

On Errors in the Formation of the Special Theory of Relativity ©

The incorrect line of thinking that led physics down the wrong path to the Special Theory of Relativity (STR)

This paper examines and challenges the logic that was used by Einstein to establish the STR and by others to defend it. The theory has been supported by most physicists through history. Unfortunately, it is based on the misinterpretation of experiments and a misunderstanding of an Inertial Reference Frame (IRF).

The study by physicists of electromagnetic fields found it was necessary that Newton's Laws be modified to accommodate a relativistic mass with the Lorentz transformation. This insured that the velocity of light is a constant (Einstein's 2nd postulate) and Maxwell's equations for electric and magnetic field forces remained invariant in all inertial reference frames. That change insured the Laws of Physics were the same in all IRFs. Although physics would not accept a relative velocity of light, it was perfectly acceptable, but wrong, to conclude that Time and Space should be relative.

On The constancy of Light Speed / Maxwell's equations and Light Speed

- Maxwell's equations give only one speed of light
- The Michaelson/Morley (M/M) experiment could not find a difference in the velocity of light in relation to the aether
- On Galileo Transformations incorporating Maxwell equations
 - Electric and Magnetic forces and light speed were not invariant
- Fizeau's experiment on a medium's expected effect on light velocity did not support the aether theory

The above points on light speed troubled Einstein and his misunderstanding of their results contributed to his pursuit of an alternative path insisting on a constant light speed postulate.

"Einstein began thinking of light's behavior when he was just 16 years old, in 1895. He did a thought experiment, where he rode on one light wave and looked at another light wave moving parallel to him."

"Classical physics should say that the light wave Einstein was looking at would have a relative speed of zero, but this contradicted Maxwell's equations that showed light always has the same speed: 186,000 miles a second." 1,2

Einstein's thought experiment about riding a light beam alongside another light beam is inherently flawed. The experiment itself confirms Einstein could not know if he was at rest or moving at a constant velocity as there is no acceleration or the presence of a gravitational field.

To be consistent with an Inertial Reference Frame (IRF), it would not be possible to ride alongside the light beam and still claim to be in an IRF. Under an IRF condition he could only experience the speed of light as 'c' as Maxwell's equations only pertain to how an Electromagnetic Field (EMF) moves in space in an IRF.

*"This led to Einstein's eventual musings on the theory of special relativity, which he broke down into the **everyday example** (emphasis added) of a person standing beside a moving train, comparing observations with a person inside the train. He imagined the train being at a point in the track equally between two trees. If a bolt of lightning hit both trees at the same time, due to the motion of the train, the person on the train would see the bolt hit one tree before the other tree. But the person beside the track would see simultaneous strikes."*

"Einstein concluded that simultaneity is relative; events that are simultaneous for one observer may not be for another," the encyclopedia stated. "This led him to the counterintuitive idea that time flows differently according to the state of motion, and to the conclusion that distance is also relative." (Quotes above from an article at Space.com¹ --just one of many sources that use the same arguments above to justify the STR)

The thought experiment for the moving train is frequently used, but it easily confuses the listener enough not to question it. This thought experiment's "everyday example" has an unspoken condition in that this is an argument for Special Relativity (SR) and **the rules of an Inertial Reference Frame (IRF) must apply for SR**. That is:

- ***Both observers can make the same claim*** as each is in his own IRF.
- In special relativity all IRFs are equal.
- Neither believes, nor can detect, he is the one who is moving.
- Neither observer is accelerating or is in a gravitational field
- In that case then ***both observers hold an equal position*** in the argument about what is observed.

The observer on the train could rightly make the claim that he is the one who is not moving and sees the lightning strikes simultaneously. Which of course seems ridiculous considering he is on a moving train and the other observer is standing on land. It is presented as an obvious logical argument that cannot be disputed. But it already assumes that the speed of light is a constant (Einstein's 2nd postulate in SR) because there is a claimed time difference between the two.

That is why ***any examples for an argument for the STR are best placed in space*** where it is easily understood why each observer can make the same claim and each nullifies the other's claim. The train (or space ship) occupant can claim he is the one not moving.

Since both observers can make the same claim, they cancel each other out and the argument given for the STR has no standing and SR falls. The same flawed logic that was used by Einstein to formulate the STR is consistently used again and again.

Maxwell's equations only pertain to how an Electromagnetic Field (EMF) moves in the medium of the vacuum of space without the presence of a gravitational field. His equations establish the relationship for an inertial frame of reference, a massless energy field, and space.

An observer 'A' in his IRF or in observing another IRF 'B' cannot establish if he or 'B' is at rest or moving at a constant velocity although he can certainly claim either. Maxwell's equations hold to the constant speed of light measured by 'A' for 'A' and the same constant speed of light measure by 'B' for 'B' under that condition and only under that condition. 'A' and 'B' cannot make any judgement about the other's measurement for light speed as each could make the same claim.

A second or any number of additional observers could also only measure and find the light speed in their IRF as 'c' since they are under the same restriction, that is, they do not know if they are in a constant fixed motion or at rest.

Relativity for IRFs means each observer could make the same claim that any corresponding observer makes on them. Each could conclude that it is the other that is stationary or moving. Any judgement by one IRF on velocity, including light, of another IRF is relative.

Each could make the same measurement as the other pertaining to relative velocity consistent with the classical laws of physics and Galilean relativity, but none has the right to make a judgment about the other's clock.

Only when one insists that nature's rule requires the velocity of light to be a constant at the maximum possible speed 'c' does one observer find a change in measured times and lengths when observing another IRF. Each gets to make a judgment on the other's clock and length if he insists that the classical laws of physics in Galilean relativity do not apply and the velocity of light is the same for all IRFs viewing other IRFs. But here again, each could make the same claim and all is nullified.

The velocity of light is the same for all only within the confinement of each observer's own IRF; where each cannot distinguish if he is moving or stationary. In other words, when he is not accelerating or in the presence of a gravitational field, he will only find the standard measured value 'c'.

A good example of the detailed analysis employed by many to incorrectly conclude that time dilation is real and length is shortened is given here.³ The series of videos presented *starts* with the acceptance of the SR postulate that the velocity of light is a constant at 'c', and then allows *the subsequent lessons to consistently give the perspective of the 'moving' IRF according to the point of view of the 'stationary' speaker's IRF*, not realizing that the moving IRF could equally claim the same perspective of the speaker's IRF. That being the case the argument does not hold.

Michaelson/Morley Experiments

The above argument around the moving train also applies here. That is, in their efforts to establish the existence of the aether, they did not understand that the experiments were happening in an IRF.

The results of the M/M experiment were a confirmation that **they were essentially within an IRF** condition and thus could only get the result that the velocity of light did not change with the earth's orientation position to the aether. Within the brief period of their experiment, the earth was not accelerating and any effects from gravity were beyond their ability to detect. As far as the experiment is concerned they could not sense if they were moving at a constant velocity or were stationary. Certainly, not only within the time frame of the experiment, there is no direct sense that the earth is moving through space and rotating.

Aristotle believed that the earth was not moving because he observed that if a ball is thrown up into the air it falls back down to the same place. If the earth was moving then it would move out ahead of the ball and the ball would not fall back to the same place it was thrown from.⁴ It was a reasonable argument for his time, but Galileo showed this was wrong. He was the first to have the correct view of the relativity principle pointing out that the ball was actually a part the earth's reference frame and experienced as an IRF since on earth we do not detect if we are stationary or moving at a constant speed. It seems that physics was trying to go down that same path as Aristotle with Space in the 19th century.

Their laboratory and the very aether they wished to detect were all part of earth's IRF. M/M and others did not see that their experiment and the aether/space associated with it were all part of the same IRF just as if they were all closed up inside a rocket ship that was not accelerating in space. It did not matter that they had not set up their experiment in space traveling at a constant velocity or were stationary and outside any gravitational influence. That would have been better; but the results would have been the same.

It would have been reasonable to conclude that the speed of light should be a constant under these IRF conditions, not that it conclusively showed that the aether does not exist. After all, they were already aware that the calculation for the velocity of light in a vacuum from Maxwell's equations was correctly calculated based on the vacuum properties of magnetic permeability & electric permittivity. How could it have these properties if it did not exist?

Also, another possibility is that the aether itself was not moving with or against the light, but rather the aether itself carried the energy of the light while its position remained stationary relative to the experimental setup. That approach would also nullify any attempt to account for the earth's rotation; and also explain the constant velocity results found in emitter or boost experiments performed in more recent times.

Lorentz and others believed the failure to measure a light speed difference in the M/M experiments could be due to a shortening of lengths to explain why the speed of light appeared to be independent. It was also considered that there was a problem with Maxwell's equations as discussed by Richard Feynman in his Stanford lectures on Physics.^{6,7}

“Suppose we are riding in a car that is going at a speed u , and light from the rear is going past the car with speed c . Differentiating... $x' = x - ut$...gives

$$dx'/dt = dx/dt - u,$$

*which means that according to the Galilean transformation the apparent speed of the passing light, as we measure it in the car, should not be c but should be $c - u$. For instance, if the car is going 100,000 mi/sec, and the light is going 186,000 mi/sec, then apparently the light going past the car should go 86,000 mi/sec. In any case, by measuring the speed of the light going past the car (if the Galilean transformation is correct for light), one could determine the speed of the car. **A number of experiments based on this general idea were performed to determine the velocity of the earth, but they all failed—they gave no velocity at all.***

(Emphasis added- Feynman referring to M/M experiment. But the above example is not an IRF if the car's velocity is known. In an IFR moving at a constant velocity or being stationary cannot be determined. Because it was not understood why they failed to find the velocity, they concluded the aether did not exist and missed the realization that they were in an IRF where, as Maxwell's equations predict, the velocity of light would be found to be 'c', not c-u, for the observer in such a frame there is no 'u'.)

...something was wrong with the equations of physics. What could it be?”

“It seemed almost obvious that these equations must be wrong, so the thing to do was to change them in such a way that under the Galilean transformation the principle of relativity would be satisfied. When this was tried, the new terms that had to be put into the equations led to predictions of new electrical phenomena that did not exist at all when tested experimentally, so this attempt had to be abandoned. Then it gradually became apparent that Maxwell's laws of electrodynamics were correct, and the trouble must be sought elsewhere.”

*“Einstein, following a suggestion originally made by Poincaré, then proposed that all the physical laws should be of such a kind that they remain unchanged under a Lorentz transformation. In other words, we should change, not the laws of electrodynamics, but the laws of mechanics.”*⁷

Einstein believed the results of the Fizeau experiment helped him in his formulating the STR.⁵ He believed that the M/M experiments failure to determine a variation in the velocity of light supported his conclusion that the aether was not real and he could correctly drop the idea of the aether as playing a part in the movement of light through the vacuum since the Fizeau experiment initially gave support to the idea that if light moved through a medium, the M/M experiment would have detected it.

(Ironically, Even though the basis for his theory for SR included the non-existence of the aether, Einstein brought back the idea that the vacuum of space was needed in his General Relativity theory; as it is what ‘warps’ due to the force of gravity.)

Electrodynamics and Lorentz Symmetry in SR

On Requiring an Inertial Frame of Reference for Generating a Magnetic Field

Before Einstein developed his STR, physicists saw a conflict in that Maxwell’s equations predicted a constant value for the speed of light although classical physics understood that velocity was relative and that Galilean relativity should apply. Measuring the movement of all objects with mass in the world followed Galilean relativity; the measured velocity was relative depending on the frame of reference; something everyone experiences when moving in a vehicle or airplane. Requiring the velocity of light to hold to Galilean relativity meant it would also mean that electric and magnetic forces would also have to change.

Objects with mass moving through space are subject to the rules of Galilean relativity and any observer measuring the velocity of objects with mass must take note of the reference frame employed. Is it the same for massless energy?

A major issue for Einstein and the physics community involved the EMF known as the moving magnet and conductor problem.^{8,9} He wrote:

It is known that Maxwell's electrodynamics – as usually understood at the present time – when applied to moving bodies, leads to asymmetries which do not appear to be inherent in the phenomena. Take, for example, the reciprocal electrodynamic action of a magnet and a conductor. The observable phenomenon here depends only on the relative motion of the conductor and the magnet, whereas the customary view draws a sharp distinction between the two cases in which either the one or the other of these bodies is in motion. For if the magnet is in motion and the conductor at rest, there arises in the neighborhood of the magnet an electric field with a certain definite energy, producing a current at the places where parts of the conductor are situated. But if the magnet is stationary and the conductor in motion, no electric field arises in the neighborhood of the magnet. In the conductor, however, we find an electromotive force, to which in itself there is no corresponding energy, but which gives rise – assuming equality of relative motion in the two cases discussed – to electric currents of the same path and intensity as those produced by the electric forces in the former case.

—A. Einstein, *On the electrodynamics of moving bodies* (1905)⁸

“The observable quantity in the experiment, the current, is the same in either case, in accordance with the basic *principle of relativity*, which states: "Only *relative* motion is observable; there is no absolute standard of rest".^[1] However, according to Maxwell's equations, the charges in the conductor experience a **magnetic force** in the frame of the magnet and an **electric force** in the frame of the conductor. The same phenomenon would seem to have two different descriptions depending on the frame of reference of the observer.”⁸

Applying the relativity principle to light was in conflict with Maxwell’s equations. This meant the laws of electromagnetism would change depending on the frame of reference which would be at odds with classical physics that says the laws of physics are the same everywhere. Thus, for the laws of physics to be the same everywhere it was necessary for Newton’s laws of mechanics to change. Mass in Newton’s law was changed to be relative; that meant our view of time and space would no longer be absolute.

All Adding up to Special Relativity

Summing up the above data that was available at the time:

- Maxwell’s equations calculated only a constant velocity of ‘c’ for light
- M/M experiments could not find any variation in light speed
- Fizeau’s experiment in conjunction with M/M experiments suggested there was no aether
- The problem of a conductor moving in a magnetic field is not consistently treated in Maxwell’s equations.

Einstein concluded:

- The laws of physics needed to be the same everywhere
- The Lorentz transformations provided the necessary modifications to Galilean relativity
- The speed of light was unique in the universe
- The speed of light would be the same for all observers
- Time and space would be relative and connected

This shortly led with the assistance of his collaborator mathematician Hermann Minkowski to uniting space to time in a four dimensional continuum called spacetime.

Conclusion

The arguments used to establish the Special Theory of Relativity do not hold up under the examination discussed here and presented elsewhere.

(The author of this paper has provided a thought experiment that demonstrates that the measured times in IRF do not change and thus it is the relative speed of light that must be changing.¹⁰ Now if that were correct, physics claims this would mean someone could determine their velocity and this is a violation of the concept of relativity because it should not be possible to establish if one is moving or at rest, that is, finding an absolute frame of reference. But that is not the case, only a relative velocity of light is found using the local reference frame, which is consistent with a Galileo frame. A relative velocity of light is no more absolute then the relative velocity judgement one makes about a car passing him on the road.)

The Lorentz transformation successfully achieved the desired invariance for Maxwell's equations being able to hold 'c' constant and not generate variations in the forces for electric and magnetic fields. However, this did require a modification of classical Newtonian mechanics for an object's mass. Mass had to be relative.

Although the equations of Maxwell do not appear to have the expected symmetry, the actual observed results indicate a balance and equality. This is totally in step with Galilean relativity as both the conductor and the wire can each make the same claim about movement or being at rest. However, physics now argues that this can only be explained by Special Relativity. The details given to provide an explanation (the length shortening produced by Einstein's postulates and the Lorentz transformation) on what is happening seems more to be an attempt to justify the theory of SR. It is now the standard position that SR explains the existence of magnetism. Maxwell's equations and magnetism can stand independent of SR.

The laws of physics are the same in all IRFs regardless of the mathematical acrobatics that are employed. It is unfortunate that a few but significant missteps, in attempting to understand the world, have led to the incorrect STR which has survived for over a century; a theory that makes monumental invalid conclusions about objects with mass losing length and introducing time dilation.

There is only an apparent contradiction in this fundamental truth of the universe that the velocity of light is a constant because it is the fundamental truth itself that is misunderstood. Newton's Laws and Galilean relativity are not in conflict with Maxwell's Equations. It is the interpretation of the meaning of Maxwell's calculation that gives only one speed for 'c' that is in error. It is necessary that Galilean relativity be followed. Relativity for IRFs means that all conclusions for all IRF observers will be relative. Thus, no judgments can be made by one IRF observer on another since the other IRF can make the same judgements being applied to him and we get the inevitable contradiction.

SR is about an IRF moving through space at a constant velocity. There is no acceleration and gravity is not in the picture. Under that condition the velocity of light will be 'c' for that IRF and only for that IRF. But where in the universe do we observe this ideal frame? It is the exception. The rule for the atomic to the galactic involves acceleration and gravity. That constant 'c' rule does not apply.

Light can have a relative velocity when one IRF is observing the movement of light in another IRF. It need not be forced to the rule of a constant 'c' for all IRFs. Maxwell's equations tell us that light is an inherent massless energy pulse of space itself. Space insures that light will have a velocity of 'c' when in an observer's IRF. It is reasonable for the massless energy of light to conform to the Galileo relativity rules for objects with mass.

Could the use of the Lorentz transformation been confined to Maxwell's equations without forcing it on Newton's mechanics and avoid the invalid, but accepted, change in time and length? That change in time and length led to the bizarre continuum called SpaceTime. Einstein incorporated gravity into the picture in the development of General Relativity where Space continues to play a key role while Time has mistakenly been given an equal role.

Space is connected to and interacts with all particles, mass or massless. Forces and fields are a manifestation of that interaction depending on velocity, acceleration, charge, distance, and reference frame.

Relation of Space & Particles & Generated Fields/Forces					
Particle	Velocity	Charge	Distance	IRF*	Generated Fields/Forces
w/mass	constant	No		Yes	None
w/mass	constant	Yes	Long Range (LR)	Yes	E/M
w/mass	acceleration	No	Atomic	No	Strong & Weak Forces
w/mass	acceleration	No	Atomic to LR	No	Gravity
w/mass	acceleration	Yes	Atomic	No	E/M & Gravity
massless	constant	No		Yes	EMF (light)

*Inertial Reference Frame

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Kenneth Paul Hoffman;

Kenhoffman48@msn.com

Kenneth Paul Hoffman

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