The Rest Frame of the Michelson-Morley Experiment as the Preferred Reference Frame in the Special Theory of Relativity

HenokTadesse, Electrical Engineer, BSc.
Ethiopia, Debrezeit, P.O Box 412
Mobile: +251 910 751339; email *entkidmt@yahoo.com* or *wchmar@gmail.com*
03 October 2017

Abstract

In order to explain the null result of the Michelson-Morley experiment, Einstein denied the existence of the absolute reference frame. It will be shown that all Einstein did was replace the absolute reference frame with another preferred reference frame: the rest frame of the Michelson-Morley apparatus. According to the Special Theory of Relativity (SRT) , there is no preferred reference frame and all inertial reference frames are equivalent in predicting and analyzing the result of the Michelson-Morley experiment. No reference frame, including the rest frame of the experiment, has any special significance over other reference frames. It will be shown that the SRT analysis of the experiment violates this principle. This is because all other inertial observers moving relative to the Michelson-Morley apparatus do not know the outcome of the experiment until they get the experimental result of the observer in the rest frame of the apparatus. Only then can they use the Lorentz Transformation equations to 'predict' the 'null' outcome of the experiment in their own reference frames. If all inertial reference frames are really equivalent, why not first analyze the experiment in one of the reference frames moving relative to the apparatus, in which case there will be a fringe shift δ, and use Lorentz Transformation so that all other observers (including the observer in the rest frame of the apparatus) agree on the same fringe shift δ. The Special Relativity Theory (SRT) is just another form of Lorentz ether theory (LET): both depend on a preferred reference frame. In LET the ether is the preferred reference frame, while in SRT the rest frame of the experimental apparatus is the preferred reference frame. SRT only shifted the privilege of deciding the outcome of the experiment from the absolute reference frame to the rest frame of the Michelson-Morley experiment. The same hidden fallacy exists in the SRT analysis of the Trouton-Noble experiment. An alternative theory of absolute motion and the speed of light will be proposed.

Introduction

The null result of the Michelson-Morley experiment provoked the Lorentz Transformation, Lorentz's ether theory and the Special Relativity Theory (SRT). According to SRT, the laws of physics (mechanics and electromagnetism)are the same in all inertial reference frames. The Lorentz Transformation equations ensure that all observers predict the same outcome of experiments. In the case of the Michelson-Morley experiment(MMX), all observers moving relative to the experimental apparatus will predict the same null fringe shift as the observer in the rest frame of the apparatus. We will see a hidden fallacy in the standard analysis.

Fallacy in the SRT analysis of the Michelson-Morley experiment

In the standard analysis of the Michelson-Morley experiment, Lorentz Transformation equations are applied so that the same *null* fringe shift is predicted in all inertial reference frames moving relative to the rest frame of the experimental apparatus.

The hypothesis that all inertial reference frames are equivalent can only be truly tested as follows. Imagine a Michelson-Morley apparatus and some inertial reference frames, including the rest frame of the MMX apparatus. Since, according to the second postulate of SRT, the speed of light is independent of the velocity of the source in all inertial frames (all observers have 'their own ether'), all observers will predict different fringe shifts in their own reference frames, except the observer in the rest frame of the apparatus, which predicts a null fringe shift (according to SRT).

Consider inertial reference frames S_0 ,S_1, S_2, S_3, S_4 and S_5 , where S_0 is the rest frame of the MMX apparatus, all moving relative to each other. Let the fringe shifts be δ_0 ,δ_1 , δ_2 , δ_3 , δ_4 and δ_5 in S_0 , S_1, S_2, S_3, S_4 and S_5 , respectively. The fringe shift in the rest frame of the apparatus is (according to SRT) obviously null (i.e. δ_0 = NULL).

But all observers cannot predict different fringe shifts; they should agree on the same fringe shift, whether a null or no-null fringe shift. This is ensured by the Lorentz Transformation.

The crucial question is: since SRT asserts that all inertial reference frames are absolutely equivalent, and since all observers should agree on the same fringe shift, which fringe shift should the observers agree on ? Once they agree upon one of the fringe shifts, then Lorentz Transformation can be applied so that all the other observers will also predict the same fringe shift.

Since all inertial reference frames, *including the rest frame* of the apparatus, are absolutely equivalent (SRT), then we cannot choose, for example S_1, in which the fringe shift is $\delta 1$. Otherwise, this would violate the principle that there is no preferred reference frame.

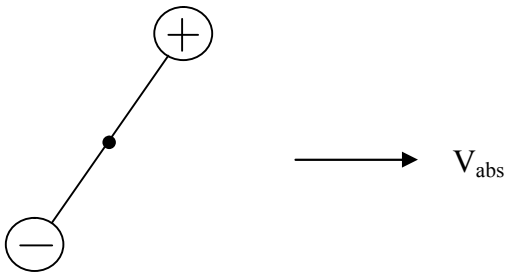
SRT contradicts itself by choosing S_0, the rest frame of the apparatus, by assuming that all other observers should predict a null fringe shift.

In the case of the Michelson Morley experiment, the rest frame (S_0) of the apparatus is *presumed* to be the preferred reference frame because only in S_0 can the outcome of the experiment be 'correctly' predicted: a 'null' fringe shift. SRT presumes that the 'correct' result is the one observed in the rest frame of the MMX apparatus. Therefore, all other reference frames moving relative to S_0 are the non-privileged frames because they should predict the same result as S_0.

The Special Relativity Theory (SRT) is just another form of Lorentz ether theory (LET): both depend on a preferred reference frame. In LET the ether is the preferred reference frame, while in SRT the rest frame of the experimental apparatus is the preferred reference frame. SRT only *shifted* the privilege of deciding the outcome of the experiment from the absolute reference frame to the rest frame of the Michelson-Morley experiment.

Fallacy in the SRT analysis of the Trouton- Noble experiment

The Trouton-Noble experiment was designed as a test of the SRT. Absolute motion (ether) theory predicts a torque developed in a system of two absolutely co-moving charges. Apparently, a 'null' fringe shift was observed in the experiment.



The same fallacy exists in the SRT analysis of the Trouton Noble experiment. The zero torque in the rest frame of the charges is presumed to be what all observers moving relative to the charges should observe. This means that the rest frame of the charges is the privileged reference frame because the predicted outcome in this frame (which is 'null') is presumed to be the only 'correct' outcome of the experiment. This is a self-contradiction in SRT. The rest frame of the charges should have no special significance according to SRT itself; it should be considered as all the other inertial frames in every respect.

Therefore, strictly following SRT's postulates, all reference frames, including the rest frame of the charges, are equivalent in all respects. Therefore, we should also be able to choose *any* reference frame moving relative to the charges in which there will be a torque, and use Lorentz Transformation for other reference frames, including the rest frame of the apparatus, to ensure that all observers agree on the same magnitude of torque. But this will lead to absurdity: there will be infinitely many possible torques because there are infinitely many possible inertial frames. We cannot choose the rest frame of the charges to avoid this absurdity because the rest frame has no special significance. The conclusion is that a strict application of SRT leads to absurdity.

Emission theory

Just as an additional clarification of the above argument, consider the emission theory of light. The emission theory fulfills the principle of relativity better than SRT. This is because, according to emission theory, all inertial reference frames are truly equivalent. The rest frame of the Michelson-Morley apparatus has no special significance in emission theory. This is just to illustrate the failure of SRT in that it contradicts its own premise: there is no preferred reference frame . Emission theory has been disproved by moving source experiments and is not compatible with Maxwell's equations.

We discard the reference frame concept altogether and take a new approach to solve the century-old light speed puzzle as follows.

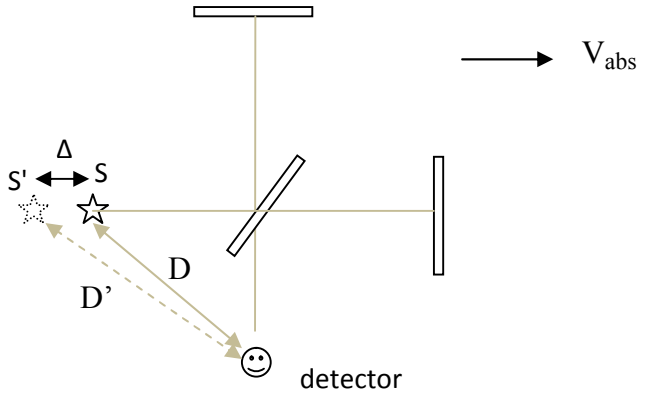
Apparent Source Theory (AST)

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 form of Apparent Source Theory - Modified Emission Theory

An intuitive form of AST is as follows.

The speed of light relative to a source 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.

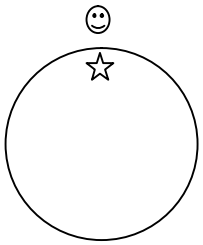
Michelson-Morley experiment

It is now easy to explain the null result of the Michelson-Morley experiment (MMX) by the modified emission theory above. Intuitively, 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 relative to the source will not cause any fringe shift because both the transverse and longitudinal beams will be affected equally.

The hypothetical Sagnac effect

The explanation of the hypothetical Sagnac effect is also straight forward. A hypothetical Sagnac device is one in which the light travels around a circular path by a continual reflection from circular mirror.



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 ($c - V_{abs}$) :

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

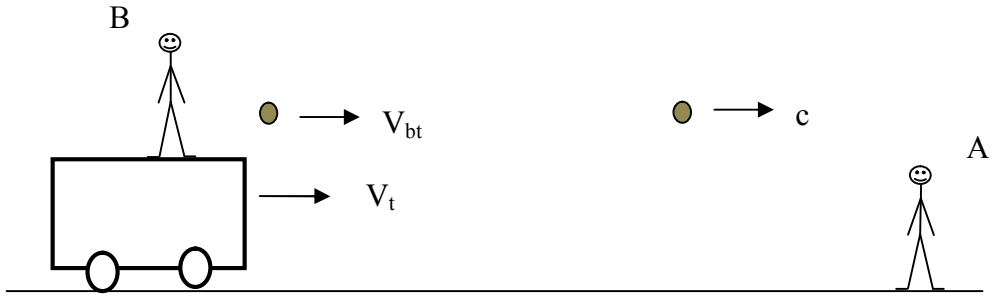
In the case of an observer who is at absolute rest behind a light source moving with absolute velocity V_{abs} , the velocity of light is $c + V_{abs}$ in the backward direction *relative to the source.*

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.

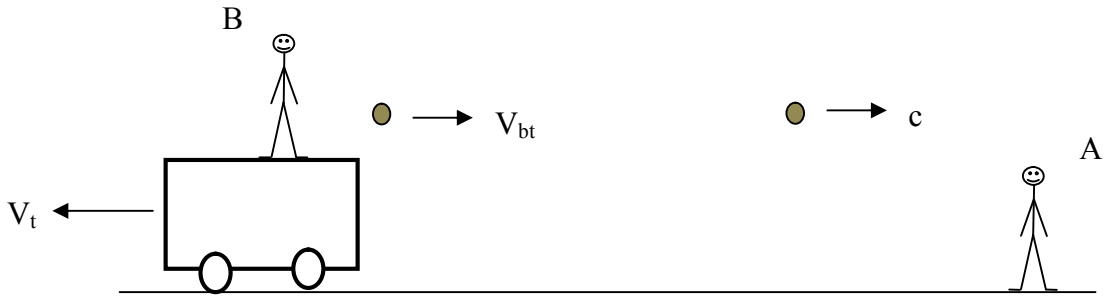
As an analogy, consider a stationary observer A and a truck moving relative to A. Another observer B is on the truck, throwing balls in the forward or backward direction while the truck is moving. Suppose the truck (and observer B) moves towards observer A with velocity V_t . The requirement is that 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.

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



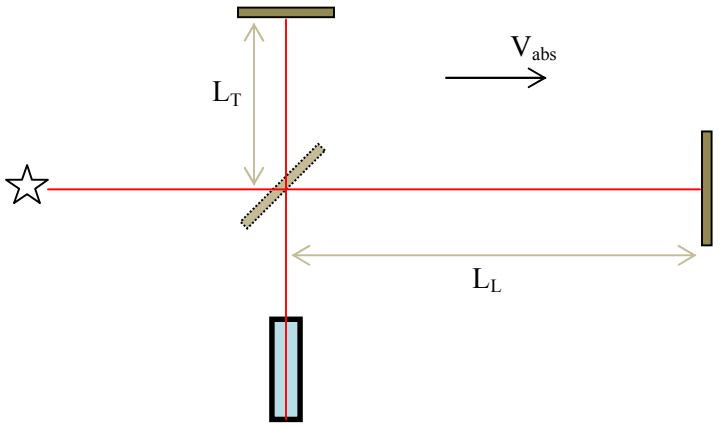
Therefore, the velocity of the balls relative to observer A is constant *c* independent of the velocity of the truck, analogous to the speed of light being constant *c* relative to an observer at absolute rest, independent of source velocity.

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

Limitation of the intuitive form of AST

It should be noted that the intuitive form has limited applicability and is only meant to present Apparent Source Theory (AST) in a more intuitive form, in order to show its potentials. We have already shown that the intuitive form easily explains the Michelson-Morley experiment, moving source experiments and the hypothetical (circular) Sagnac experiment.

However, the intuitive form not only has limitations but also is fundamentally wrong. The limitation becomes clear when one tries to apply it to the generalized Michelson-Morley experiment in which the arm lengths can be unequal, such as in the Kennedy-Thorndike experiment. We know that the Kennedy-Thorndike experiment also gave a 'null' fringe shift, like the Michelson-Morley experiment. The intuitive form of AST predicts a fringe shift for unequal arm lengths.



According to the intuitive form of AST, the velocity of light moving with absolute velocity V_{abs} is $c - V_{abs}$ in the forward direction *relative to the real/physical source*. Therefore, the velocity of both the incident and reflected lights of both the longitudinal and transverse light beams would be $(c - V_{abs})$, in the reference frame of the apparatus. This would be $(c + V_{abs})$ if the direction of absolute velocity of the apparatus was to the left.

Therefore, the difference between the round trip times of the longitudinal and transverse light beams would be:

$$\Delta T = \frac{2L_L}{c - V_{abs}} - \frac{2L_T}{c - V_{abs}} = \frac{2}{c - V_{abs}} \left(L_L - L_T \right)$$

We can see that, for $L_L \neq L_T$, the intuitive form predicts a fringe shift, with change in orientation of the experimental apparatus relative to the absolute velocity of the Earth (i.e. with change in absolute velocity). We know that there was a 'null' fringe shift in the Kennedy-Thorndike experiment.

For example, if the fringe position was observed while the experimental apparatus was moving to the right, and then the direction of the absolute velocity was changed to the left (this is done by rotating the apparatus), the fringe shift would be calculated as follows.

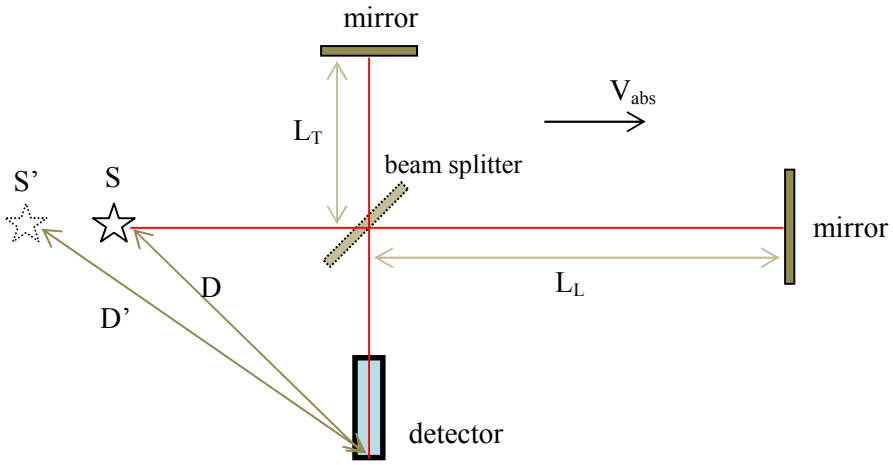
$$\delta t = \frac{2}{c - V_{abs}} \left(L_L - L_T \right) - \frac{2}{c + V_{abs}} \left(L_L - L_T \right)$$

$$\delta t = 2 \left(L_L - L_T \right) \left(\frac{1}{c - V_{abs}} - \frac{1}{c + V_{abs}} \right)$$

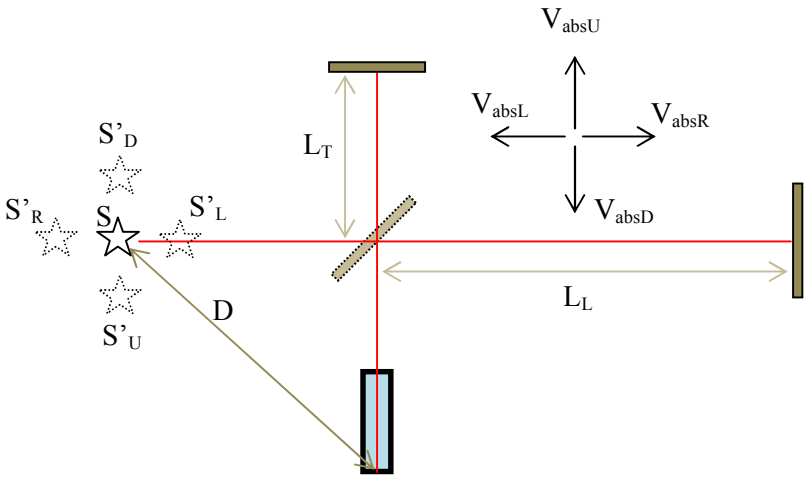
$$\delta t = 4 \left(L_L - L_T \right) \left(\frac{V_{abs}}{c^2 - {V_{abs}}^2} \right)$$

For example, for V_{abs} = 390 Km/s , (L_L - L_T) = 10 cm , the fringe shift for λ = 600nm is calculated to be 867 wavelengths. This contradicts the null fringe shift of the Kennedy-Thorndike experiment.

It is easy to figure out that Apparent Source theory (AST) predicts a 'null' fringe shift both for the Michelson-Morley and Kennedy-Thorndike experiments.



According to AST, the effect of absolute motion of the interferometer in the Michelson-Morley and Kennedy-Thorndike experiments is to create an apparent change in position of the light source relative to the detector. An apparent change in the position of the source relative to the detector will not create any (significant) fringe shift for the same reason that an actual/physical change of the source will not create any (significant) fringe shift. There will not be any (significant) fringe shift if the position of the light source was slightly changed both in the Michelson-Morley and Kennedy-Thorndike experiments. According to AST, rotation of the experimental apparatus (with respect to Earth's absolute velocity) is equivalent to slight corresponding change of the source position: both will result in a 'null' fringe shift. 'Null' is quoted here because there may be small fringe shift, much less than that predicted by the ether theory. The exact amount of fringe shift is determined from optics.



The intuitive form is also fundamentally wrong because it treats light in the conventional way: light presumed as a local phenomenon. According to AST, light is a dual phenomenon: *local and non-local*. AST is the fundamentally correct theory.

Implication for Lorentz's ether theory and Einstein's relativity theories

The whole story of relativistic physics began with the null result of first order and second order ether drift experiments and the constant *c* in Maxwell's equations. The theoretical framework proposed in this paper successfully explains many light speed experiments[1]that have puzzled physicists for decades, without invoking any exotic ideas such as the ether, length contraction, time dilation.

Experimental evidences for absolute motion have accumulated, including the Miller experiments, the Sagnac effect, the Marinov, the Silvertooth, the CMBR anisotropy, the Roland De Witte experiments[1].

Experimental evidences [13] also exist supporting the dependence of the (group) velocity of light on the observer velocity. An alternative explanation also exists[1] (Exponential Law of Doppler Effect) for the Ives-Stilwell experiment.

It has been confirmed experimentally [12] that electrostatic fields have infinite speed, disproving the Special Theory of Relativity, which has its foundation on the assumption that no information can be transmitted at speed greater than the speed of light. The universal speed limit applies only to physical/material objects that have mass[1].

The equivalence principle has also been shown to be wrong[14].

Therefore, Lorentz's transformations and all theories based on it (Lorentz's ether theory, Special Relativity and General Relativity) are rendered wrong and irrelevant by theoretical and experimental evidences presented in this paper.

Conclusion

It has been shown that the Special Theory of Relativity (SRT) depends on a privileged reference frame: the rest frame of the experimental apparatus, to predict the outcome of the Michelson-Morley experiment. This is a self-contradiction. A new, compelling theory of absolute motion and the speed of, Apparent Source Theory, has also been proposed. The Special Theory of Relativity has been refuted by experimental, logical and theoretical evidences.

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

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