Investigation of Connection between the Moving Magnet Conductor Problem and the Special Theory of Relativity

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Abstract

The Moving Magnet Conductor problem is the problem of 'coincidence' of the effect of magnetic field in the reference frame of the magnet and the effect of electric field in the reference frame of the conductor, the effect being a definite current flowing in the conductor, for a magnet and a conductor in relative motion. In this paper, we will show that this problem will not lead to the theory of relativity, i.e. to the conclusion that absolute motion doesn't exist. This 'coincidence' occurs only in the special case in which at least one of the two (either the magnet or the conductor) is at absolute rest and hence is only a special case. In general, the magnet and the conductor can have a relative motion while having a common absolute motion. This is the case, for example, of a magnet - conductor experiment carried out on Earth, which has an absolute velocity of 390 Km/s . In such cases, the motion of the magnet and the motion of the conductor will have different effects even if the relative velocities are the same. We will apply Apparent Source Theory (AST) to this problem. In the case of light, the effect of absolute motion for co-moving light source and observer is to create an apparent change in position of the light source relative to the observer. Therefore, no fringe shift will occur in the Michelson-Morley experiment due to an apparent change of source position *for the same reason* that no (significant) fringe shift will occur if the position of the source was actually, physically changed relative to the detector. Intuitively, AST can be stated as: the speed of light is equal to $c - V_{abs}$ in the forward direction and $c + V_{abs}$ in the backward direction, *relative to the source*, for a source moving with absolute velocity V_{abs}. This theory readily explains the Michelson-Morley experiment, the Sagnac effect and moving source experiments. AST applies not only to light sources, but also to all electromagnetic sources: sources of electric fields (charges) , sources of magnetic fields (magnets or electromagnets) and sources of gravitational fields. Therefore, for absolutely co-moving magnet and (infinitesimal) conductor, the effect of absolute velocity is to create an apparent change in position of the magnet as seen by the conductor. The procedure of analysis is to replace the real magnet with an apparent magnet and analyze the problem as if both the apparent magnet and the conductor are at rest. There will not be any current induced in the conductor because the conductor is not moving relative to the magnet (hence relative to the apparent magnet). Since the conductor is at rest relative to the magnet, it is also at rest relative to the apparent magnet and hence no current will be induced in the conductor. There will be no induced current in this case for the same reason that there will be no induced current in the case of magnet and conductor both at absolute rest. An intuitive way of stating the same theory is to assume that the magnetic field is carried by the real magnet, but will be distorted due to absolute motion. Therefore, absolute motion of a magnet can be detected by a co-moving observer from the distortion of its field. The magnetic field of a magnet moving with absolute velocity will become weaker in front of the magnet and stronger behind the magnet. The electric field of a charge in absolute motion will become weaker in front of the charge and stronger behind the charge.

Introduction

The Moving Magnet Conductor Problem of classical physics was one of the main Einstein's arguments in his Special Theory of Relativity (SRT). Einstein argued in his 1905 paper that there is no way to know the absolute motion of a magnet. In this paper, it will be shown that Einstein's argument is fallacious and misleading because it represents only the special case in which at least one of the two (the magnet or the conductor) is at absolute rest. A solution to this problem is proposed in this paper.

Apparent Source Theory (AST) is a theory already proposed by this author. AST has successfully solved many of the hitherto puzzling light speed experiments, such as the Michelson-Morley experiment, the Sagnac effect and moving source experiments.

AST applies not only to light sources, but also to all electromagnetic sources: sources of electric fields (charges), sources of magnetic fields (magnets) and sources of gravitational fields (masses). Therefore, we begin with introduction to AST as applied to light.

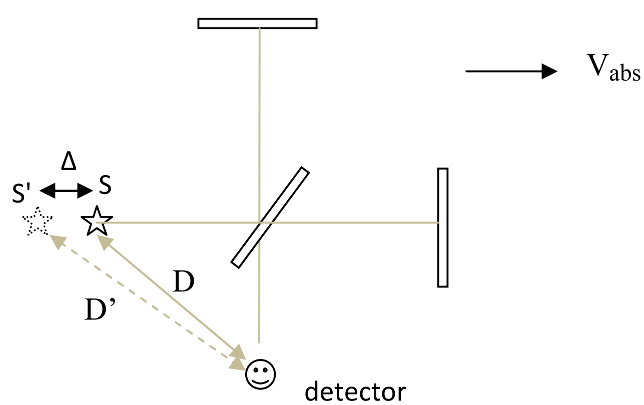
Apparent Source Theory (AST)

Apparent Source Theory[1] (AST) has already been proposed by this author to explain the Michelson-Morley experiment, the Sagnac effect, moving source experiments and many other experiments within a single theoretical framework. AST turns out to be a fusion of ether theory and emission theory in a novel way. In this paper, we give a brief introduction to it.

We will present a new interpretation of absolute motion as follows.

The effect of absolute motion for co-moving light source and observer is to create an apparent change in the position(distance and direction) of the light source relative to the observer.

With this interpretation, the Michelson- Morley and the Kennedy-Thorndike experiments can be readily explained.



From the above diagram of the Michelson-Morley experiment, we see that the effect of absolute velocity is just to create an *apparent* change of the position of the light source *relative* to the detector. The apparent change in position is determined by the direct source-detector distance D , the orientation of the source-detector line with respect to the absolute velocity and the magnitude of the absolute velocity[1].

The procedure of analyzing the Michelson-Morley experiment is:

1. Replace the real source S by an apparent source S' , to account for the absolute velocity
2. Analyze the experiment by assuming that the (*group*) velocity of light is constant *c relative to the apparent source* S'.

The best way to understand the effect of this apparent change of source position is to ask: *what is the effect of actually, physically shifting the source from position S to position S' ?* Obviously there will be no (significant) fringe shift in this case because, intuitively, both the longitudinal and lateral beams will be affected identically. It is possible to prove this experimentally in optics.

Therefore, in the present case, the apparent shift of the source is common both to the forward and lateral/transverse light beams and doesn't change the relative path lengths of the two beams and hence no (significant)fringe shift will occur.

Intuitive understanding of Apparent Source Theory - Modified Emission Theory

An intuitive form of AST is as follows.

The speed of light <u>relative to a source</u> moving with absolute velocity V_{abs} *is* $c - V_{abs}$ *in the forward direction and* $c + V_{abs}$ *in the backward direction.*

The above is a modified emission theory. It is a fusion of ether theory and emission theory.

Next we will see that this intuitive theory can easily explain the Michelson-Morley experiment, the Sagnac effect and moving source experiments.

<u>Michelson-Morley experiment</u>

It is now easy to explain the null result of the Michelson-Morley experiment (MMX) by the modified emission theory above. Modified emission theory is just conventional emission theory in which the velocity of light *relative to the source* depends on the absolute velocity of the source.

There will not be any fringe shift in the Michelson-Morley experiment because, as stated above, the effect of absolute velocity is just to create change in the speed of light *relative to the source*. A change in the speed of light <u>relative to the source</u> will not cause any fringe shift because both the transverse and longitudinal beams will be affected equally.

The Sagnac effect

The explanation of Sagnac effect is also straight forward. The effect of absolute motion of the light source is to decrease the speed of light relative to the source in the forward direction and to increase the speed of light relative to the source in the backward direction. The speed of light *relative to the source* will be equal to c - ωR in the forward direction and c + ωR in the backward direction. Hence a co-moving detector will observe a fringe shift.

Moving source experiments

We know that the null result of the Michelson-Morley experiment could be explained in a most straightforward way by the emission theory of light. However, the emission theory was abandoned because of moving source experiments, which confirmed that the speed of light is independent of the velocity of the source. The trick of nature is as follows. For emission theory to be compatible with moving source experiments, the speed of light should vary *relative to the source* so that the speed of light is independent of the absolute velocity of the source.

Imagine a light source in absolute motion and an observer at absolute rest. In this case the speed of light relative to the source is the same *c* in every direction. Now suppose that the light source is moving with (absolute) velocity V_{abs} towards the observer.

For the speed of light to be independent of the velocity of the source, the speed of light *relative to the source* should be c - V_{abs}in the forward direction. Therefore, the speed of light relative to the observer will be the *sum* of source velocity (V_{abs}) and the speed of light relative to the source (c - V_{abs}) :

$$V_{abs} + (c - V_{abs}) = c$$

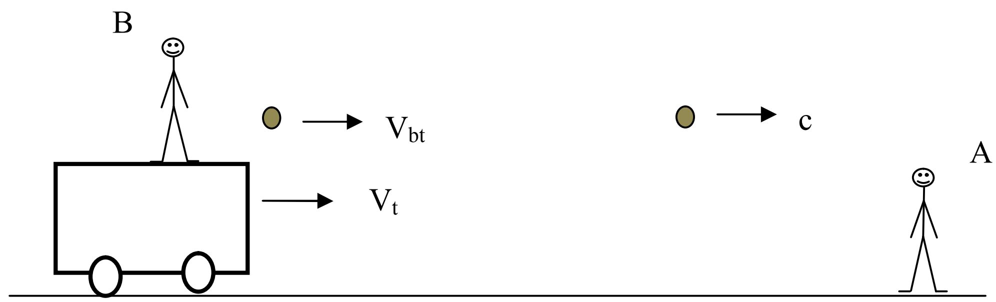
In the case of an observer who is at absolute rest behind a light source moving with absolute velocity V_{abs} , the velocity of light is c + V_{abs}in the backward direction *relative to the source.*

The speed of light relative to the observer will be the *difference* between the speed of light *relative to the source* (c + V_{abs}) and the source absolute velocity (V_{abs}) :

$$(c + V_{abs}) - V_{abs} = c$$

Therefore, we have shown that the speed of light is independent of the velocity of the source if we modify the conventional emission theory as above. This is a fusion of ether theory and emission theory. Note that the ether doesn't exist. By 'ether theory' we mean ' absolute motion theory' here. Although the ether doesn't exist (as disproved by the Michelson-Morley experiment), absolute motion does exist.

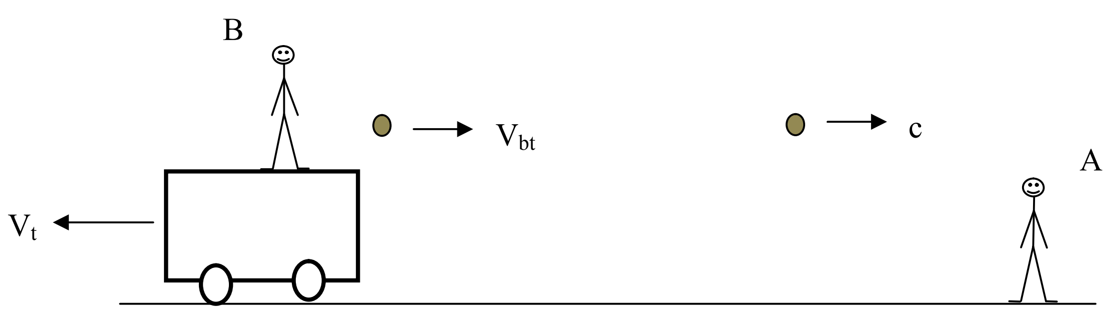
As an analogy, consider a stationary observer A and a truck moving relative to A. Another observer B is on the truck, throwing balls in the forward or backward direction while the truck is moving. Suppose the truck (and observer B) moves towards observer A with velocity V_t . The requirement is that observer B adjusts the velocity of the balls *relative to the truck* (V_{bt})so that the velocity of the ball relative to the stationary observer is always constant c irrespective of the velocity of the truck.



$$V_t + V_{bt} = \text{constant} = c$$

If observer B throws balls towards observer A while the truck is moving away from observer A , as shown below, the velocity of the balls relative to A will be the difference between V_t and V_{bt}, which is constant as above.

$$V_t - V_{bt} = \text{constant} = c$$



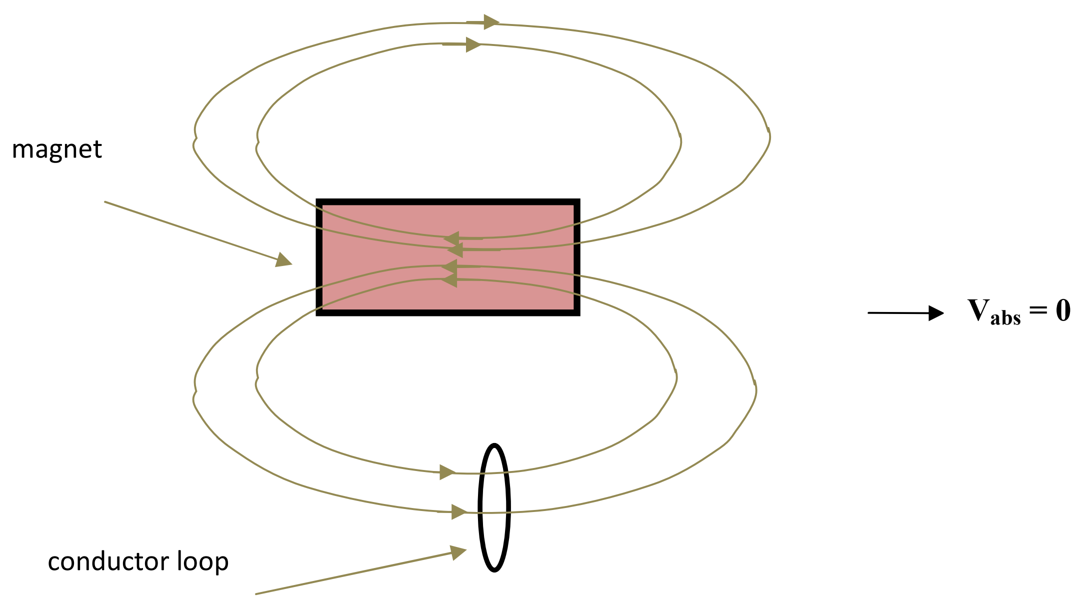
Therefore, the velocity of the balls relative to observer A is constant *c* independent of the velocity of the truck, analogous to the speed of light being constant *c* relative to an observer at absolute rest, independent of source velocity.

For a comprehensive description of AST the author recommends papers [1][2][3][4][5][6][7][8][9][10].

Moving Magnet Conductor problem

First I will present the magnet-conductor problem as presented by John D Norton [11].

Consider co-moving magnet and conductor both at absolute rest. A well known fact is that the conductor and the magnet should move relative to each other for current to be induced in the conductor loop.



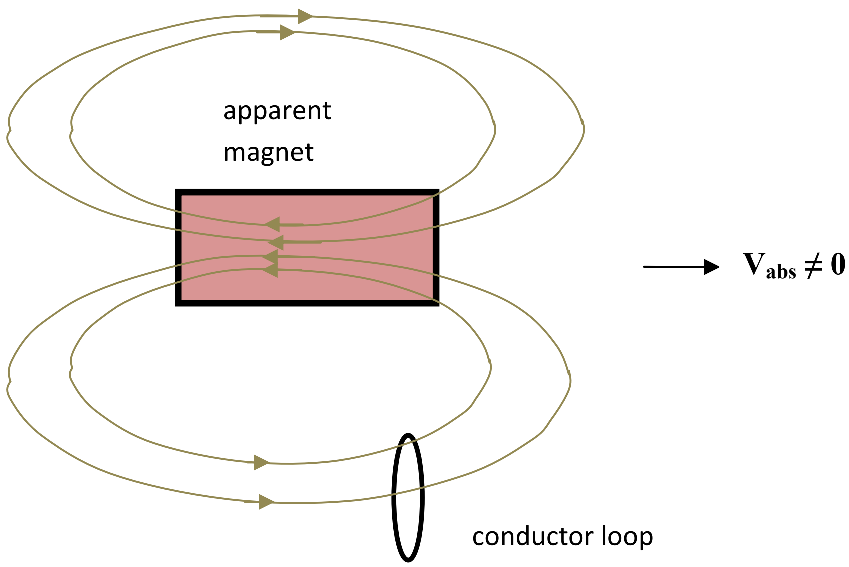
Current will not be induced in the conductor for any position of the conductor relative to the magnet if they are both at absolute rest and hence at rest relative to each other.

Now suppose that the co-moving conductor and magnet start moving with absolute velocity V_{abs} to the right. Maxwell's theory tells us that there will be no induced current in the conductor because the EMF induced in the conductor due to absolute motion of the magnet is exactly cancelled by the EMF induced due to absolute motion of the conductor in the magnetic field[11]. In effect, we can say that there should be relative motion between the magnet and the conductor for current to be induced in the conductor.

According to AST, the effect of absolute motion is to create an apparent change in position of the magnet relative to the conductor. The procedure of analyses is:

1. replace the real magnet with an apparent magnet
2. analyze the problem as if both the conductor and the *apparent* magnet are at absolute rest.

Note the apparent change in position of the magnet relative to the conductor in the next figure (the real magnet not shown). Once we replace the real magnet with an apparent magnet, we only use the apparent magnet, and not the real magnet, to analyze the system.

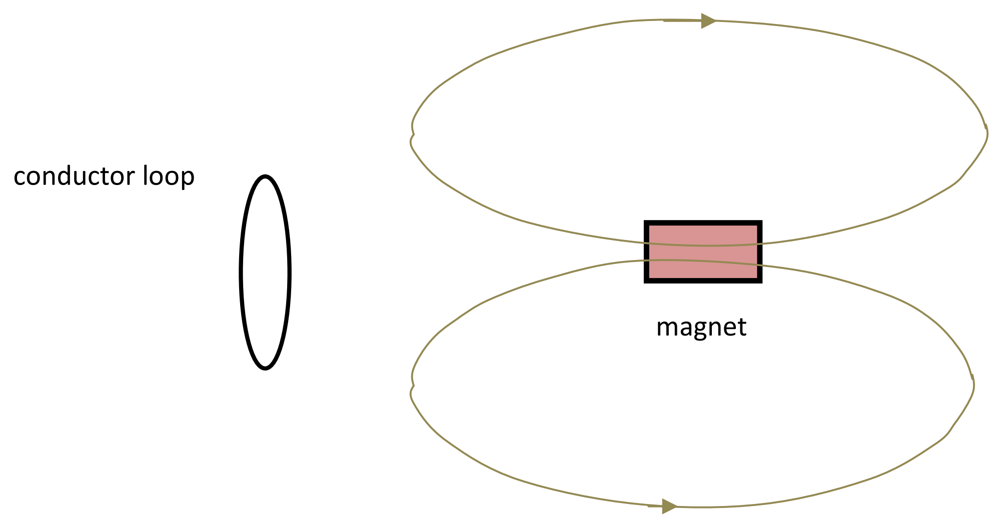


Now a simple question: will there be current induced in the conductor simply because the position of the magnet has apparently shifted relative to the conductor ? To answer this question, we ask another question. Consider a conductor and a magnet both at absolute rest. Will there be induced current only by changing the position of the magnet relative to the conductor (with both at rest, with no relative motion between them)? Obviously, the answer to the later question is 'no'. The answer for the former question is also 'no' for the same reason. This is because, once we replace the real magnet with an apparent magnet to account for the absolute velocity, we analyze the problem as if both the conductor and the apparent magnet are at absolute rest.

In order for current to be induced in the conductor, the conductor and *apparent* magnet should be in relative motion, which occurs only if the conductor and the real magnet are in relative motion. If the conductor and the real (physical) magnet are at rest relative to each other, then the conductor and the apparent magnet will also be at rest relative to each other.

Einstein's argument that it is impossible to know whether co-moving magnet and conductor are in absolute motion is wrong and misleading. An observer co-moving with the magnet detects absolute motion as follows. The observer needs a magnet which has symmetrical field, i.e. the magnitude of the magnetic field at a given point in the north pole region is equal to magnitude of the corresponding point in the south pole region. Ideally such symmetrical magnetic field can be produced, for example, by a cylindrical magnet. Then the observer measures the magnetic field at the given point in the north pole region by *moving* an infinitesimally small conductor loop relative to the magnet. Then he/she repeats the measurement at a corresponding point in the south pole region. If the magnitudes of the field are equal, and the directions correspond to that of a magnet at absolute rest, then the observer deduces that the magnet is at absolute rest. Otherwise, the magnet is in absolute motion.

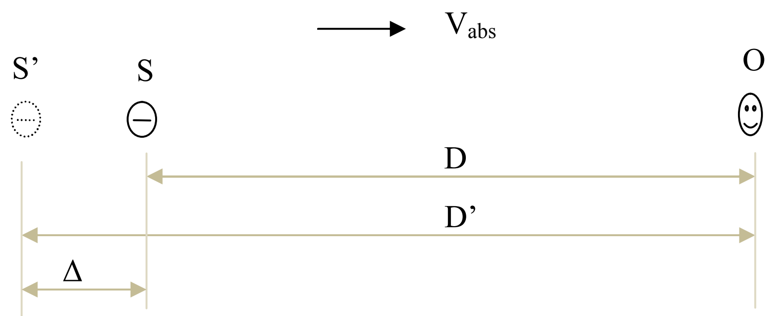
We can also discuss the moving magnet conductor problem as it is usually presented.



Consider a conductor and a magnet in relative motion. From experience we know that a definite current will be induced in the conductor loop. We assume that one of the two (*not both*) is in absolute motion and the other is at rest. The conductor is at rest while the magnet is moving or the magnet is at rest while the conductor is moving. In this case the motion of the magnet is equivalent to the motion of the conductor in that the amount of current induced in the conductor is the same in both cases. This is the 'coincidence' problem.

Now suppose that the magnet and the conductor are on a common platform moving with absolute velocity V_{abs} . Suppose that the magnet and conductor are also in relative motion, with relative velocity V, in addition to their common absolute velocity. In this case, unlike the last case, the motion of the magnet and the motion of the conductor will not be equivalent, even for the same relative velocity V. The amount of current induced in the conductor will be different for the different cases, even if the relative velocity remains the same in all cases.

To clarify this point, consider the same problem in the case of electrical charge, for convenience.



It has been postulated in [1] that, for absolutely co-moving charge and observer the effect of absolute motion is to create an apparent change in position of the charge relative to the observer. The real distance D and the apparent distance D' between the observer and the charge are determined as:

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

But

$$\Delta = D' - D$$

From which

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

where V_{abs} is the absolute velocity *of the charge*.

We will see the effect of observer velocity and charge velocity. Suppose that the charge is at rest relative to the platform but the observer is moving with velocity V relative to the charge (relative to the platform). In this case there is no change in V_{abs} which represents the absolute velocity of the charge in the above equations. Therefore, the apparent distance D' will be:

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

Now suppose that the charge is moving relative to the platform (relative to the observer) with velocity V but the observer is at rest relative to the platform. In this case, V_{abs} in the above equations will change because it represents the absolute velocity of source (charge) in the above equations.

$$V_{abs}' = V_{abs} \pm V$$

Therefore, for the same distance D , the apparent distance D' will be different from the previous case.

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

Therefore, we have seen that the velocity of the charge and the velocity of the observer are not equivalent if *both* the source (charge) and the observer have non-zero absolute velocities. For the same physical distance D, they will have different effects. In this case the effect is the electric field measured by the observer.

The same procedure applies for co-moving magnet and observer. In this case also, if both are in absolute motion, motion of the magnet and motion of the observer will never be equivalent, even if the relative velocity V is the same in the two cases.

'Coincidence' of the effect of electric and magnetic fields

So far we haven't considered the case of either the magnet or the conductor (not both) being at absolute rest. In a previous paper[1] it has been shown that the electric field of an absolutely moving electron is as if the field is rigidly carried by the electron, as seen by an observer at absolute rest, and this has been confirmed experimentally[12]. Therefore, if the field is carried rigidly by the electron, the motion of the electron and the motion of the observer are equivalent, at least to the first order of V/c. Likewise, the field of a magnet in absolute motion is as if it is carried rigidly by the magnet, relative to an observer at absolute rest.

Conclusion

In this paper we have shown that Einstein's argument regarding the Moving Magnet Conductor problem is fallacious because a co-moving conductor will detect the absolute motion of a magnet as a deformation of the magnetic field. The effect of absolute motion for co-moving magnet and (infinitesimal) conductor is just to create an apparent change in position of the magnet relative to the conductor. Einstein's argument will not lead relativity because it is limited to the special case in which at least one of the two (the conductor or the magnet) is at rest. It fails for the general case in which *both* the magnet and the conductor are in absolute motion, while in relative motion.

Thanks to God and the Mother of God, Our Lady Saint Virgin Mary

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