The Irrelevance of Abstract Reference Frames in Physics

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Abstract

In the past century, abstract mathematical reference frames have become the universal way to formulate and understand the fundamental laws of physics. Galileo's principle of relativity and Einstein's special relativity theory states that the laws of physics are the same in all inertial reference frames. The subtly hidden assumption in this statement is that the laws of physics can be formulated correctly at least in one inertial reference frame, which is shown to be wrong. In the general theory of relativity (accelerating) reference frames can even affect the laws of physics. The true laws of physics became hidden by the very idea of using *reference frames as the observers*. In the reference frame concept, the laws of physics are formulated as seen by the third observer, i.e. reference frame. The mystery that has eluded physicists so far is that a third observer (reference frame) is irrelevant or cannot see the true nature of electromagnetic interaction between two charges, for example. Electromagnetic and gravitational phenomena are elusive in that they do not act in the classical way expected by the third observer (reference frame). The traditional concept of reference frames was based on classical, conventional thinking and experience, such as the motion of a ball or the propagation of classical waves as seen in two relatively moving inertial frames. Einstein's special relativity theory was built upon the fallacious Galileo's reference frames. Galileo's relativity is only approximately correct and applies only to ordinary, everyday experiences and is fundamentally wrong. According to the new theory proposed in this paper, the *observer* is fundamentally the body or particle *directly* experiencing electromagnetic or gravitational fields and waves. The *observer* is the atom, molecule, electron or proton directly detecting or experiencing electromagnetic and gravitational fields and waves, such as the atoms in light detecting devices, the human eye or massive bodies experiencing gravitation of another body. Einstein (correctly) discovered his chasing a beam of light thought experiment. However, since physicists universally thought in terms of reference frames, this (wrongly) led him to the special theory of relativity. The principle of relativity should be discarded ; reference frames, whether inertial, accelerating or rotating , are irrelevant in the formulation of the fundamental laws of physics. The concept of reference frames must be abandoned altogether. The fundamental laws of physics cannot be correctly formulated in any reference frame, i.e. relative to the third 'observer' who is not directly experiencing electromagnetic or gravitational phenomena. A new way of formulating the laws of physics relative to (as seen by) the *direct observer* is introduced. Newton's and Mach's views on inertia will be reconciled.

Introduction

During the past century, abstract reference frames have become the universal way or the paradigm to think of, understand and formulate the laws of physics. Galileo was the first to introduce the concept of inertial reference frames in order to formulate his principle of relativity. Humans have always thought about the laws of physics in terms of reference frames because it is the natural way and no other way was conceivable. However, during the past century reference frames have taken an even fundamental role in physics, with the advent of special relativity.

Galileo's principle of relativity is stated as: the laws of mechanics are the same in all inertial reference frames. This means that if a law of physics, such as Newton's law of gravitation, is correctly formulated in one reference frame, the same law can be obtained by using Galilean transformation for other reference frames in relative motion.

Einstein extended Galileo's principle of relativity to include electromagnetism: the laws of physics are the same in all inertial reference frames. This principle suggested that the speed of light, as a law of physics, must also be the same constant *c* in all inertial reference frames. The constancy of the speed of light in all inertial reference frames required a new coordinate transformation law different from Galilean transformation. From this law followed the relativity of space and time, length contraction and time-dilation, and much of 20th century physics.

Einstein (correctly) discovered his beautiful chasing a beam of light thought experiment [1][2]. However, since physicists universally thought in terms of reference frames, this (wrongly) led him to the special theory of relativity.

The hidden fallacy in the principle of relativity

The principle of relativity is restated below:

the laws of mechanics and physics are the same in all inertial reference frames.

The principle of relativity makes two crucial assumptions:

1. the laws of physics can be formulated correctly in at least one inertial reference frame
(this is a hidden assumption, not explicitly stated)

2. the same laws of physics hold in all other relatively moving inertial reference frames, which is made possible by using coordinate transformation equations.

There is a hidden assumption in the above statement of relativity that no one has noticed and questioned for centuries. It has always been implicitly assumed that the laws of physics can be correctly formulated in at least one inertial reference frame. The principle of relativity starts by assuming that the laws of physics can be correctly formulated at least in one inertial reference

frame and then concerns itself with how the same laws can be obtained in other relatively moving inertial reference frames, by using coordinate transformation equations.

The subtly hidden and fallacious assumption is that the fundamental laws of physics can be correctly formulated at least in one inertial reference frame. In this paper, it is revealed that *the fundamental laws of physics cannot be correctly formulated in any reference frame* in the first place, including the absolute reference frame and the rest frame of the Michelson-Morley (MM) experiment, for example. In other words, any attempt to formulate the laws of physics in any (inertial) reference frame will be fundamentally wrong. The absolute reference frame wrongly predicts a large fringe shift (0.4 fringes in the 1887 experiment) for the Michelson-Morley experiment and the rest frame of the Michelson-Morley experiment wrongly predicts a completely null result and thus fails to predict the small fringe shifts observed in the Miller experiments. Special relativity starts by wrongly assuming a null fringe shift for the rest frame of the MM experiment.

The reference frames approach can be approximately correct for ordinary classical phenomena, but fundamentally it is wrong. For example, Newton's law of gravitation cannot be formulated correctly in any reference frame. This also means that Newton's law of gravitation is not completely correct in its current form. This is why it has failed, for example, to account for the anomalous precession of Mercury's perihelion. Newton's law of gravitation is incomplete because it doesn't predict perihelion advance for a two body system. This is not a failure of Newton's law itself, but a failure of the reference frame concept with which Newton's law and other laws of physics have been formulated.

The concept of reference frames was originally introduced by Galileo. It is based on fundamentally wrong classical, conventional thinking and experiences at the time of Galileo, such as the motion of a ball or the propagation of classical waves as seen from two relatively moving inertial reference frames. The laws of physics formulated relative to Galileo's reference frames can be approximately or sufficiently correct for ordinary phenomena, such as projectile motion of a ball. Newton's law of gravitation can be formulated only approximately by using Galileo's inertial reference frames. However, physicists in the second half of the 19th century adopted Galileo's reference frames as the fundamental way to formulate the laws of physics. Einstein adopted and modified Galileo's concept of reference frames. Thus the mystery of electromagnetism and gravitation remained hidden for centuries.

The direct observer

The traditional concept of reference frames is fundamentally wrong because the laws of physics are being formulated from the point of view of the *third 'observer'*, which is Galileo's reference frame. The crucial distinction revealed here is that the laws of physics cannot be formulated

correctly from the point of view of the third 'observer', the 'observer' that is not directly experiencing or detecting electromagnetic and gravitational phenomena.

In this paper, we introduce a new concept of the ' *direct observer* '. This is the true observer that is directly detecting or experiencing electromagnetic and gravitational fields and waves. The laws of physics can be formulated correctly only from the perspective of the 'direct observer' , according to a new theory called Apparent Source Theory (AST) [1][2].

Apparent Source Theory

A new fundamental law of physics is proposed as follows:

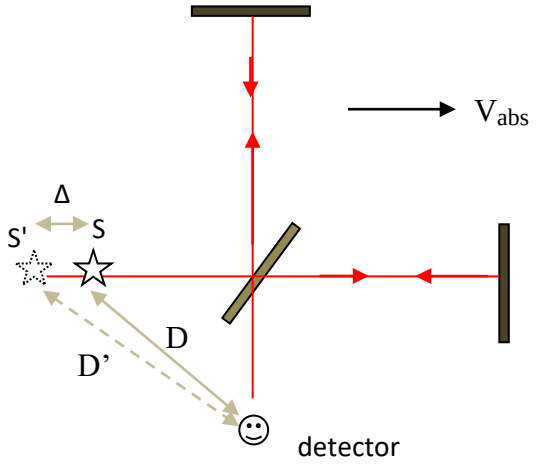
The effect of absolute motion of an observer is to create an apparent change in the position of the source relative to the observer. This means that absolute motion of the "direct observer" creates an apparent change in the point (distance and direction) of light emission relative to the observer and an apparent change in position of a source of electrostatic field (charge) or gravitational field (mass).In other words, absolute motion of the direct observer creates an apparent change in the past position of a light source and an apparent change in the current (instantaneous) position of a source of static field . Absolute motion of an observer creates an apparent change in the current position of a charge and an apparent change in the current position of a mass.

This theory is called Apparent Source Theory (AST).

Consider a light source S and an absolutely moving observer O. Assume that the physical/actual distance between the light source and the observer is *D*, at the instant of light emission. Apparent Source Theory states that, to the observer it appears that the light was emitted from distance *D'*, not *D*. That is, absolute motion of the observer creates an apparent change in the past position of the light source. Therefore, accordingly, it takes the light time $t = D'/c$ to reach the observer, where

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

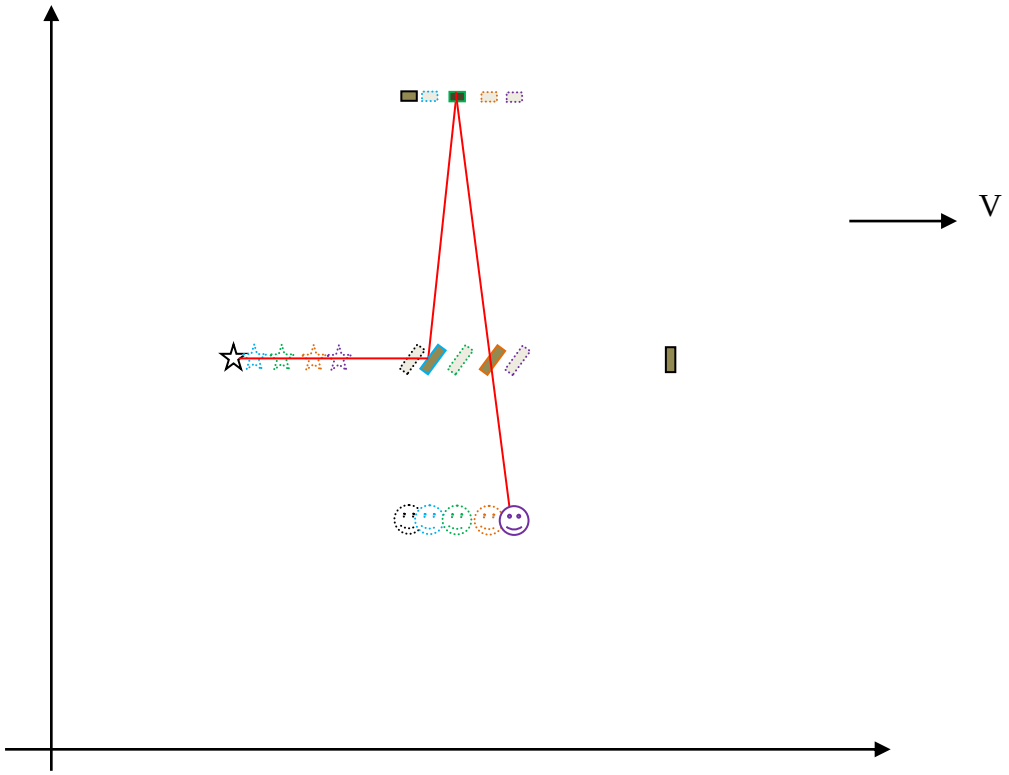
The only effect of absolute motion of the observer is to create an apparent change in point of light emission relative to the observer. This is unlike ether theory, in which motion of the mirrors and beam-splitters in the ether are considered. In the case of the Michelson-Morley experiment, therefore, the effect of absolute motion of the *direct observer*/detector is to create an apparent change in the point of light emission (i.e. an apparent change in the position of the light source), as shown below.



For the absolute velocity directed to the right shown above, therefore, there will be no fringe shift for the same reason that there will be no fringe shift if the light source was actually/ physically shifted from S to S' instead of setting the apparatus into absolute motion. This is because both the longitudinal and transverse light beams will be delayed exactly by the same value. The crucial distinction of Apparent Source Theory is that only the (absolute) motion of the observer is relevant, and the mirrors are assumed to be in their actual position. The effect of observer's/detector's absolute motion is to create an apparent change in position of the light source as seen by the observer/detector.

Traditionally, the analysis of the Michelson-Morley experiment in a reference frame in which it is moving led to the prediction of a fringe shift which contradicted the 'null' result of the experiment. This led to the development of Lorentz's length contraction and Lorentz's transformation equations, which were developed to explain the null results of such experiments. Thus, we can see that Galileo's fallacious reference frame concept has led to a fringe shift, which in turn led to the development of relativistic physics. The fallacy was to apply Galilean transformation which resulted in a fringe shift, which in turn required resorting to unnatural hypotheses such as length contraction and illogical ideas such as time dilation.

From the perspective of the (third) observer at rest in the reference frame in which the Michelson-Morley interferometer is in motion, the path of transverse light beam is as shown below. The path for the longitudinal beam can also be drawn in a similar way.



We can see that the path length of light depends on the velocity of the Michelson-Morley relative to the reference frame.

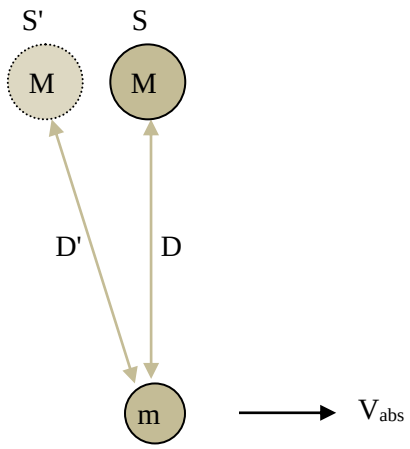
According to Apparent Source Theory, the path length of light is determined only by the absolute velocity of the observer/detector, independent of the velocity of the interferometer in any reference frame.

Application of Apparent Source Theory to Gravitation and Electrostatics

Now let us apply Apparent Source Theory in formulating Newton's law of gravitation and Coulomb's law of electrostatic force.

Apparent Source Theory for electrostatics and gravitation is restated as follows [1][2]:

The effect of absolute motion of an observer is to create an apparent change in the current / instantaneous position (distance and direction) of the source of gravitational field (mass) and the source of electrostatic field (charge).



This means that, as seen by mass *m*, the current position of mass *M* is at *D'* , not at its actual position *D*. Although the position of mass *M* now is actually at *D* relative to *m*, gravity behaves as if the position of *M* now is at *D'*, as seen by *m* . This apparent change in position of *M* as seen by *m* is created due to absolute motion of *m*. Only when *m* is at absolute rest can the actual position (distance) *D* be correctly used to compute the gravitational force of *M* on *m*.

Newton's law of gravitation for the force of gravitation of M on *m* , for *m* moving with absolute velocity V_{abs} to the right, is therefore:

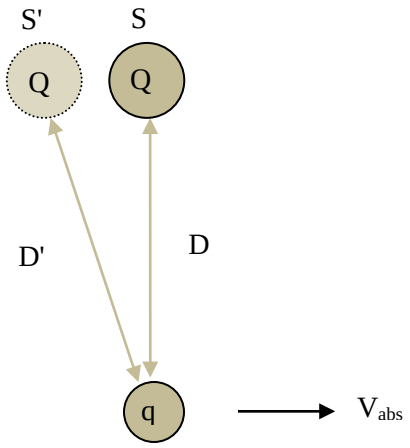
$$F = G\,\frac{Mm}{D'^{\,2}}$$

where [1][2]

$$D' = D\frac{c}{\sqrt{c^2 - {V_{abs}}^2}}$$

For electrostatic force:

$$F = \frac{1}{4\pi\varepsilon_0}\frac{Q\,q}{D'^2}$$

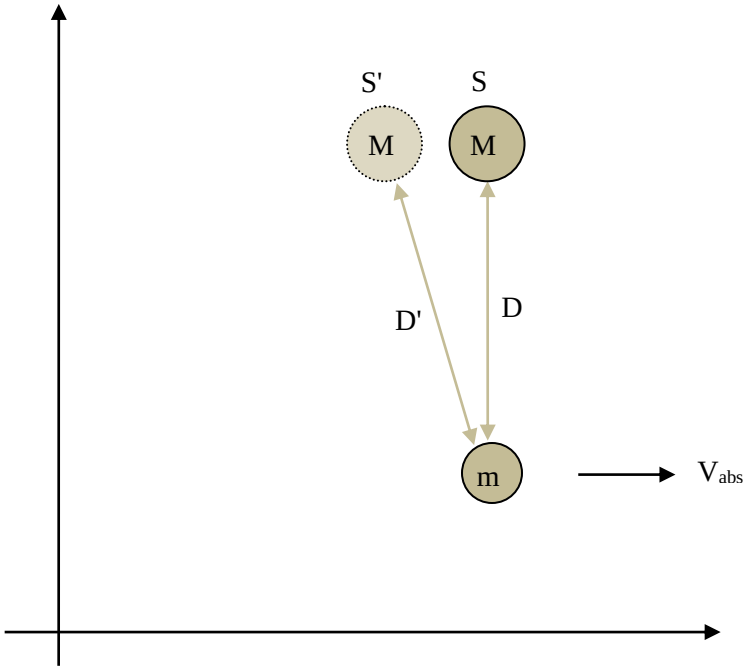


Therefore, the only way to correctly model gravitational and electrostatic force experienced by a given mass *m* and charge *q* , which are here the "direct observers", respectively, is to assume an apparent change in position of the other mass *M* and the other charge *Q*, and accordingly compute the force by using the apparent distance *D'* . The apparent change in the instantaneous position of the other mass *M* and the other charge *Q* is determined by the absolute velocity of the observer mass *m* and the observer charge *q*, respectively, and the physical/actual distance *D* and the orientation of the line connecting the two masses or the two charges relative to the absolute velocity vector [1][2]. In the figures above the line connecting *Q* and *q* , and the line connecting *M* and *m* ,is assumed to be perpendicular to V_{abs}.

Analysis of these systems with the traditional concept of reference frames is fundamentally flawed. The fact that *M* always appears to be at distance *D'* , and not *D* , relative to (as seen by) *m* will elude all third observers (reference frames), which assume that *m* sees *M* to be at distance

D. Apparent Source Theory states that *m* always sees *M* to be at distance (position) *D'*, which depends only on the absolute velocity of *m*, and the velocity of any reference frame is irrelevant.

To avoid confusion, we state the procedure of analysis of a two body gravitational problem by using an absolute reference frame as follows. In order to determine the gravitational force of *M* on *m* , for example, we don't use the actual/physical distance *D* as measured in the reference frame; we use the apparent distance *D'* as seen by *m* . What is surprising is that the distance we use to determine the gravitational force of *m* on *M* will be different from the distance we use to determine the gravitational force of *M* on *m* . The former depends on the absolute velocity of *M* and the latter depends on the absolute velocity of *m* , which are independent.



What is absolute motion ?

In the formulation of Apparent Source Theory above, we have used the absolute velocity of the observer. But we know that the ether has been disproved by the Michelson-Morley experiment. On the other hand, absolute motion has been decisively detected in multiple experiments such as the Silvertooth experiment, the CMBR anisotropy experiment and the Marinov experiment. Therefore, this leads to the conclusion that absolute motion exists, but the ether doesn't exist and hence absolute motion is not motion relative to the ether.

The question is: if absolute motion exists but is not motion relative to the ether, then what is absolute motion ? In my papers [2][3] I have argued that absolute motion is basically motion relative to all matter in the universe.

Absolute motion is proposed to be motion relative to the space defined or 'fixed' by a collection of massive cosmic objects, such as a collection of nearby (local) galaxies and stars. A group of local cosmic bodies (stars, galaxies) collectively define or 'fix' the space in their vicinity which will be the local absolute space. Thus the local absolute space in which the solar system is moving can be in motion relative to a local absolute space defined by a group of galaxies and stars millions of light years away.

The laws of physics, such as Newton's law of gravitation and Coulomb's law of electrostatic force, are incomplete in their current form and should be modified to include the effect of absolute motion. The laws of physics can be formulated in their simplest forms relative to the *direct observer that is at absolute rest*, the real observer/detector directly experiencing electromagnetic and gravitational phenomena. Apparent Source Theory (AST) states that the effect of absolute motion of the direct observer is to create an apparent change in point of light emission or an apparent change in position of sources of electrostatic and gravitational fields relative to the observer. Absolute motion of the observer in the local absolute space will modify the simple laws of physics. Thus the results of experiments can be correctly explained and predicted by taking into account the apparent change of the source (source of light, electromagnetic, electrostatic, gravitational fields and waves) as seen by (relative to) the "direct observer" in absolute motion, according to AST.

Intimate relation between inertia and absolute motion - Reconciling Newton's and Mach's views of inertia

Newton argued by using his rotating bucket argument that inertia is relative to absolute space. Ernest Mach, on the other hand, rejected Newton's absolute space and argued that inertia of a body is relative to all other bodies in the universe. In my recent paper[3], I have explained inertia as a net electromagnetic interaction of the body relative to all matter in the universe and that absolute motion of a body is basically the motion of the body relative to all matter in the universe. Velocity of an object relative to more massive and nearby bodies significantly determines the absolute velocity of that object, whereas velocity of the object relative to less massive and distant bodies will have less effect on the absolute velocity of the object.

Absolute motion of an object can also be seen as motion relative to local absolute space created collectively by a group of local galaxies or local stars within a galaxy. Cosmic massive bodies collectively define or 'fix' the space in their vicinity to create local absolute space. Motion of an object relative to this local absolute space is absolute motion. A device capable of detecting

absolute motion, for example the Silvertooth experiment, can detect motion relative to the local absolute space.

Thus we have reconciled Newton's and Mach's views on inertia. Newton's argument that inertia is relative to absolute space is effectively correct but his assumption of an independently existing absolute space is wrong. Mach is also correct in his argument that inertia is relative to all matter in the universe, and this should be qualified by adding that more massive and nearby bodies in the universe have greater role than less massive and distant bodies in the universe. With this new view of inertia and absolute motion, therefore, there will be no actual difference between Newton's view and Mach's view of inertia.

Newton's second law

Our new theory of absolute motion / absolute space will also have another ramification. Newton's second law of motion, $F = ma = m\, dV/dt$, will be given a new interpretation. Thus, the acceleration of a body is to be understood as acceleration relative to the local absolute space defined or 'fixed' in the vicinity of cosmic massive bodies. Therefore, Newton's second law should be re-written as:

$$F = ma = m \frac{dV_{abs}}{dt}$$

where V_{abs} is velocity relative to local absolute space.

Newton's first law of inertia

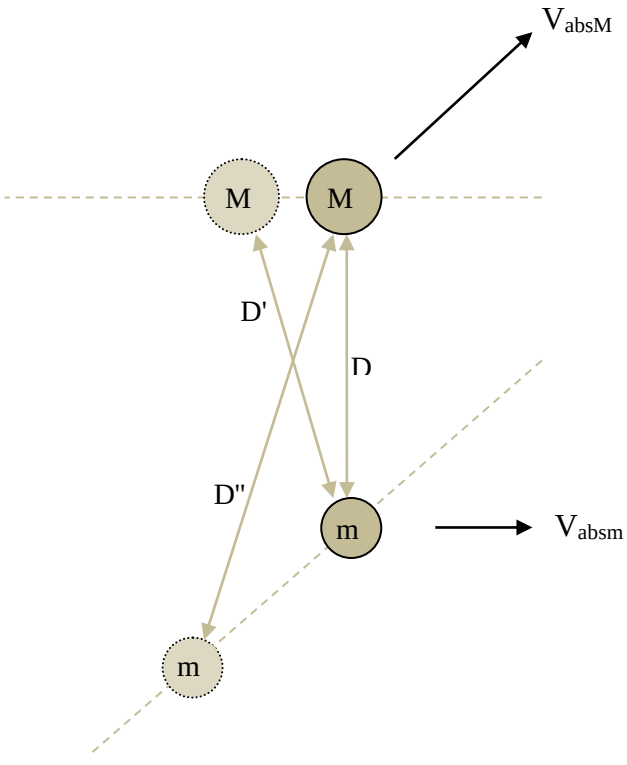
Newton's first law states that a body continues to be at its state of rest or continues to move with uniform velocity unless acted upon by an external force. This law cannot be observed in the real universe and hence is only an abstraction. This is because, from the new interpretation of Newton's second law above, it is the absolute velocity of the body that remains constant in the absence of an external force. But this condition (absence of external force) cannot exist in the real universe because absolute space itself is created by matter in the universe and wherever there is matter there is gravity and hence an external gravitational force always exists in the universe. Therefore, a spacecraft that has run out of fuel will never move 'inertially' in space because of the action of gravity.

One may wonder: what about an object at sufficiently large distance from all matter in the universe ? In this case Newton's gravity will approach zero, and one may think that inertial motion can exist there. However, absolute space doesn't exist also in such a place. What is the consequence of non-existence of absolute space ? The inertia of an object will approach zero in such a space. The inertia of an electron orbiting the nucleus will approach zero and the electrons (the atom) will collapse under the electrostatic force. The nucleus may also 'collapse' and the

atom will collapse into an infinitely small space. It is difficult to imagine the existence of ponderable matter as we know it in the absence of absolute space, which is created by matter itself. This conclusion has a profound implication that all matter in the universe has only a collective existence. This means that a single physical object cannot exist as we know it in an empty universe.

Newton's law of action and reaction

We have seen that mass *m* sees mass *M* to be at apparent distance (position) *D'* , and not actual distance *D*. But mass *M* also sees mass *m* to be at a different apparent distance *D''* . *D'* depends on the absolute velocity of *m* , whereas *D''* depends on the absolute velocity of *M*, which are independent and can be different. Hence, if *M* and *m* have different absolute velocities, the gravitational force of *M* on *m* is no longer equal to the gravitational force of *m* on *M*, violating Newton's third law of action and reaction. Therefore, the law of action and reaction is not universal.



Gravitational 'time dilation', GPS clock adjustment , the Pound-Rebecca experiment

The theory of inertial mass and absolute motion proposed above may also explain the speeding up of GPS clocks at high altitudes, compared to their rate on Earth's surface. This is based on the theory proposed above that the inertia (mass) of a physical object is a net 'magnetic' interaction of the body with matter in the universe, with nearby and massive bodies having greater influence than far away and less massive bodies having less effect[4]. Therefore, the mass of the electrons of the Cesium atom of the atomic clock will decrease slightly with distance from the Earth and this may change the emission lines, thereby increasing the frequency of the atomic clock.

In the Pound-Rebecca experiment, gamma rays emitted from the source located at higher altitude were detected by an absorber at ground level. Normally, when both the source and the absorber are at ground level, the source emits exactly at the same frequency of the absorber. It is claimed that, due to the higher altitude of the source, gravity will cause acceleration of the photons, increasing the frequency of the photons when they reach the detector, thereby detuning the source and the absorber. In order for the gamma photon to be absorbed, therefore, its frequency must be decreased by the same amount it has increased due to gravitational acceleration. This was done by using Doppler effect, by moving the detector away from the source by the right value of velocity.

The Pound-Rebecca experiment, if the claimed result was really observed, can be seen as a manifestation of the theory that inertia varies with distance from nearby cosmic bodies. The frequency of the gamma source will increase because it is at a higher altitude. This may be explained by decrease of inertia of the electrons in the Cesium atom with altitude, changing emission lines. Therefore, the reason why the frequency of the photons increases at the detector is just because the source emitted at higher frequency, not because gravitational acceleration has increased the energy (frequency) of the photons.

I suspect that Pound and Rebecca may have observed the effect but the claim that the frequency of the photon increased by the same amount predicted by general theory of relativity (GTR) is, if GTR is wrong, not true.

Conclusion

The concept of reference frames, including the absolute reference frame, is fundamentally wrong and irrelevant in formulation of the fundamental laws of physics. Arguments about the laws of physics by using reference frames are flawed. The actual interaction between electromagnetic and gravitational sources and observers/detectors is so subtle that it will elude a third 'observer', that is the traditional reference frame. Analysis of the Michelson-Morley in any reference frame is flawed, including the absolute reference frame and the rest frame of the Michelson-Morley (MM) experiment. Analysis of the experiment in the absolute reference frame will logically but wrongly consider the motion of the mirrors also. Analysis of the experiment in the absolute reference frame wrongly predicts a large fringe shift and analysis in the rest frame of the MM experiment wrongly predicts a completely null result, failing to predict the small fringe shifts observed. To the observer at rest in the absolute reference frame, the velocity of light varies for a moving observer, which is a fundamentally flawed conclusion. The elusive nature of electromagnetism and gravity completely eludes the reference frame approach. Apparent Source Theory is a successful model to describe and explain many of the usually confusing, contradicting facts in electromagnetism and gravity. Most or all of the experiments and observations on light, electromagnetism and gravity can be explained by a single crucial insight: *absolute motion of the observer creates an apparent change in point of light emission or an apparent change in position of a charge or a mass relative to the observer.* The only effect of absolute motion in the Michelson-Morley experiment is to create an apparent change in position of the light source. Motion of the mirrors and the beam splitter are not considered, i.e. their actual position is used in the analysis. Only absolute motion of the observer is relevant, hence no confusions about motion of mirrors. The 'observer' is basically the atom, or particle directly detecting the light. Absolute motion of the observer creates an apparent change in the current/ instantaneous position of sources of static fields. Whereas absolute motion of the observer creates an apparent change in the *past* position of a light source, it creates an apparent change in the position of a charge and a mass *now*.

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Thanks to God and His Mother Our Lady Saint Virgin Mary

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