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Mini Review

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Scientific measurements and the influence of mechanical and perceptual error in special relativity

Abstract

The true meaning of the special theory of relativity for light is described by incorporating the first description of relativity of time, space, and velocity written by Isaac Newton in the 17th Century, together with the intrinsic properties of light determined elegantly by James Clerk Maxwell in the 18th Century. Diagrams derived from Newton's work assist in properly explaining light-mass interactions introduced theoretically in the 20th Century. Because true absolute magnitudes of these variables are distinct from measurements of these quantities, both experimental error and perceptual error have caused widespread confusion and false extrapolations of the meaning of special relativity that are addressed here. Time does not dilate its rate of progression if detectors or observers undergo motion through space.

Volume 6 Issue 3 - 2022

Richard Sauerheber
STAR Center, Palomar Community College, USA

Correspondence: Richard Sauerheber, STAR Center, Palomar Community College, 1140 W. Mission Rd. San Marcos, C 92069, USA, Email RSauerheber@palomar.edu

Received: August 01, 2022 | **Published:** August 22, 2022

Introduction

Premier physicist Sir Isaac Newton first described in detail the difference between true time, displacement, and velocity versus measured values for these quantities. True magnitudes are absolute and unaffected by motion of external bodies in the universe. Measurements of time, displacement, and velocity however are relative and subject to error. For example, the true time for an event is different than the relative time one obtains from a measurement using instruments such as clocks, pendulums, the orbiting earth, etc. The magnitude of mechanical or operational error is comparable to the precision of the method. In addition, perceptual error involves misinterpretation of the meaning of the mechanically observed measurements. Measurements cannot be claimed to be true and absolute magnitudes of the quantities being measured.[1] Newton wrote that equating true time with relative time is false and unscientific. It must be added that assuming measurements of time are actual true time for events leads to false beliefs that are harmful.

Light is special in relativity because James Clerk Maxwell discovered that the true absolute speed of light, in order to exist as light, is a fixed constant, given by c = E/B from its coordinate of origin (or any stationary position in space).

This means that measurements of the speed of light in its propagation direction (conducted by Hertz and by Michelson that have confirmed with high accuracy light speed derived by Maxwell) need not be used in theoretic analyses involving light since its true absolute speed is known, especially in vacuum. As described later, this does not mean that the relative velocity between a light front and a moving physical object is also c, but rather, light intrinsic speed remains c regardless of the motion of such an object.

A common misconception that has become widely spread in scientific[2] and public journals[3] is that time itself for an event involving light actually dilates or slows if an observer or detector, not in control of the event, is in relative motion with respect to the light. Typically shown in Physics texts is that the distance light travels along a moving object is assumed by one observer to simply be the length of the object, while another observer in relative motion with respect to the other sees a different light travel distance. Because light speed is fixed relative to motionless space, there is only one distance light travels between two positions in space. Equating observed magnitudes with true absolute values, namely 1) relative velocity, between an object and light, with c, and 2) the distance light travels, along a moving object, with the actual total distance light travels through space, both violate the Newton principle since measured quantities are being substituted for true magnitudes. Such assumptions have led to many false extrapolations of the true meaning of the special theory of relativity for light.

Results and discussion

To properly introduce relativity, and to distinguish true from measured time, and true distance and velocity from measurements of these variables, Newton used the example of a sailing ship on the orbiting earth with a sailor also walking on the ship. A pictorial description of his words is shown in Figure 1. The earth moves along its orbit direction with respect to the sun at 10,010 units of velocity, while a ship sails in the opposite direction with respect to the earth at a velocity of -10 units, and a sailor walks to the stern of the ship at a velocity of 1 unit with respect to the ship. In a single unit of time, the earth travels forward 10,010 units with respect to a stationary position in space, while the ship travels 10,000 units in that same direction, and the sailor travels 10,001 units.

These errors can be seen as mistaken by using the diagram shown in Figure 2. A light photon travels from one end of a rod. The rod moves in the same direction as the photon with velocity v = ½c. The distance the photon travels to reach the opposite end of the rod must therefore be the length of the rod plus the distance the rod moves while the photon passes the rod. If an observer on the rod assumes that the distance the light travels was measured, L and equates this with the true distance light actually travels in the event, then this is an example of a violation of the Newton principle, equating relative measurement of distance with true distance. Assuming the perceived distance light travels is L, then the moving observer on the rod falsely concludes that time for the event could be computed from t = L/c.

The distance light must travel to pass a receding rod is greater than the length of the rod. This is like the case of the sailor on the ship, where the distance the sailor actually travels with respect to the earth, -9 units in an allotted time, is not the 1 unit the sailor walked along the ship. If he assumes the total distance of travel was only the 1 unit walked along the ship, then the sailor is subject to an illusion. Similarly, if an observer on the moving rod assumes the light only traveled the length of the rod, he is subject to a similar illusion.

The time for light to pass the receding rod is not merely L/c, which would be the time if the rod were stationary. The time is actually obtained from the distance the light travels in that time, ct, which equals the length of the rod L plus the distance the rod moves during

the light travel time, vt = (½c)t. Thus ct = L + (½c)t, and t = L/(c - ½c) = 2L/c. The time for an event involving light that is computed by a moving observer as above is calculated incorrectly. It is not that time dilates due to motion of that observer who does not control the event. Rather, as Newton wrote, time for an event is absolute, and measurements of time are relative and subject to error. The true time here is the true length of the rod L plus the true distance the rod moves while being passed by the light, all divided by the true speed of light c. Although this formula for the time for the event can be labeled this way in theory and delineates the issue, it must also be emphasized that this too is technically subject to a perception error. That is, any rotational motion of the galaxy and translational velocity of the universe of galaxies, that was not included in this theoretic situation, would render this also as an estimate rather than the true time. This is because light is not attached to physical matter, has no mass itself, and is thus not subject to gravity or friction, while the rod would be.

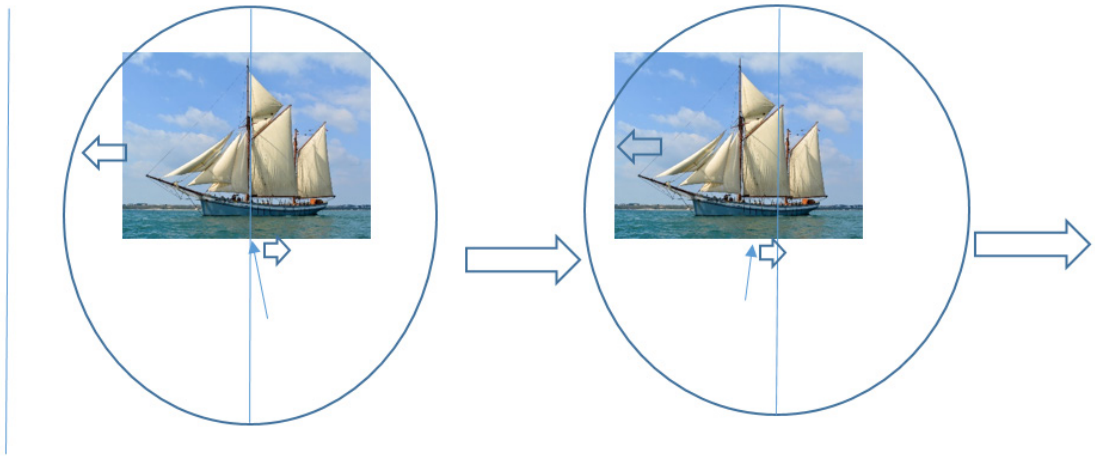

Figure 1 Velocity and speed are always relative, with respect to some object or spatial coordinate. As detailed by Isaac Newton, as the earth orbits Easterly at a rate of 10,010 units from a stationary line in space (indicated on the left), a ship sails Westerly due to a gale wind at a rate of 10 units, shifting to the left of the earth's central axis (shown on the right). A sailor in the meantime began at the ship's mast at center (arrow on left), aligned with the earth's axis, and walked at a rate of 1 unit Easterly and becomes slightly East of the mast (arrow on right). The relative velocity of the ship with respect to the stationary line in space is 10,000 units in an Easterly direction (its speed magnitude is 10,000), resulting from the earth velocity East added to the wind negative velocity West, all while the velocity of the ship relative to the earth remains 10 Westerly. The velocity of the sailor with respect to the ship is 1 Easterly, but with respect to the earth is -9 to the West (the sum of the wind velocity and the walking sailor velocity) and is 10,001 with respect to stationary space (the sum of the earth orbit velocity 10,010 plus the wind velocity -10 plus the sailor walking velocity of 1). The lengths of the block arrows indicate the constant magnitudes of all three velocities before and after the movement shown. The angular velocity of the galaxy and any translational velocity of the universe of galaxies are neglected for clarity. The ship heads West but travels East with respect to stationary space because the earth is faster East. The sailor heads East (toward the stern of the ship) but travels West with respect to the earth's axis because the ship is faster than he, but travels East with respect to stationary space because he and the earth are together faster than the ship.

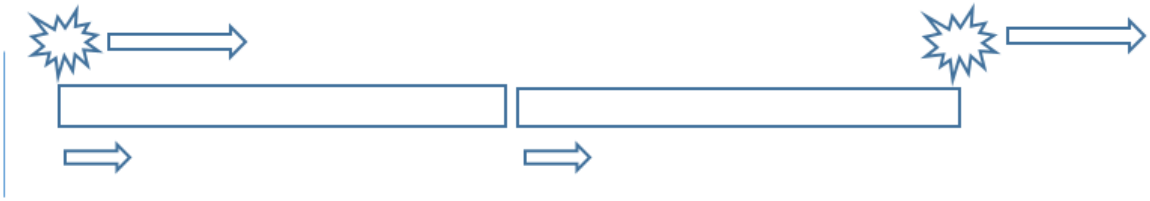

Figure 2 A photon of light originates at one end of a rod (on left) and travels at speed c to the East at the other end of the rod, while the rod moves with velocity v = ½c to the East. Speed c is an intrinsic property of light from the location in space at which it originates (and to any theoretically stationary point in space). Thus the velocity of the photon with respect to its point of origin is c to the East, represented by the long block arrows. The velocity of the rod with respect to stationary space is v to the East, represented by the shorter block arrows below the rod. If rod velocity v = ½c, the relative velocity of the photon with respect to the rod is c – v = c - ½c = ½c to the East, where light velocity c to the East is greater than rod velocity. The rod moves a distance equal to its length L as the photon travels distance 2L to pass the rod.

Taken together, this demonstrates that although the operation of a moving clock can be affected by its own motion, time for an event is not the same as the affected reading on the clock. True time is not equal to measured time, as above, especially here when computing time by using an incorrect travel distance for the photon. True time for an event is not affected by motion of an observer who does not change the event. As well, true time is not affected if time is computed using a correct relative velocity. For example, the time to pass the rod above could be computed from t = L/(c – v) which also produces the same correct result, 2L/c. c- v is the relative velocity between the photon and the rod. This would only be the true time of course if there were no motion of the galaxy to complicate the theoretic situation. In conclusion, the time for this event is not L/c no matter how strongly the moving observer claims it is.

It has been found that photons of light from a laser source that travels laterally at the orbiting speed, have a component velocity in common with the source, while of course propagating forward at directional speed c. As found in two separate laboratories,[4,5] photons reflected on a grid do not shift along the grid during 24 hours of continuous observation time, while the earth and grid orbit the sun with a velocity that shifts the grid several millimeters as photons travel between source and target. In other words, photons leave the source at successive source positions and angle travel to meet the grid

Citation: Sauerheber R. Scientific measurements and the influence of mechanical and perceptual error in special relativity. *Phys Astron Int J.* 2022;6(3):101–103. DOI: 10.15406/paij.2022.06.00260

spot as the grid, earth, and laser source all shift during the time the light travels from the laser to the grid.

A similar situation occurs when one aims a laser North East from a theoretically stationary position, where photons angle travel North East with a component East that is less than c, while propagating NE at speed c. For the situation with a real laser on the orbiting earth however, all photons angle travel from different positions as the laser laterally moves in time. This has been referred to as synchronous aberration, since an actual light image of an object that travels from the object to an observer's eye angle travels to the eye so that the image remains between the object and the eye at all times on route to the eye, while traveling in an angled direction at speed c to the eye.[6] This information may be used to analyze the widely held notion that time dilates for a light event for observers who are in motion, compared to observers who are stationary.

In the 2 dimensional case, for light to travel from the lower left corner of a rightward moving "light box" to a mirror on the top of the box a distance H directly above the location of the light source, the time is not t = H/c. The time is H/v where v is the velocity component of light in the vertical direction, not speed c in the propagation direction, that light must travel to reach the shifted mirror in its new location. The time can also be computed correctly as D/c, where D is the actual total distance light angle travels to join the mirror in its new location when the light arrives. If the box lateral velocity was = ½c, then t = D/c directly, or using the proper component of vertical velocity t = H/[c(H/D)] = D/c. It is most certainly not H/c as was first argued since 1905. Light component velocities in a direction skewed from the propagation direction are not magnitude c, in spite of wide claims otherwise. And angled light paths are not rays as usually drawn in texts, since each photon departs the source from a different location while the source moves.[6]

Time dilation due to motion of an observer has been adequately disproven experimentally, theoretically, and mathematically, as described in numerous publications from 1963 to 2021.[4,6-8] Nevertheless, many choose to continue making the claim that light velocity is identical to light speed, and that perceived distance by observers in relative motion is actually equal to real distance traveled by light, and that calculated differences in time for light events by observers in relative motion represent true dilated time. The notion that age of twins is somehow not identical because of relative motion between them, which is an extrapolation of time dilation due to motion, remains in discussion as though it is viable. But the age of twins is absolute, and is the true time since birth and remains the same for all ages of the lives of twins. Age of a person is not determined by motion after birth.

The description here is intended to emphasize how Isaac Newton first explained relativity and that differences from reality can arise when assuming that relative measurements are the same as the absolute true magnitudes for the measured quantities. When Maxwell derived the intrinsic speed that light must have in its propagation direction from its coordinate of origin, it became clear that relativity for light is indeed special. But ignoring the work of Newton, or assuming it is incorrect, is not scientific. It is time to return to scientific integrity on this issue.

Acknowledgments

None.

Conflicts of interest

None.

References

1. Newton Sir Isaac. *Mathematical Principles of Natural Philosophy,* In: Great Books of the Western World, R. M. Hutchins, editor in chief, Newton Huygens, University of Chicago, 1952.
2. Einstein A. On the Electrodynamics of Moving Bodies In: The Principle of Relativity. Methuen and Col, Ltd., London, 1923.
3. Time Dilation. Wikipedia, the Free Encyclopedia.
4. Sauerheber RD. Clarifying the nature of light: Velocity, massless energy, and special relativity. *Optik.* 2018;168:974–986.
5. Brauns Etienne. On a straightforward laser experiment revealing a massive experimental anomaly, thereby falsifying the contemporary science's Equivalence Principle paradigm for photon phenomena. *Optik*. 2021:165858.
6. Sauerheber RD. Intrinsic Properties of the Photon. International Journal of Optics and Photonic Engeineering.
7. Otis AS. Light Velocity and Relativity, Christian Burckel and Associates, Yonkers-on-Hudson, NY, 1963.
8. Livingston DM. The Master of Light, a Biography of Albert A. Michelson, University of Chicago Press, Chicago, ILL. 1973.