Corrections to Maxwell's equations for 'free' space – Invalidating the theory of relativity?!

November 21, 2012

Henok Tadesse, Electrical Engineer, B.Sc

Ethiopia

e-mail: *entkidmt@yahoo.com* or wchmar@gmail.com

Abstract

Maxwell's electromagnetic wave equations for 'free' space have a serious draw back in that they do not completely determine the wave in 'free' space. They only determine the speed of the wave (as if unrelated to any reference frame) but do not determine the waveform, the frequency, the amplitude and the direction of propagation of the wave at every point in 'free' space. In short they do not show any 'connection' of the wave with its source. The wave is 'detached' from its source or it is not 'connected' to any source through these equations. The fundamental problem with Maxwell's equations for 'free' space is the assumption of 'free' space in which even the source of the wave has no effect at all on the wave. EM waves are just travelling disturbances on (of) static electric and magnetic fields and these disturbances always originate from changing charges or changing current. Maxwell's equations do not show how changes in static fields will be propagated to all points in space. This means they do not show the interaction of the static and dynamic fields (they only show the interaction between the dynamic E and B fields). Maxwell's original equations for 'free' space are actually useful only for qualitative study and understanding of the mechanism of the propagation of electromagnetic waves, by the interaction of E and B fields. In this paper, additional terms to be added to the original Maxwell's equations and a theory of electrostatic and magneto-static fields as the 'mediums' for electromagnetic waves have been proposed.

One of the most important consequences of these equations , assuming they are correct, is if there is any dependence of the speed of the resulting electromagnetic wave function on distance r; angles Θ and ϕ relative to the source (at least on distance r for simplicity). Intuitively, we can guess that this dependence exists by looking at the equations because E_s and B_s (the static fields) depend on r. In this case, the speed of the EM wave (light) will be constant only relative to its source and hence Einstein's postulate of the constancy of speed of light for all observers will be wrong, invalidating the whole theory of relativity. An observer in relative motion with respect to a light source not only measures a different light speed, but also will observe a different light beam than an observer at rest relative to the light source due to Doppler effect.

Key words

Corrections to Maxwell's equations, no 'free' space, speed of light is relative, static fields are medium for EM waves, propagation of changes in static fields, no EM waves exist 'detached' from their source, invalidating theory of relativity.

Introduction

Maxwell's equations were some of the great discoveries of the nineteenth century. They have enabled the study and understanding of the behaviour of propagation of electromagnetic waves by the interaction of the E and B fields. Maxwell's equations show an absolutely constant ($3x10^8$ m/s) speed of electromagnetic waves not related to any reference frame. This was one of the reasons why scientists of the nineteenth century developed the 'ether' hypothesis, which was disproved by Michelson Morley experiment. This finally led to the development of the whole theory of relativity, which has been considered to be one of the fundamental theories governing the universe for more than one hundred years now. The validity of the whole theory of relativity depended upon the nature of the speed of light, which was implied to be an absolute constant by Maxwell's equations.

However, Maxwell's equations and the assumptions behind them may have been the source of confusion in physics for more than one hundred years. They have resulted in a whole stream in physics: relativity.

Maxwell's equations for 'free' space do not completely determine the parameters of the wave in 'free' space. The amplitude and the frequency of the resulting wave function are not determined. The wave form of the wave function is always sinusoidal, irrespective of the waveform of the source charge and source current variations. Only the speed of the wave is determined, and this speed is implied to be an absolute one. These equations do not have terms that 'connect' the 'free' space wave to its source.

Therefore, Maxwell's equations may have some fundamental mistakes. Maxwell's equations may only help in the qualitative study and understanding of the mechanism of propagation of electromagnetic waves in 'free' space; they do not completely determine the wave quantitatively. In this paper correction terms to Maxwell's equations have been proposed so that it will be possible to completely determine the wave in 'free' space.

One of the greatest consequences of these proposed equations will be if the resulting 'free' space wave function has a speed that depends on distance r from source. In this case, Einstein's postulate of the absolute constancy of the speed of light will be proved to be wrong. According to the 'intuitive' analysis of the proposed equations presented in this paper, this dependence exists. The solutions of the differential equations have not been provided in this paper.

Results and discussion

Drawbacks of original Maxwell's equations for 'free' space

A set of equations for determining the 'free' space behaviour of electromagnetic waves should completely determine all the parameters of the wave: the waveform, the frequency, the phase, the amplitude and the speed of the wave. Therefore these equations should contain terms that 'connect' the wave to its source including the distance r from the source, angles Θ and ϕ relative to the source, frequency and amplitude of the source, time varying charge $Q(t)$ and time varying current $I(t)$. At every point in space the wave should be completely determined: the frequency, the

amplitude, the waveform, the speed, the direction of propagation.
Moreover, these equations should also show how changes in static electric and magnetic fields originating from changing charges and changing currents propagate to all points of space, by the interaction of the static and dynamic fields.

However Maxwell's equations for 'free' space do not contain any terms connecting the wave to its source, and they do not determine the waveform, the amplitude and the frequency of the wave in 'free' space. They imply an EM wave 'detached' from its source or an EM wave that doesn't have a source. They also imply perfectly plane waves with E and B fields exactly in phase. The direction of propagation of the wave at every point in 'free' space is also not determined. They do not show how changes in static fields propagate to all points in space.

There is no 'free' space in which an EM wave propagates 'detached' from its source (from the static fields). No EM wave exists that has no source. All EM waves are travelling disturbances on (of) electro- and magneto-static fields which always originate from a changing charge or changing current. The 'free' space wave can never be a perfectly plane wave (as implied by Maxwell's original equations ?) because all waves originate from a source and thus will never be plane waves.

The concept of 'free' space can be used to simplify solutions to practical problems. But such approximation cannot be used to define the fundamental nature of electromagnetic waves. An EM wave 'detached' from its source is analogous to a water wave continuing to travel on land when it has arrived at the shore. Just as water waves are defined with respect to water and travel only on water, EM waves are also defined with respect to and travel on static electric or magnetic fields.

A fundamental difference between the nature of waves and particles

There seems to be a lot of confusion or mix up of understanding between the fundamental natures of waves and particles, since the discovery of the wave-particle duality. Electromagnetic waves are just 'messengers' passing a cause from one place to an effect to another place. They only carry disturbances of static electric and magnetic fields. A photon is, even if it has some particle properties, *fundamentally a wave*. As a wave, it cannot exist independently of its medium: the static electric or magnetic field. An electron is, even if it has some wave nature, *fundamentally a particle*. To say photons are attracted by gravitational field can is a result of this confusion. The bending of light near massive bodies can be explained by the phenomena of diffraction [1].

Original Maxwell's original equations for 'free' space.

The wave is assumed to be propagating on a 'free space medium'.   Maxwell's original equations [2] for 'free' space are as follows.

$$\nabla . B = 0$$

$$\nabla . E = 0$$

$$\nabla \, x \, E = -\frac{\partial B}{\partial t}$$

$$\nabla \, x \, B = \mu o \, \epsilon o \frac{\partial E}{\partial t}$$

The solution to these set of differential equations is a wave function with speed equal to $\frac{1}{\sqrt{\mu o \, \epsilon o}}$. This speed is an absolute one not related to any reference frame. The resulting wave is a perfect plane wave or its direction of propagation is not determined.

Fig.1 shows the propagation of the E and B fields according to Maxwell's original equations. Note that the thickness of both the E and H rings is constant as the wave propagates forward, indicating non diminishing amplitude of the wave as it propagates forward.

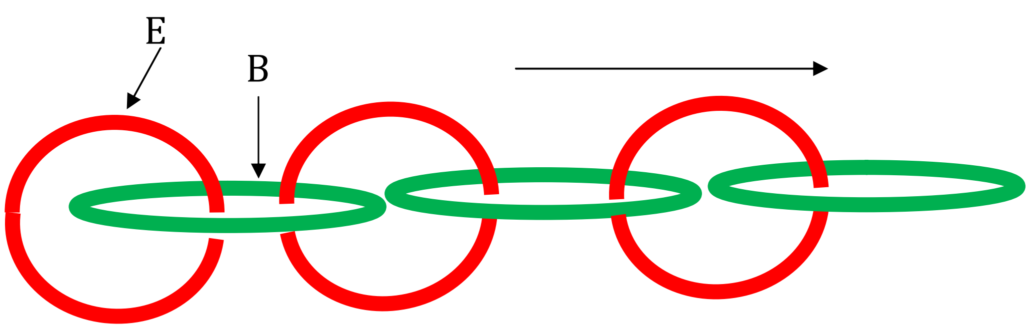

Fig. 1

Modified Maxwell's equations

Static electric and magnetic fields are the 'medium' for EM waves. EM waves are travelling disturbances on (of) static or magnetic fields. Therefore, there are two kinds of an EM wave:

1. An EM wave propagating on ('attached' to) an electrostatic field
2. An EM wave propagating on ('attached' to) a magneto-static field

Thus the speed of EM waves ($3x10^8$ m/s) is relative to these static fields or relative to their sources. The speed of light is defined and is constant only relative to its source. This also means that it varies for other frames of reference other than the source's.

EM waves propagating on static electric field

Theoretically this kind of wave can be created by two point charges in air (or vacuum) separated with some distance and carrying opposite charges varying with time (Fig.2).

Suppose a voltage source is connected to two conducting objects (Fig. 3). Suppose that initially the steady state voltage value is V_1. A steady state value of static electric field intensity (Es) exists at every point in space. Now suppose that the voltage starts changing from V_1 and finally settles on a new steady state value V_2. The static electric

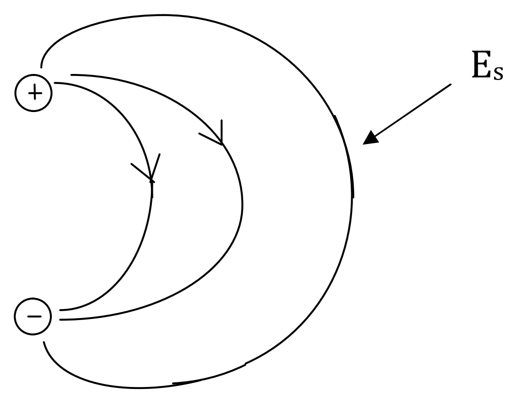

Fig. 2

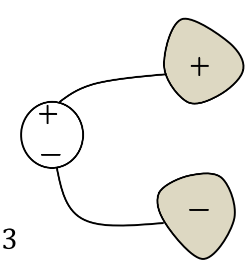

Fig. 3

field intensity (Es) at every point in space should change to a new value. How is the change transmitted to every point in space? Just before the voltage starts increasing, there will be no changing (induced) electric field in the space between the objects. As the voltage is changing, the static electric field (Es)starts to change in the vicinity of the conducting objects. The changing electric field will induce a changing magnetic field (B) and this in turn will induce a changing electric field (E) in the vicinity of the conducting objects. Thus a changing electric field and a changing magnetic field will form an electromagnetic wave that carries changes in static electric field intensity to every point in space. After the voltage has settled at V_2, the electric field in the vicinity of the conducting objects will settle and hence no more changing electric and magnetic fields (E and B) exist in the circuit and in the space in the vicinity of the circuit and hence no EM waves will be created. The E and B fields (Fig.4) will diminish to zero and only the new value of Es will remain in the steady state condition. Therefore, the role of E and B fields is to carry *changes* in the static electric field intensity (Es) to every point in space in this case.

The modified Maxwell's equations for 'free' space, with proposed correction terms in red, for an EM wave 'attached' to (propagating on) an electrostatic field, are presented as follows.

$$\nabla . B = 0$$

$$\nabla . E = 0 = \nabla . Es$$

$$\nabla x E = -\frac{\partial B}{\partial t}$$

$$\nabla x B = \mu o\, \epsilon o \frac{\partial E}{\partial t} - \mu o\, \epsilon o \frac{\partial Es}{\partial t}$$

where Es represents the electrostatic field, whereas E and B represent the dynamic fields.

Es is determined just as we calculate electric field strengths for every point in space in electro-statics. In Fig.4, the E_s, the E and the B fields are shown to decrease in strength as the wave progresses forward. ∇ x B is shown to create not only E (or $\frac{\partial E}{\partial t}$) but also E_s (or $\frac{\partial Es}{\partial t}$). However, only the E part will create the next B at the next point in space. The E_s part doesn't contribute to the next B in space. Terms on both sides of the equation can be considered as cause(s) or as effect(s). According to the original Maxwell's equations all electric fields created by ∇ x B will create the next B, thus implying a wave with constant amplitude as it propagates, never diminishing in strength. The original Maxwell's equations do not show the creation of E_s (which doesn't contribute for the next B) because ' free' space was assumed to be one in which no static fields exist or their significance was not understood.

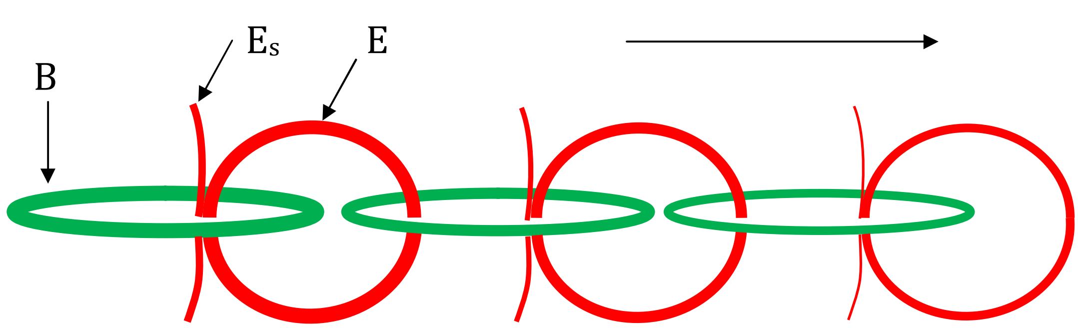

Fig . 4

EM waves propagating on static magnetic fields

Consider a wire loop with current source (Fig. 5). Suppose a steady state current of value I_1 is flowing in the circuit. This will create a steady state magnetic field at all points in space. Suppose the current value starts changing from I_1 until it finally settles on a new steady state value, I_2 . The value of magnetic field intensity at all points in space should change also. How does this change be transmitted to all points in space? Just before the current started changing, no electric fields existed (assume the resistance of the wire, the source voltage and source resistance are zero; in this case current will flow with zero electromotive force). While the current is changing, a voltage (an electric field) will be induced along the wire (due to wire self inductance) ; so, magnetic and electric fields will start changing in the vicinity of the wire. Therefore, the changing electric and magnetic fields in the vicinity of the wire will propagate to all points in space carrying changes in static magnetic field to all points in space. After the current value has settled on a new steady state value, the induced electric and magnetic fields (E and B) will diminish to zero in the circuit and its vicinity and the static magnetic field (Bs) will settle at new steady state values at all points in space, with delay depending on distance from the circuit and speed of EM waves. In this case, the induced electric and magnetic fields (E and B) existed only while the current was changing and their role was to form an electromagnetic field that will carry *changes* in the static magnetic field (Bs) to every point in space.

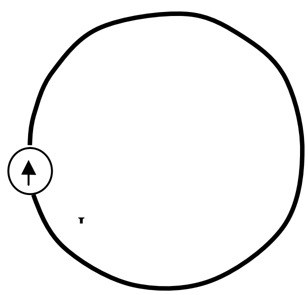

Fig. 5

The modified Maxwell's Equations for 'free' space, with proposed correction terms in red, for an EM wave 'attached' to (propagating on) a magneto-static field are presented below.

$$\nabla . B \;=\; 0 \;=\; \nabla . Bs$$

$$\nabla . E \;=\; 0$$

$$\nabla\, x\, E \;=\; -\frac{\partial B}{\partial t} + -\frac{\partial Bs}{\partial t}$$

$$\nabla\, x\, B \;=\; \mu o\, \epsilon o \frac{\partial E}{\partial t}$$

where Bs represents the static magnetic field, where E and B represent the dynamic fields.
Bs at every point in space is determined just as we calculate magnetic field strengths in magneto-statics. Here also (Fig. 6) ∇ x E creates not only B (or $\frac{\partial B}{\partial t}$), but also B_s (or $\frac{\partial Bs}{\partial t}$). However, only the B part is shown to create the next E in space. Terms on both sides of the equation can be considered as cause(s) or as effect(s). Again note that, unlike the implications of Maxwell's original equations, the strengths of E, B and B_S continuously decrease as the wave propagates forward. The original Maxwell's equations do not show the creation of B_s (which doesn't contribute for the next E in space) because ' free' space was assumed to be one in which no static fields exist or their significance was not understood.

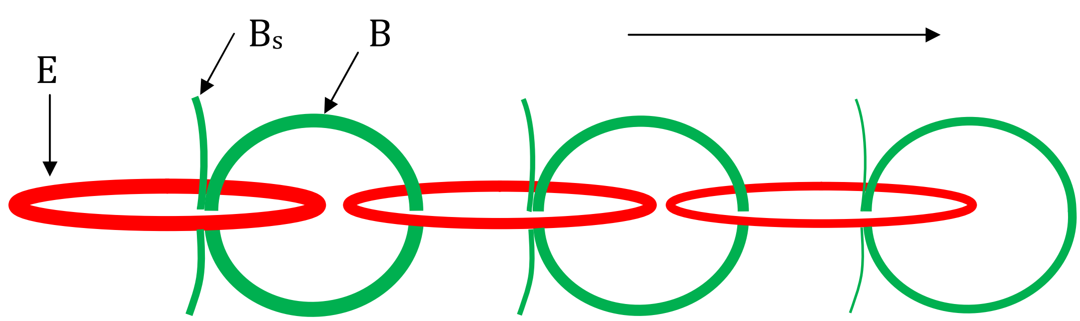

Fig . 6

Theoretically, this kind of wave can also be created by a wire of zero resistance carrying a time varying electric current (Fig . 7). No static electric fields will be created here because there is no voltage drop along the wire.

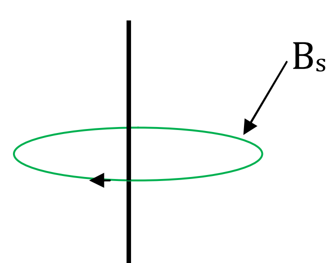

Fig . 7

The two kinds of waves mentioned above are only abstractions and do not exist independently in practice. All current carrying wires do not have zero resistance in practice and all finite conducting objects separated by air (vacuum) will have finite sizes and hence will carry conduction current. Therefore, both kinds of waves always exist together. A source of EM waves which creates both electrostatic and magneto static fields (e. g a wire carrying time varying current and has non zero resistance) can be considered as two independent sources (emitting two waves). Therefore, two kinds of waves result from all sources, one propagating on (or carrying changes in) the electro-static field and another propagating on (or carrying changes in) the magneto-static field. Of course, one type of wave will dominate for each type of radiator. For example, an EM wave propagating on electrostatic field will dominate for a dipole antenna and an EM wave propagating on magneto-static field will dominate for a loop antenna.

Analysis of the proposed equations to show the dependence of speed of EM waves on distance r from the source

The solution to the newly proposed set of equations should result in a completely defined wave function: amplitude, frequency, waveform and speed, and direction of propagation, with terms 'connecting' the wave to its source. *The most important consequence of these equations , assuming they are correct, is if there is any dependence of the speed of the resulting electromagnetic wave function on distance r, angles Θ and ϕ (at least on distance r for simplicity).* If the speed of the EM wave depends on distance r, angles Θ or ϕ, then the speed of an electromagnetic wave is only relative to its source and not absolute. *In this case Einstein's postulate of the constancy of speed of light for all observers will be wrong, invalidating the whole theory of relativity.*

The solution to the set of proposed vector differential equations is not presented in this paper. However, an 'intuitive' analysis of the equations will be presented below.

We start with Maxwell's original equation:

$$\nabla \times B = \mu o \, \epsilon o \frac{\partial E}{\partial t}$$

From this equation it follows that:

$$\frac{\nabla \times B}{\frac{\partial E}{\partial t}} = \mu o \, \epsilon o$$

We know that the speed of light in vacuum ('free' space) is equal to $\frac{1}{\sqrt{\mu o \, \epsilon o}}$.

Therefore we can intuitively assume that the speed of an electromagnetic wave is determined by the ratio:

$$\frac{\nabla \times B}{\frac{\partial E}{\partial t}}$$

Now let us look at the modified Maxwell's equation:

$$\nabla \times B = \mu o \, \epsilon o \frac{\partial E}{\partial t} + \mu o \, \epsilon o \frac{\partial Es}{\partial t}$$

From this equation, it follows that, after dividing both sides by $\frac{\partial E}{\partial t}$

$$\frac{\nabla \times B}{\frac{\partial E}{\partial t}} = \mu o \, \epsilon o + \mu o \, \epsilon o \frac{\frac{\partial Es}{\partial t}}{\frac{\partial E}{\partial t}}$$

Since E_s and E at any point are both created by the same $\nabla \times B$ they should be in phase. Therefore, the term

$$\frac{\frac{\partial Es}{\partial t}}{\frac{\partial E}{\partial t}}$$

on the right hand side doesn't vary with time, as the time variations in the numerator will cancel out the time variations in the denominator and it is only a function of r because E and Es are functions of r. E should vary (decrease) with r because we know that the wave becomes weaker and weaker with distance. Thus, the above term will be a function of r, $f(r)$.

$$\frac{\frac{\partial Es}{\partial t}}{\frac{\partial E}{\partial t}} = f(r)$$

Thus substituting $f(r)$ into the previous equation:

$$\frac{\nabla \times B}{\frac{\partial E}{\partial t}} = \mu o \, \epsilon o + \mu o \, \epsilon o \, f(r)$$

Therefore the speed of the EM wave at distance r from the source will be:

$$\frac{1}{\sqrt{\mu o \, \epsilon o + \mu o \, \epsilon o f(r)}}$$

Thus, according to the above analysis, the speed of an EM wave (light) depends on distance r from its source, which means that whenever we speak of the speed of an EM wave we always mean a speed relative to the source.

Es is proportional to $\frac{1}{r^2}$ whereas E [3] is proportional to $\frac{1}{r}$. Therefore the function *f(r)* is approximately proportional to $\frac{1}{r}$:

$$f(r) \ \alpha \ \frac{1}{r}$$

Therefore *f(r)* approaches zero (negligible) for 'free' space (i. e for sufficiently large distance *r*) so that the speed of the wave will approach $\frac{1}{\sqrt{\mu o \ \epsilon o}}$ for 'free' space.

Therefore, *the speed for 'free' space wave will still depend on r even though this dependence is negligible*, so that the speed of an EM wave is relative (to its source) and not absolute.

Modified Maxwell's equations for non-'free' space: general form

The correction terms added to 'free' space equations should also be added to the general Maxwell's equations that can be applied to any medium.

$$\nabla . B \ = \ 0 = \nabla . Bs$$

$$\nabla . E \ = \ 0$$

$$\nabla . Es \ = \ \frac{\rho}{\epsilon o}$$

$$\nabla \ x \ E \ = \ -\frac{\partial B}{\partial t} + -\frac{\partial Bs}{\partial t}$$

$$\nabla \ x \ B \ = \ \mu o \ J \ + \ \mu o \ \epsilon o \frac{\partial E}{\partial t} + \ \mu o \ \epsilon o \frac{\partial Es}{\partial t}$$

Es and Bs represent the static fields respectively, whereas E and B represent the dynamic fields. $\nabla . Bs$ and $\frac{\partial Bs}{\partial t}$ are set to zero for EM waves propagating on electrostatic fields, and $\nabla . Es$ and $\frac{\partial Es}{\partial t}$ are set to zero for EM waves propagating on magneto static fields.

Some arguments against the theory of relativity

Based on the discussions on relative nature of the speed of light as presented so far, some arguments to invalidate the theory of relativity and its 'evidences' are presented below.

An observer in relative motion with respect to the source of a light beam not only measures a different speed of light but also will observe a different light beam

Suppose an observer B is in relative motion with a light source and suppose also that there is also another observer A at rest relative to the source. Will the two observers measure the same speed of light? No. The two observers being in relative motion will not observe the *same* light beam in the first place because, due to Doppler's effect, the frequency of the light will change as observed by B when compared with the frequency observed by observer A. So as they are observing two different light beams it doesn't make sense to compare the speeds measured. Therefore, observer B should be at rest relative to the source to observe *the same* (*frequency*) beam of light and measure *the same speed* as observer A.

Michelson – Morley experiment

The result of Michelson-Morley experiment has been considered as an evidence supporting special relativity. We will look at the experiment from the perspective of the theories presented in this paper. The two beams in the experiment originated from the *same source* and as both travelled in the same medium (air), they should always have the same speed *relative to the light source*. Both beams also travelled equal distances. Therefore, the two beams will always have the same speed *relative to the source* and hence no interference patterns should form. The result of Michelson- Morley experiment proved the absence of the 'ether'. However, the absence of the 'ether' doesn't prove the correctness of the special relativity theory. The result of the experiment can be explained by the theory proposed in this paper: the speed of light is defined and is constant only relative to its source.

Bending of light near massive objects

According to the theory presented in this paper, light can never be 'detached' and set 'free' however far away it is from its source. There is a fundamental difference between the nature of light 'particles' and real particles. There seems to be mix up of understanding between the fundamental natures of particles and waves since the discovery of the wave particle duality. Particles are 'free' whereas EM waves are never 'free'. Therefore the path of light (an EM wave) is determined by the interaction between its source and the massive object the light is passing by, whereas the path of a particle is determined by the interaction between the particle itself and the massive object. Bending of light near massive objects is not due to the mass but due to the size of the objects and it is caused by the phenomenon of diffraction [1].

There isn't any experimental evidence to support special relativity! [4]

Lorentz's theory can be used to interpret those phenomena that are being considered to be evidences to special relativity.

Conclusion

Maxwell's equations for 'free' space have been so useful in the qualitative study of the behaviour and mechanism of propagation of electromagnetic waves. But they cannot be used for the quantitative determination of a wave in 'free' space. They do not show the interaction of the static fields with the dynamic fields so that changes in static fields originating from changing charges or changing currents will be transmitted to every point in space. Even though the differential equations of the modified Maxwell's equations have not been solved in this paper, we have seen that the speed of the resulting wave function depends on the distance r from the source since E_S and B_s are functions of r. *It is not the significance of this dependence of the speed on distance r that matters to conclude that the speed of light in 'free' space is relative to its source and not absolute: it is whether there is any dependence on r at all that we can conclude that the speed of light is relative to its source or the static fields.* Static electric and magnetic fields are the 'mediums' on which electromagnetic waves propagate. Maxwell's original equations implied an absolute value of the speed of light/EM wave in 'free' space. The modified Maxwell's equations will not only enable complete determination of a wave in 'free' space, but also will have profound implication on the nature of the speed of light: that the speed of light is constant only relative to its source. So Einstein's postulate of the constancy of the speed of light for all observers will be wrong and this invalidates the whole theory of relativity.

References

1. The bending of light near massive objects is not due to their mass, but due to their size- black holes are objects of cosmic size, by Henok Tadesse
http://vixra.org/abs/1211.0012

2. http://en.wikipedia.org/wiki/Maxwell's_equations

3. TN1200.04 Calculating Radiated Power and Field Strength for Conducted Power Measurements
http://www.semtech.com/images/datasheet/semtech_acs_rad_pwr_field_strength.pdf

4. There isn't any experimental evidence to support special relativity! , by Xinwei Huang

http://www.sciforums.com/showthread.php?104606-There-isn%92t-any-experimental-evidence-to-support-special-relativity!