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

(solutions to the vector differential equations not provided)

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Abstract

The speed of light is constant relative to its source ! This means that all observers in relative motion with the source will observe not only a different speed but also a different light beam !

Maxwell's equations for electromagnetic waves for 'free' space have a serious draw back in that they do not completely determine a wave in 'free' space. They only determine the speed of the wave (as if unrelated to any reference frame) but do not determine the frequency and amplitude of the waves. 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. Therefore, a set of wave equations which completely determine the wave in 'free space' has been developed. In this paper, additional terms to be added to Maxwell's equations have been proposed so that the resulting set of equations will completely determine the wave in 'free' space. 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. Maxwell's equations for 'free' space are useful only for qualitative study and understanding of the mechanism of the propagation of electromagnetic waves, by the the interaction of E and B fields. The proposed set of equations with correction terms in red is presented below.

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

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

$$\nabla \times E \;=\; -\,\partial B/\partial t \;+\; -\,\partial B_s/\partial t$$

$$\nabla \times B \;=\; \mu_o \epsilon_o \partial E/\partial t \;+\; \mu_o \epsilon_o \partial E_s/\partial t$$

E_s and B_s represent electro- and magneto- static fields respectively. $\nabla . B_s$ and $\partial B_s/\partial t$ are set to zero for EM waves propagating on electrostatic fields, and $\nabla . E_s$ and $\partial E_s/\partial t$ are set to zero for EM waves propagating on magneto static fields.

The most important consequence of these equations , assuming they are correct, is if there is any dependence of the speed of the electromagnetic wave function (obtained after solving the above differential equations or qualitative analysis of these equations) on distance r, angles θ and ϕ (at least on distance r for simplification). Intuitively we can guess that this dependence exists by looking at the equations because E_s and B_s depend on r. 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. However, the differential equations have to be solved for the resulting wave function to make the final conclusion.

Introduction

Maxwell's theory of electromagnetism was one of the greatest discoveries of the nineteenth century. Maxwell's equations have enabled us to study and understand the behaviour of electromagnetic waves in different mediums, how EM waves actually propagate by the interaction of the E and B fields. However the assumptions of Maxwell on which his equations were based may have been the source of confusion about the speed of electromagnetic waves for more than one hundred years. Maxwell's equations showed an absolutely constant ($3x10^8$ m/s) speed of electromagnetic waves not related to any reference frame. This has contributed to the reasons why scientists of the nineteenth century hypothesized and had been searching for the 'ether', a medium supposed to be at an absolute rest to be the reference frame for the speed of light. However, the presence of the 'ether' was disproved by Michelson Morley experiment. This later resulted in the development of the special and general theory of relativity, which has been considered to be one of the two most fundamental theories governing the universe, besides quantum mechanics, 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 for 'free' space do not completely determine the parameters of the wave travelling in 'free' space. These equations do not have terms that 'connect' the 'free' space wave to its source. Maxwell's equations only help for the qualitative study and understanding of the propagation of electromagnetic waves in 'free' space and not to completely determine it quantitatively. In this paper corrections to Maxwell's equations will be proposed so that it will be possible to completely determine the wave in free space. The greatest consequence of these equations will be if the resulting wave function has a speed that depends on distance from source, r. The solutions of the differential equations have not been provided in this paper. However, intuitive analysis has been presented.

Discussions

Drawbacks of 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 frequency, the amplitude and the speed of the wave. Therefore these equations should contain terms that 'connect' the wave to its source including: distance from source r, angles Θ and ϕ relative to the source and frequency and amplitude of the source, time varying charge Q(t) and time varying current I(t). However Maxwell's equations for 'free' space do not contain these terms and determine only the speed of an electromagnetic wave in 'free' space, as if it was not related to any reference frame. These equations do not determine the amplitude and frequency of the wave in 'free' space. They imply an EM wave 'detached' from its source. They also imply perfectly plane waves with E and H fields exactly in phase. However this can never happen because all waves originate from a source and thus will never be plane waves.

There is no 'free' space- There is no EM wave 'detached' from its source - No EM wave exists that has no source.

The concept of 'free' space can be used to simplify solutions to practical problems. But this approximation cannot be used to define the fundamental nature of electromagnetic waves. If we assume absolutely free space, we mean a space in which even the source of the wave (through electrostatic and magneto static fields) has no effect on the wave at all. This implies an EM wave 'detached' from its source. To think of an EM wave detached from its source is similar to thinking of a water wave continuing to travel on land when it has arrived at the shore.

All EM waves are travelling disturbances of electro- and magneto-static fields which always originate from a changing charge or changing current .

A fundamental difference between the nature of waves and particles

Waves are just 'messengers' passing a cause from an object (particle)in one place to an effect to an object (particle) in another place. However, there seems a lot of confusion and mix up in understanding between the fundamental nature of waves and particles. Before the discovery of the wave particle duality, the problem was to think of these two as entirely different and as having no intersection. Now after we have understood the wave particle duality the problem is mixing up of understanding between the two natures. A photon, even if it has some particle properties is *fundamentally* a wave. An electron, even if it has some wave nature, it is *fundamentally* a particle. I think to say photons are attracted by gravitational field is a result of this confusion. Then why does light bend near massive objects? This question is discussed at the end of this paper (page 10).

Maxwell's original equations for 'free' space:

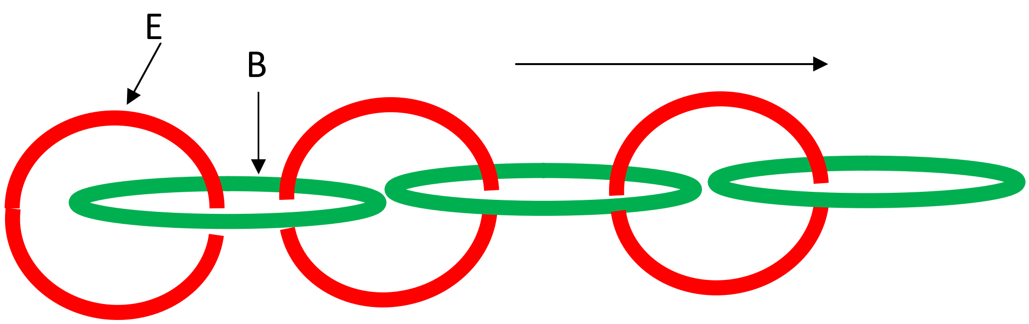
$$\nabla . B = 0$$

$$\nabla . E = 0$$

$$\nabla \times E = -\partial B/\partial t$$

$$\nabla \times B = \mu_o \epsilon_o \partial E/\partial t$$

The solution to these set of differential equations is a wave function with speed equal to $1/(\mu_o \epsilon_o)^{1/2}$. This speed is absolute speed not related to any reference frame.
The resulting wave is a perfect plane wave.



The above figure represents the propagation of the E and B fields according to Maxwell's original equations.

Red rings represent E fields and green rings represent B fields. Note that the thickness of both the E and H rings is constant as the wave propagates forward.

According to the theory presented in this paper there are two kinds of EM waves:

1. An EM wave propagating 'attached' to an electrostatic field and

2. An EM wave propagating 'attached' to a magnetostatic field

Therefore, EM waves propagate on electrostatic or magneto static fields as a 'medium'. Thus the speed of EM waves ($3x10^8$ m/s) is relative to these fields or relative to their sources because these fields are at rest relative to their source. ***The speed of light is always constant relative to its source. This also means that it varies for other frames of reference other than the source's.***

Modified Maxwell's Equations for 'free' space, with proposed correction terms in red, for an EM wave 'attached' to an electrostatic field.

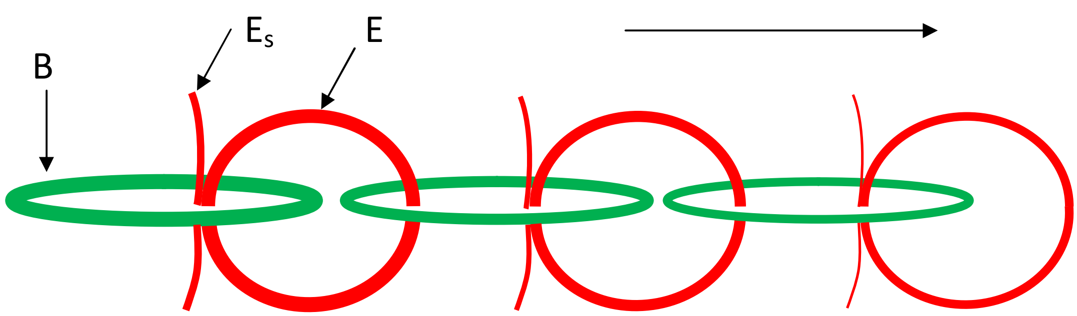
$$\nabla . B = 0$$

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

$$\nabla \times E = - \partial B / \partial t$$

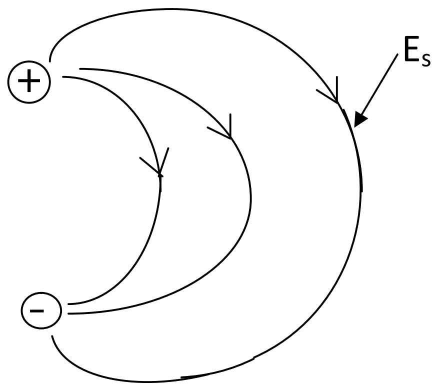
$$\nabla \times B = \mu_o \epsilon_o \partial E / \partial t + \mu_o \epsilon_o \partial E_s / \partial t$$

Where E_s represents electrostatic field



In the above figure the E_s, the E and the B fields decrease in strength as the wave progresses. $\nabla \times B$ creates not only E but also E_s (we can also discuss from the point of view of '$\partial E/\partial t$ creates $\nabla \times B$', and this doesn't bring any difference) . However, only the E part will create the B at the next point in space. The E_s part doesn't contribute to the next B in space. The difference from the original Maxwell equations is that in the original equations all electric fields created by $\nabla \times B$ 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 it was assumed that there will not be any electrostatic field in 'free' space or its significance was not considered.

This kind of wave can be created by two opposite stationary charges separated with some distance and the charges varying with time. No static magnetic fields will be created because there are no moving charges.



Modified Maxwell's Equations for 'free' space, with proposed correction terms in red, for an EM wave 'attached' to a magneto-static field

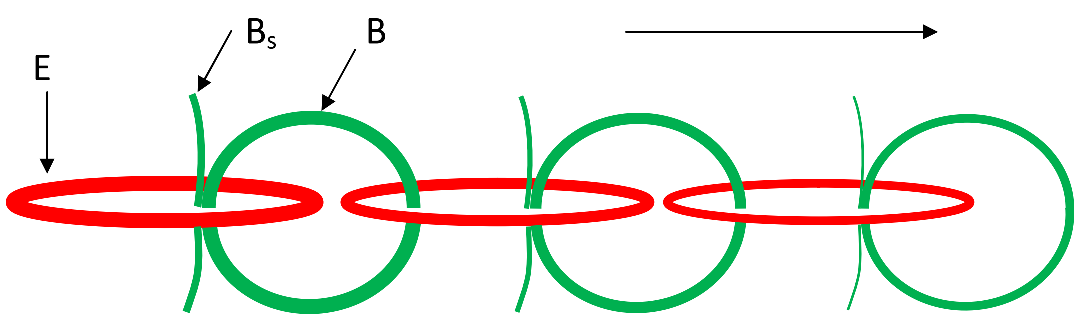
$$\nabla . B \;=\; 0 \;=\; \nabla . B_s$$

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

$$\nabla \times E \;=\; -\,\partial B/\partial t \;+\; -\,\partial B_s/\partial t$$

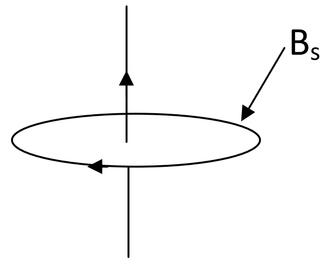
$$\nabla \times B \;=\; \mu_o \epsilon_o \partial E/\partial t$$

Where B_s represents magneto- static field.



Here also $\nabla \times E$ creates not only B, but also B_s. However, only the B part will create the next E in space. Again note that the strengths of E, B and B_S continuously decrease as the wave propagates. The original Maxwell's equations do not show the creation of B_s which doesn't contribute for the next E because it was assumed that there would not be any magneto-static field in 'free' space or its significance was not considered.

This kind of wave can be created by a wire carrying a time varying current with no voltage drop along its length. No static electric fields will be created here because there is no voltage drop along the wire.



For a source of EM waves which creates both electrostatic and magneto static fields (for example a wire carrying time varying current and time varying voltage across it), it can be considered as two independent sources (two waves)or the problem can be handled by the principle of superposition.

Electromagnetic waves transmit disturbances in electrostatic or magneto static fields which always originate from a changing charge or a changing current respectively to all space surrounding the source. Therefore ∇ x B at a point in space creates a total time changing electric field at that point, part of which is 'consumed' at that point to change the value of the electrostatic field at that point and the remaining part will carry forward the change to the next points in space continuously decreasing in strength as it propagates ahead. Similar reasoning applies to ∇ x E . According to these equations the strength of the wave decreases with increasing distance from its source. In the original Maxwell's equations for free space the waves are perfectly plane waves and have always constant strength as they propagate, which implies waves without sources.

The solution to this set of equations should result in a completely defined wave function: amplitude, frequency, and speed, 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 electromagnetic wave function (obtained after solving the differential equations) on distance r, angles Θ and ϕ (at least on distance r for simplification).* The extent of this dependence is surely negligible for 'free' space (far field region), resulting in the same value of speed as Maxwell's original equations, but if there is *any* dependence on r at all this will have a dramatic implication on our understanding of the fundamental nature of the speed of light/EM waves (whether it is absolute or relative) and on the theory of relativity. 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.

Intuitive analysis of the modified Maxwell's equations to show that the speed of an EM wave depends on distance r from its source

Only working out the solution of the modified differential equations can enable one to make a final conclusion about the resulting wave function. However, this solution has not been provided in this paper (the solution may be provided in the future). However, in this paper an intuitive analysis will be presented below.

We start with Maxwell's original equation: $\nabla \times B = \mu_0 \epsilon_0 \partial E/\partial t$.
From this equation it follows that: $(\nabla \times B)/(\partial E/\partial t) = \mu_0 \epsilon_0$. We know that the speed of light in vacuum ('free' space) is equal to $(\mu_0 \epsilon_0)^{-1/2}$. Therefore we can intuitively infer that the speed of an electromagnetic wave is determined by the ratio $(\nabla \times B)/(\partial E/\partial t)$.

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

$$\nabla \times B = \mu_0 \epsilon_0 \partial E/\partial t + \mu_0 \epsilon_0 \partial E_s/\partial t$$

From this equation it follows that, by dividing both sides by $\partial E/\partial t$:

$$(\nabla \times B)/(\partial E/\partial t) = \mu_0 \epsilon_0 + \mu_0 \epsilon_0 (\partial E_s/\partial t) / (\partial E/\partial t)$$

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

$$(\partial E_s/\partial t) / (\partial E/\partial t) = f(r)$$

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

$$(\nabla \times B)/(\partial E/\partial t) = \mu_0 \epsilon_0 + \mu_0 \epsilon_0 f(r)$$

Therefore the speed of the EM wave at r will be: $(\mu_0 \epsilon_0 + \mu_0 \epsilon_0 f(r))^{-1/2}$

Note that we should be careful to avoid any approximations or calculations based on methods we normally use to solve practical problems, such as power at a distance r is inversely proportional to r^2. Thus, if the above analysis is correct, 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.

As r approaches infinity E_s should become more and more less than E so that the term $\mu_o \epsilon_o f(r)$ can be neglected, giving us the same result of speed as Maxwell's original equations. However, still the value of speed obtained in this way will be interpreted to be relative to its source.

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.

$$\nabla \cdot B = 0 = \nabla \cdot B_s$$

$$\nabla \cdot E = 0$$

$$\nabla \cdot E_s = \rho/\epsilon_o$$

$$\nabla \times E = -\partial B/\partial t + -\partial B_s/\partial t$$

$$\nabla \times B = \mu_o J + \mu_o \epsilon_o \partial E/\partial t + \mu_o \epsilon_o \partial E_s/\partial t$$

E_s and B_s represent electro- and magneto- static fields respectively. $\nabla \cdot B_s$ and $\partial B_s/\partial t$ are set to zero for EM waves propagating on electrostatic fields, and $\nabla \cdot E_s$ and $\partial E_s/\partial t$ are set to zero for EM waves propagating on magneto static fields.

Arguments against theory of relativity

Based on the proof of relative nature of the speed of light as presented so far and other points of view, there are also other possible arguments against the theory of relativity, additionally confirming the need for corrections to Maxwell's equations presented so far.

The speed of a light wave can only be determined in the frame of reference of its source.

Suppose an observer B is in relative motion with a light source and suppose also that there is also another observer A in the frame of reference of 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 in the frame of reference of the source to observe *the same* beam of light : measure the same frequency, the speed.

There isn't any experimental evidence to support special relativity! [1]

Lorentz's theory can be used to interpret those phenomena that are being considered to be evidences to special relativity. Look at the reference at the end for other arguments.

Michelson – Morley experiment

The Michelson-Morley experiment has been used as an evidence to support special relativity. But according to the theory presented in this paper, the two beams in the experiments originated ***from the same source*** and they both travelled in the same medium, air. So both beams would always have the same speed ***relative to the light source*** and both beams travelled equal distances. The result of Michelson- Morley experiment proved the absence of the 'ether'; it is also in agreement with the theory presented in this paper that the speed of light is defined only relative to its source. That means ***the speed of light is always constant relative to its source***.. The finding of Michelson –Morley experiment has no relationship with the correctness of the theory of relativity because the absence of the 'ether' doesn't prove the correctness of special relativity.

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 a misunderstanding and mix up of understanding between the fundamental nature of particles and waves after the discovery of the wave particle duality. Waves are just 'messengers' passing a cause from one place to an effect to another place. That is why we never see a wave at rest. We can think of particles as 'free' whereas EM waves are never 'free'. Therefore the path of light/EM wave is determined by the interaction between its source and the massive object the light is passing by. The light particle cannot interact directly with the massive object to determine its path (only a real particle can). This is the electro static or the magneto static force we have been discussing so far. ***The static fields from an atom inside a star millions of light years away are practically undetectable, but they will still determine the path of the light beam emitted from themselves in our place!*** Whereas, for a particle its path is determined by the interaction between itself and the massive body, the path of an EM wave/ light is determined by the interaction between its source and the massive body. The light beam itself cannot interact with the gravitational field of the massive body. Therefore, Newtonian gravity can't be used to explain this bending of light. And if the arguments in this paper are correct general relativity will be invalid to explain this bending of light.

Conclusions

Maxwell's equations for 'free' space have been so useful in the 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 can only be used for qualitative analysis and study. Even though the differential equations of the modified Maxwell's equations have not been solved in this paper we can intuitively understand that the speed of the resulting function should depend on distance from the source r since E_S and B_S are functions of r. *It is **not the significance** of this dependence of the speed on r that matters to conclude that the speed of light is relative to its source and not absolute: it is if there is **any dependence on r at all** that we can conclude that the speed of light is relative to its source.* The 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 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. *There isn't any experimental evidence to support special relativity!* http://www.sciforums.com/showthread.php?104606-There-isn%92t-any-experimental-evidence-to-support-special-relativity!

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