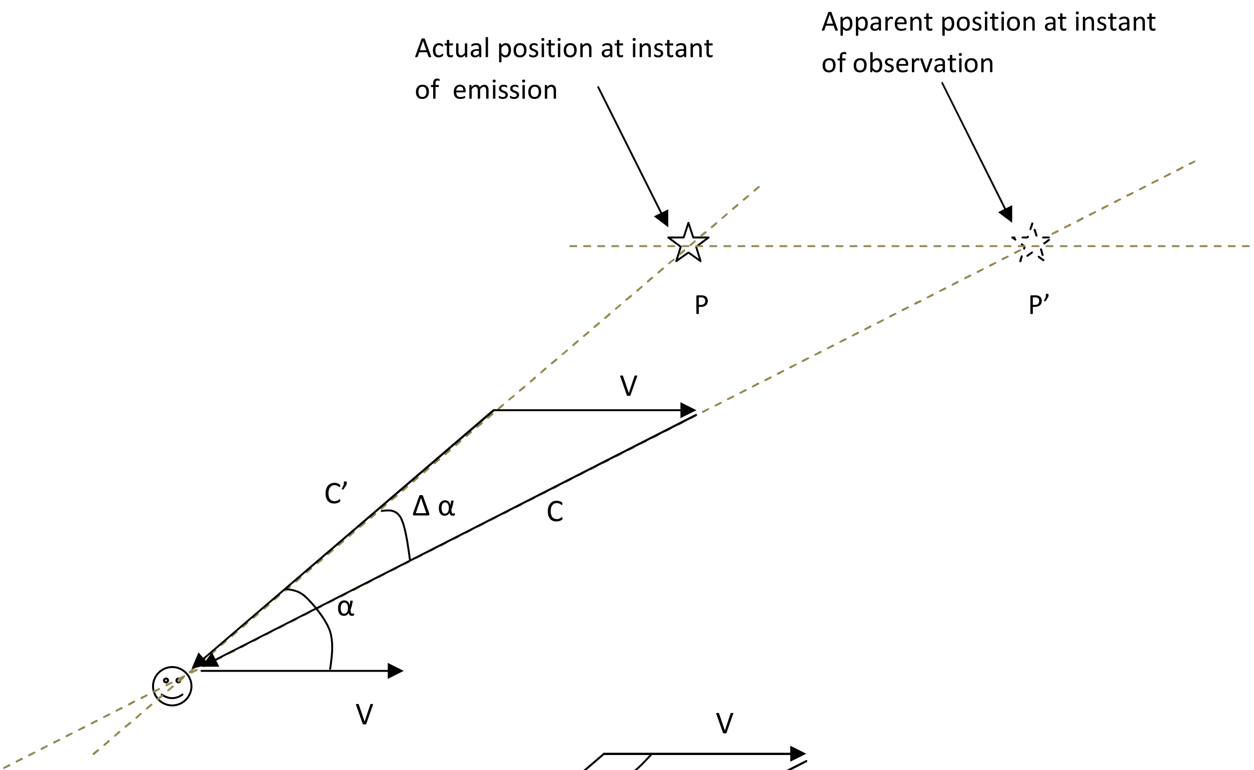
We have analyzed transverse Doppler effect in the reference frame of the star. The same result will be obtained in the reference frame of the observer also.

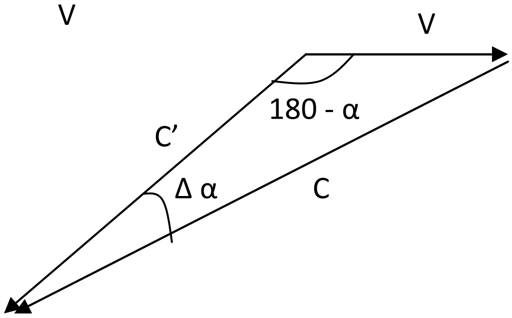
Stellar Aberration

In the reference frame of the star

The velocity (C) of light relative to the observer is the vector difference of the velocity (V) of the observer and the apparent velocity (C') of light relative to the source.

$$C' - V = C \text{ (vector difference)}$$, in the reference frame of the source





From the above triangle:

$$\sin \Delta\alpha / V = \sin (180 - \alpha) / C$$

For small angle $\Delta\alpha$

$$\sin \Delta\alpha = \Delta\alpha$$

Hence

$$\Delta\alpha / V = \sin\alpha / C$$

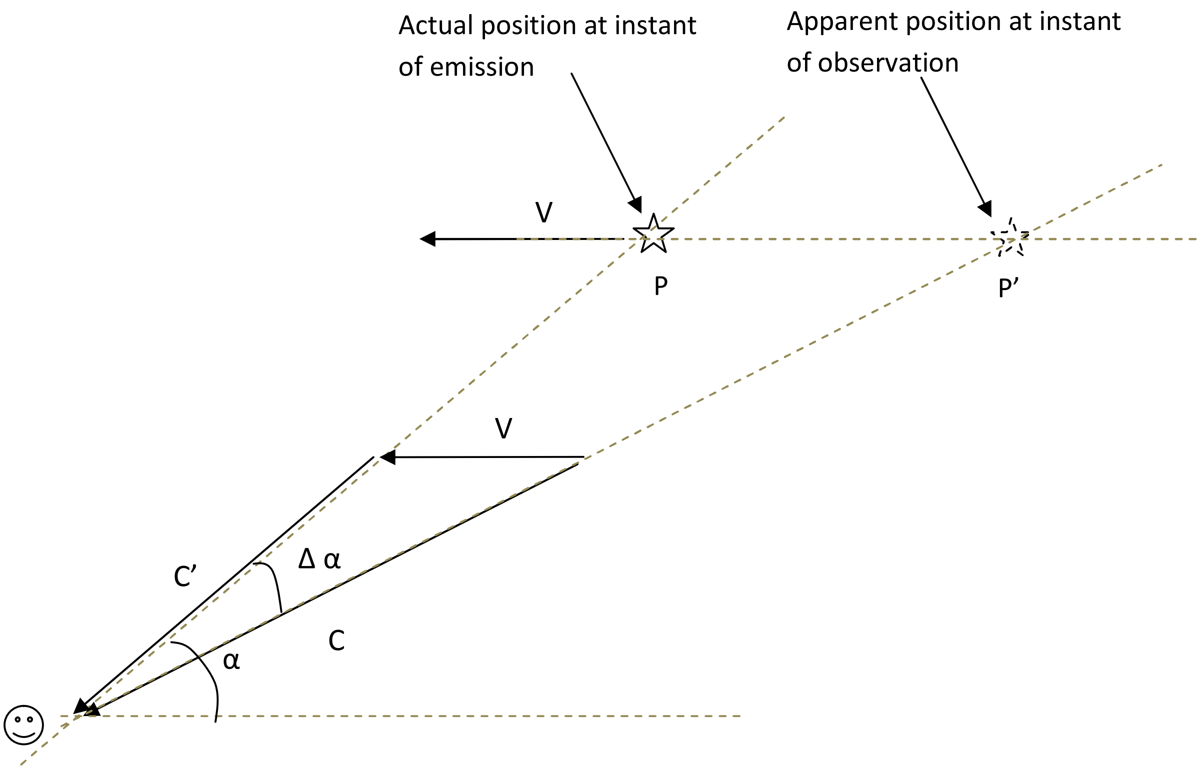
$$\Delta\alpha = (V/C) \sin\alpha$$, which is the same well known equation for stellar aberration.

Assume that the star is one light year away from the observer. Therefore, the observer is always observing light which was emitted one year ago. Assume that the star was at point P at the moment of emission (one year ago). If the observer is not moving relative to the star at the moment of observation, he sees the star to be at the same point P. However, if the observer is moving relative to the star at the moment of observation, the star appears to him to be at point P'. It appears to him as if the star emitted light from point P' one year ago.

<u>In the reference frame of the observer</u>

The velocity (C) of light relative to the observer is the vector sum of the velocity (V) of the star and the apparent velocity (C') of light relative to the source.

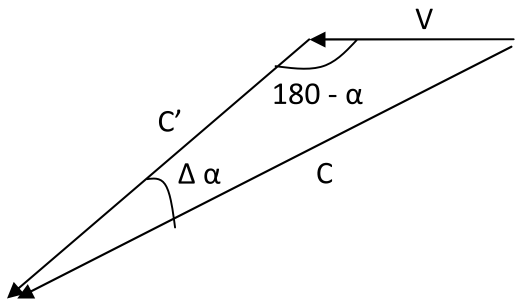
C′ + V = C (vector sum), in the reference frame of the observer.



Assume that the star is one light year away from the observer.
Therefore, the observer is always observing light which was emitted one year ago.
Assume that the star was at point P at the moment of emission (one year ago).
If the star was not moving relative to the observer at the moment of emission (one year ago), the observer would see the star to be at the same point P at the moment of observation. The observer knows that the star was at point P one year ago.
If the star was moving relative to the observer at the moment of emission (one year

ago), however, the star would appear to be at point P' at the moment of observation. It appears to the observer as if the star emitted light from point P' one year ago.

The derivation for the apparent change in the angular position of the star is the same as before.



From the above triangle:

$$\sin \Delta \alpha / V = \sin (180 - \alpha) / C$$

For small angle $\Delta \alpha$, $\sin \Delta \alpha = \Delta \alpha$

Hence

$$\Delta \alpha / V = \sin \alpha / C \quad \Rightarrow \quad \Delta \alpha = (V/C) \sin \alpha$$

Relativity of EM Waves theory with respect to a moving source, principle of relativity, and existing postulates of light

So far we assumed a stationary source with an observer moving relative to the source. Since, in the principle of relativity, the motions of the source and the observer are equivalent (either can be considered stationary), the new theory should be clarified from the perspective of a moving source. It should also be explained with respect to existing postulates of light and with respect to the principle of relativity (Galilean principle of invariance and Einstein's notion of motion and (empty) space.

The constancy of the speed of light for all observers, which is one of the two postulates of Special Relativity (SR) theory, has a firm experimental and intuitive base. It follows directly from Einstein's notion that space is empty (absolute space or ether doesn't exist) and the peculiar nature of light wave propagating in vacuum. It seems unintuitive only when one is instinctively used to thinking of space as absolute.

Three other known postulates of light exist. According to the ballistic theory of light proposed by Ritz, the speed of light in vacuum is a constant C with respective to the source at the time of emission [1]. This theory is perhaps the most straight forward explanation for the null result of Michelson-Morley experiment (MMX). This postulate, however, has been rejected as it is not in agreement with the experimentally established fact that the speed of light is independent of the speed of its source. It doesn't predict the Sagnac effect also. The ether theory has been ruled out by lack of any experimental evidence supporting it, beginning from the null result of MMX. Another postulate of light is the one proposed by Spencer and Moon. According to this postulate, the center of the spherical wave fronts is always at the source no matter how the source moves [1]. This theory can also explain the MMX null result, but predicts that the speed of light depends on the speed of the source. Moreover, the motion (acceleration) of a source is instantaneously 'felt' at all points (distances) relative to the source, which is not an intuitively sound idea.

Therefore, Einstein's light postulate is the preferred postulate of the three. However, in its current form, this postulate requires length contraction and time dilation hypothesis. Moreover, it doesn't predict stellar aberration in the reference frame of the earth [1].

According to SR, the center of a spherical wave front is at the 'point where the source was' at the time of emission. *This is why SR doesn't predict stellar aberration in the reference frame of the earth.* This assumption has to be investigated carefully if it is in accordance with the principle of relativity itself. If it is not, then this would be a self contradiction in the theory. If the center of the wave fronts does not move with the source, then this would be interpreted as ' absolute motion of the source in that reference frame'. In this case, all reference frames would be just different 'absolute reference frames', with relativistic transformation from one 'absolute reference frame' to another.

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Therefore, a new theory of light is needed which can explain all phenomena of light, agrees with experimental results, is in accordance with the principle of relativity (Galilean invariance principle and Einstein's notion of motion and his two postulates). In this paper, a new theory of electromagnetic waves and velocity of light is proposed. It is (re) stated as follows.

1. *Objective absolute space doesn't exist (Einstein's notion of space). In all analysis of source observer problems, either the observer or the source can equivalently be considered stationary with the other one moving.*

2. *The light wave spatially contracts towards (or expands away from) the source*

depending on the relative velocity (V) of the observer and the source . The apparent velocity (C') of light wave relative to the source depends on V so that the velocity of light relative to any observer is always [2] equal to C, i.e.

$C' - V = C$ *(vector difference), in the reference frame of the source, or*

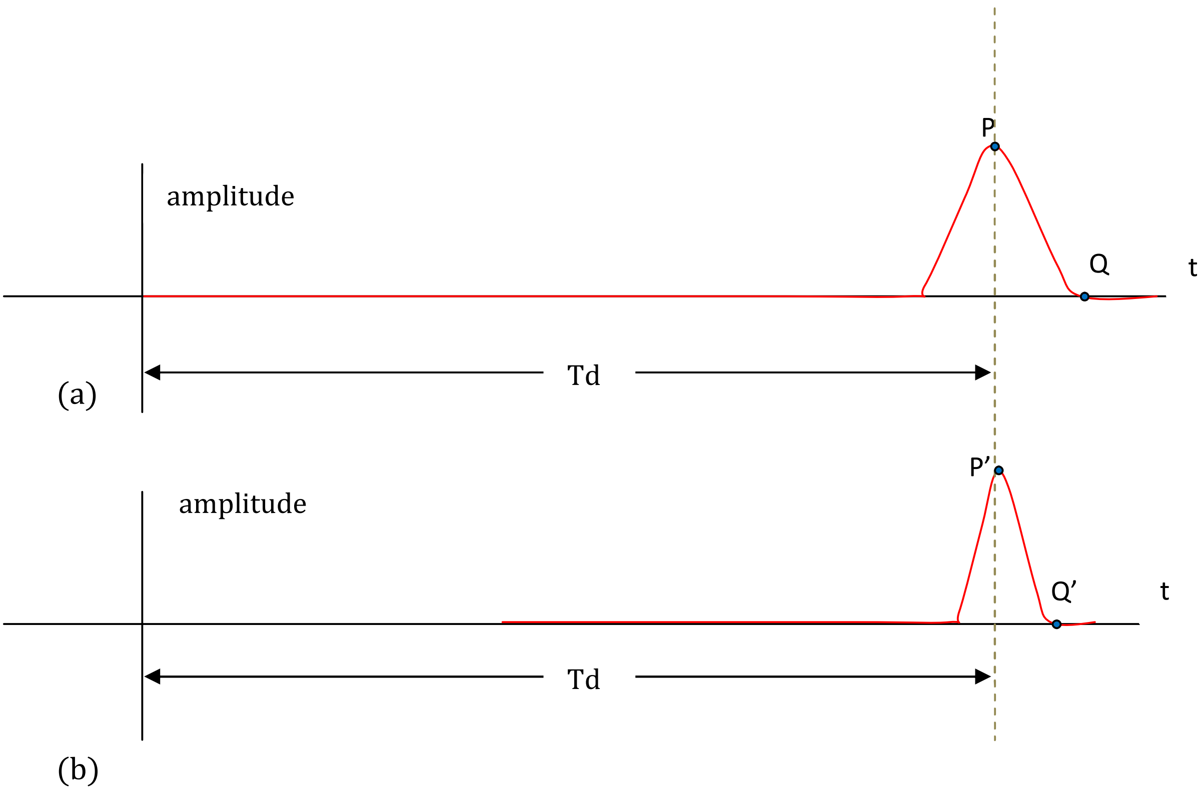
$C' + V = C$ *(vector sum), in the reference frame of the observer.*

The velocity (C') of light relative to the source is an apparent velocity and is not a physically measurable quantity.

3. *The center of the spherical wave fronts moves at the velocity that the source had at the instant of emission, and yet the speed of light is the same for all observers.*

According to the Relativity of Electromagnetic Waves theory, an observer moving towards a light source will not detect a light pulse earlier than a *corresponding* stationary observer, as explained in detail previously.

An experiment can be done to test this hypothesis. A laser light source placed on the moon transmits a narrow light pulse towards the earth. The light pulse is detected by two detectors, a stationary one on the ground and another detector placed on an aircraft flying towards the moon with a speed of about 500 m/s . It takes about one second for the light pulse to reach the earth. Within one second, the aircraft will travel a distance of 500 meters. It takes about 1.66 micro seconds for light to travel 500 meters. The experiment is so arranged that (which is not difficult) the light pulse is transmitted from the source on the moon at the instant that the aircraft is just passing by the stationary detector on the ground. Therefore, the detector on the aircraft is expected to receive the light pulse earlier than the stationary detector on the ground, by about 1.66 microseconds, according to classical and existing theories of light and space/motion. According to the Relativity of EM Waves theory, however, both detectors will detect the light pulse at exactly the same instant of time, about one second after its transmission from the moon. However, the pulse received by the detector on the aircraft is a temporally compressed (Doppler shifted) form of the pulse detected by the stationary detector.



The first diagram (a) shows the pulse received by the stationary detector, and the second diagram (b) shows the pulse received by the moving detector mounted on the aircraft.

The diagrams are drawn with the assumption that the source was emitting the peak point P of the pulse at the instant the aircraft (the moving detector) was just passing by the stationary detector on the ground.

The center of the spherical wave fronts moves at the velocity that the source had at the instant of emission [1], and yet the velocity of light relative to the observer is always equal to C. The velocity that light acquires from motion of its source is compensated for (cancelled) by the contraction or expansion of the wave which is a result of source observer relative motion, so that the speed of light relative to the observer is always equal to C. Thus the Relativity of EM Waves theory of light has both a feature of Einstein's light postulate (speed of light as independent of speed of source and speed of observer) and of emission theory of Ritz (the center of the spherical wave fronts always moving with the source at the instant of emission). This is made possible by the spatial contraction or expansion of the wave relative to its source.

The Relativity of EM Fields/ Waves theory can not explain Sagnac effect, as shown in the above table. However, the explanation of Sagnac effect is proposed in another paper written by this author [3], in which a new paradigm of absolute motion is introduced.

This theory agrees with MMX null result, explains stellar aberration and predicts longitudinal and transverse Doppler effects. It predicts stellar aberration both in the reference frame of the earth and the reference frame of the star. It agrees with the source speed independence of the speed of light. It is in accordance with Galilean invariance principle and Einstein's notion of motion. Of the theories and postulates of light known so far, none can satisfy all these at the same time. Thus Relativity of EM Waves theory conforms to the principle of relativity than Special Relativity does.

Conclusion

The discovery of this theory would have been impossible without the well known, historical and rigorous experiments that always confirmed the constancy of the speed of light and without Einstein's revolutionary notion of motion and his two postulates, especially the light postulate.

If the theory proposed in this paper proves to be correct, it will change the course of physics during the last century, and this will be deeply impressive.

I believe the discovery of this theory is a divine revelation; I believe to think of a possibility other than the three theories (the emission, the ether and special relativity) is almost impossible otherwise. Always thanks to God and His Mother, Our Lady Saint Virgin Mary.

References and notes

1. *Stellar Aberration and the Postulates on the Velocity of Light*, Domina Eberle Spencer and Uma Y. Shama

2. The exception here is if the source and observer have the *same* absolute velocity and this is when source and observer move as a unit. This has been explained in detail by this author in another paper 'Absolute Motion is Intrinsic'

3. *Absolute Motion is Intrinsic*, Henok Tadesse, 2013

4. *On the Second Postulate of the Theory of Special Relativity,* Wikisource the free online library