The Three Components of the Speed-of-Light Postulate

The presence of aether introduces a harmony into three diverse aspects of the speed of light

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Abstract: Many researchers claim that Einstein's relativity postulate, which requires that the speed of light be invariant for all inertial observers, is wrong. Their claim is based on certain evidence that the speed of light is actually variant; the speed of light, contrary to special relativity, is *not* constant. This article explains why and how Einstein's postulate of lightspeed constancy remains valid! While at the same time, the claim of lightspeed NON-constancy is also valid! The speed of light is always constant with respect to its conducting medium. The speed of light always appears constant within the restrictive Einstein postulate. The lightspeed that is inferred from an out-and-back-lightpath experiment (the implementation of Einstein's restriction) might be *c*, however, the speed out need not be equal to the speed back; the *one-way* speed might not be *c*. The following exploration, by recognizing that there are three distinct domains of validity with all three linked by the aether concept, brings together **the absolute**, **the illusionary**, and **the measurable** to formulate an *extended postulate* for the speed of light —all in all, another powerful instance of Heraclitian *harmony of opposites*.

Keywords: DSSU aether theory; Lorentz transformation; special relativity; speed of light; second postulate; absolute motion; absolute space; aether; length contraction; clock retardation.

Résumé: De nombreux chercheurs prétendent que le postulat de relativité d'Einstein, qui exige que la vitesse de la lumière soit invariante pour tous les observateurs inertiels, est faux. Leur prétention est fondée sur certaine preuve que la vitesse de la lumière est en fait variente: contrairement à la relativité speciale, la vitesse de la lumière *n'est pas* constante. Cet article explique pourqoui et comment le postulat d'Einstein de la constance de la vitesse de la lumière reste bienfondée. Quoique la prétention de la non-constance de la vitesse de la lumière est aussi valuable. La vitesse de la lumière est toujours constante quant à son véhicule de conduction. La vitesse de la lumière figure toujours constante dans le postulat restrictif d'Einstein. La vitesse de la lumière qui est deduite d'une experience d'aller et de retour de trajet de lumière (la mise en œuvre de la restriction d'Einstein) peut être *c*. Toutefois la vitesse de sortir ne doit pas être égale à la vitesse de retour. La vitesse irréversible ne peut pas être *c*. L'exploration suivante, ayant connaissance de trois domaines dinstinct de validité qui sont liés par le concept éther, rassemble **l'absolu**, **l'illusion**, et **la mesurable** afin de formuler un *postulat étendu* pour la vitesse de la lumière. Tout compte fait, encore une circonstance puissante de l'harmonie d'opposés Heraclitian.

1. Introduction

A comprehensive speed-of-light postulate demands the inclusion of three components. One must account for the intrinsic nature of the speed *c* (its absolute aspect). Another component must satisfy the requirements of Einstein's special relativity (ESR) —the *illusion* of constant lightspeed. And a third must accommodate the experimentally determined *nonconstant* speed of light.[1,2]

Such a speed-of-light postulate must be able to explain absoluteness *and* invariance *and* variance —seemingly contradictory properties— while maintaining logical consistency.

Since this article often refers to the *DSSU aether theory*[3,4], a review and an understanding of its relevant features will be helpful to the reader. In many ways, the DSSU[a] aether theory is similar to the Lorentz's aether theory developed by Hendrik Lorentz (1853-1928) near the end of the 19th century. They are both based on the Lorentz transformation equations, not the classical Galilean equations. Both incorporate physical *length contraction* and *clock retardation*. However, there are some fundamental differences, most notably the use of a dynamic space medium as opposed to Lorentz's static aether.

[a] DSSU is the acronym for Dynamic Steady State Universe, which is a model based on the premise that all things are processes.

Like all aether theories, the DSSU space medium is luminiferous. The speed of light is constant with respect to the aether medium. Its intrinsic value is c and is independent of the motion of the light source.

The theory is not restricted by the limitations of conventional relativity theory. It employs an *extended relativity* theory, which means that it encompasses *symmetrical* relativity as well as *non-symmetrical* effects. By incorporating symmetrical relativity, the Extended theory is placed in complete agreement with the results of Einstein's special relativity —in particular, lightspeed *invariance*— yet without agreeing to his postulates! By also incorporating non-symmetrical features, the Extended theory is in agreement with the evidence of lightspeed *variance*!

It is this Extended relativity theory that leads to (in fact, necessitates) a three-component postulate for the speed of light.

The Origin of the Aether Concept —a Historical Irony

Aristotle was more of a theoretical polymath than an experimental physicist. This bias often led him astray. For instance, Aristotle theorized that the speed of a falling object depended on its weight and on the viscosity of the medium through which it falls. He believed that **speed is inversely proportional to the resistance or viscosity** of the medium through which the moving entity is traveling. But, he pondered, what if there was no medium, what if there was only an empty void? He concluded that there can be no void, since that would mean zero viscosity and lead to the absurd notion that objects could fall with infinite speed. And thus, ironically, a wrong theory of falling objects led Aristotle to a valid concept of the void for which he postulated the existence of an "*ether*" medium!

Now what if Aristotle's argument were applied to light propagation? ... A modern day Aristotelian might reincarnate the argument and say that there can be no true void, since that would lead to the absurd notion of an infinite speed of light. (One wonders how the young Einstein, after abolishing the notion of a space medium, would have countered such a pertinent argument.)

What Aristotle could not have ideated, and many physicists today still do not conceive, is the probability that electromagnetic radiation and all material entities do not so much travel ***through*** the aether as they are conducted ***by*** the aether.

The reality is that without the presence of an "*ether*" medium the speed of light would be zero (not infinite).
–CR

2. Absoluteness Aspect: the Intrinsic Speed

Fundamentally, the speed of light must be intrinsically constant. That is, there must be some intrinsic factor (or factors) that causes it to have a specific speed. There must be an answer to the simple question, *Why is it 300,000 km/s and not 100,000 km/s?*

One factor immediately comes to mind: The presence of a light-conducting medium —an aether that permeates all matter and fills all space; an aether that is itself uniquely nonmaterial. As Einstein in his famous 1920 Leyden Lecture[[5]] had stipulated: "But this ether may not be thought of as endowed with the quality characteristic of ponderable media, … ." Joseph Larmor, had recognized this restriction when, writing in 1900, he remarked: "... Matter may be and likely is a structure in the aether but ***certainly aether is not a structure made of matter.***"[[6], emphasis added] In DSSU theory the aether is an ethereal "substance" in compliance with the Einstein and Larmor notions.

Now if aether serves as a light-conducting medium then, logically enough, one would expect its *density* (i.e., its nonmaterial density) to affect the speed of propagation in some way. But keep in mind that density here refers to *spatial* density (or count density) not *matter* density. The units of aether are not *material* entities and hence "density" can only refer to a sort of *counting* density.

Let us explore the spatial-density property for a moment. Consider a comparison between light and sound. (And please note here that I am not suggesting that light waves are compression waves.) A general rule for the propagation of sound is that the less space (gaps) there is between atoms and molecules of the medium the greater the wave speed. This is why the speed of sound is greater at sea level than at elevations; and greater still under water. This is why the speed in hydrogen gas (1284 m/s) is greater than in helium gas (965 m/s) which, in turn, is greater than in air (331 m/s).[b] Clearly, spatial density is the speed-determining factor, *not* mass density.

Now in the case of aether, this spatial density is taken to the ultimate extreme. The aether of DSSU theory has virtually no gaps —negligible vacuous spaces— between aether units. The density is always maximum —meaning that if this aether were, somehow (and there is a way), to be compressed, the spatial density would not change. The aether-space medium cannot be compressed to some higher density state.

A reasonable conclusion, drawn from the sound and light analogy (without specifying the nature of the respective waves), is that (i) acoustic waves vary in speed and do so because of the *variation in spatial density*, while light waves do not vary in speed simply because of the *constancy of the spatial density*. (ii) The speed of light is astonishingly high because the aether spatial density is correspondingly high.

The speed of light, in vacuum, is approximately $c = 300{,}000$ km/s.[c] However, when the conduction is through a transparent material medium the speed always appears to be less. This is due to the phenomenon of *light refraction* which consists of (i) a characteristic bending and (ii) an apparent decrease in the speed of the light. The latter has a ready explanation in the aether theory. Essentially, the speed of EM-waves (photons) in a material medium remains unchanged; it is something else that changes. The speed, with respect to the aether,

[b] These speed-of-sound values are all at 0°C and 1 atm pressure.
[c] Symbol c represents the latin word *celeritas*: "speed, swiftness"

remains unaltered and unalterable —it is always c with respect to aether. But because of the phenomenon of *photon scattering* by the atomic structure of the dielectric medium, the path-length of the photon increases and thereby gives the appearance of a slowing of wave/photon propagation, a slowing effect measured as the dielectric refractive index. The experimental details and the mathematical connection between the increase in path length and the refraction index are described in the following reference [7]. I should point out, it is quite conceivable that because of wave-particle duality the lightwave retains its cohesiveness as it propagates, while the photons, which somehow comprise the lightwave, deviate as they journey through the material medium.

The first component of the speed-of-light postulate states that the *intrinsic speed of light* is approximately $c = 300{,}000$ km/s. It is a conduction-by-aether speed whose constancy is determined, in part, by the spacing density of the aether units.

3. The Two-Way Relative Speed

The conventional method for measuring the speed of light involves a two-way-light-path method. Light pulses are beamed out and reflected back to the observer; the round-trip time and distance are measured.

Why is this important? … Because it is the method by which symmetrical relativity is achieved. In fact, it is based on the core definition that underlies Einstein's theory of special relativity. Let me explain.

The measure of the speed of anything is meaningless without employing a time interval. So, how does one define a time interval? Einstein must have understood that in a discussion at this fundamental level the intuitive notion of time intervals (say, between events at different places) is inadequate. And so, he detailed an operational definition of simultaneity and time-interval at different places as follows: Suppose time-intervals at different points of a given coordinate system are measured by clocks of similar construction; we may then synchronize these clocks by means of light signals. A emits a light ray at time t_A by A's clock, it is received and reflected by B at time t_B by B's clock, and returns to A at t'_A by A's clock. Then B's time t_B is *defined* to be simultaneous with A's time $\frac{1}{2}(t'_A + t_A)$. [8]

What is significant is that this definition makes the speed of light the same in both directions (directions AB and BA) by virtue of the time interval employed. And when extended to any pair of relatively moving observers (in uniform motion) it makes the speed of light, in a closed path, constant in all directions![8 p230-231] Furthermore, there has never been a violation of Einstein's narrowly-defined speed of light. In fact, the Michelson-Morley type experiment *when conducted in vacuum mode* provides unequivocal confirmation for the definition.

Essentially, Einstein achieves light speed invariance by requiring that the light pulse be measured using an out-and-reflected-back method. And keep in mind that the above definition has prior authority over his broadly stated 2nd postulate.

Einstein's theory is, of course, based on abstract space. We, however, wish to prove this invariance for aether space. Can it be shown that the DSSU theory predicts constant lightspeed (regardless of observer's motion through aether)? ... Let us see.

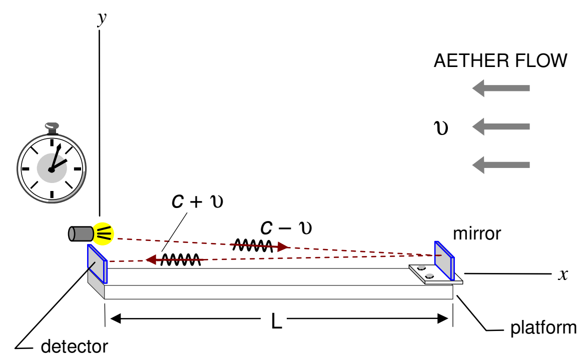

Fig. 1. "Two-way" method for measuring lightspeed. We already know that the speed of the light pulse is constant c *with respect to aether*. (We know this because we are using a luminiferous aether theory.) But what is the measured (the apparent) speed of the light pulse?

Consider the set-up shown in Fig. 1. Ignore the impracticality of trying to use a stopwatch to time the round-trip motion of a light pulse; simply focus on the equation for the apparent speed of light,

$$c_{\text{apparent}} = \frac{2L}{\Delta t} \,. \tag{1}$$

The apparent speed of light is the distance the pulse travels divided by the clock time-interval that the round-trip takes. The right side of the expression is simply the way in which speed —any speed— is defined.

The pulse being measured has an absolute speed c with respect to aether. The speed υ is the flow of the aether itself (this is the same as saying that the apparatus frame is absolutely moving through the aether with speed υ). Now, to be consistent, length L and clock time Δt must also be expressed in terms of their motion *through* aether.[d]

To be consistent with "absolute" c and "absolute" υ, everything on the equation's right side, the *apparent* length and *apparent* time-interval, must be converted into intrinsic terms. This means that both *length contraction* and *clock retardation* (as in the original meaning of time dilation) must be taken into account. In an aether-based theory these two physical effects result from the motion of bodies *through* the aether.

The intrinsically contracted length is [9]

[d] The expression $\left((c)_{\text{PER AETHER}} \pm (\upsilon)_{\text{PER AETHER}}\right)$, from Fig. 1, is an aether-referenced speed and so must be applied over an aether-referenced length $L_{\text{int}} = L/\gamma$ and using an aether-referenced time $\Delta t_{\text{int}} = \gamma \Delta t$.

$$L_{\text{intrinsic}} = \frac{L}{\gamma}, \tag{2}$$

where γ is the gamma factor, also known as the Lorentz factor and the intrinsic time-interval is [9]

$$\Delta t_{\text{intrinsic}} = \gamma \, \Delta t \, . \tag{3}$$

What is it that makes these expressions intrinsic? The expanded gamma factor, $\gamma = \left(1 - \upsilon^2/c^2\right)^{-1/2}$, contains the all-important distortion-causing *aether velocity* υ.

By substituting eqns (2) and (3) into eqn (1),

$$c_{\text{apparent}} = \frac{2L_{\text{int}}\gamma}{\Delta t_{\text{int}}/\gamma} = \frac{2L_{\text{int}}\gamma^2}{\Delta t_{\text{int}}} \, . \tag{4}$$

The round-trip time can now be formulated using the velocities shown in Fig. 1,

$$\Delta t_{\text{int}} = \frac{L_{\text{int}}}{c-\upsilon} + \frac{L_{\text{int}}}{c+\upsilon} = \frac{2L_{\text{int}}}{c}\frac{1}{\left(1-\upsilon^2/c^2\right)},$$

$$\Delta t_{\text{int}} = \left(\frac{2L_{\text{int}}}{c}\right)\gamma^2, \tag{5}$$

which allows eqn (4) to be simplified to:

$$c_{\text{apparent}} = \frac{2L_{\text{int}}\gamma^2}{\left(2L_{\text{int}}/c\right)\gamma^2} = c \, . \tag{6}$$

The *apparent* speed of light equals c which is a *constant* (and has the well-known value of about 300,000 km/s).

Thus, the speed of light is invariant and the DSSU aether theory agrees with Einstein's 2nd postulate.

It is the contraction of length and the slowing of clocks that gives us the remarkable illusion of the constancy of the speed of light under the conditions just described.

But change the conditions and the light pulse will reveal its *observer-dependent speed variance*.

4. The One-Way Relative Speed

Given that an aether medium exists and there is an intrinsic speed of light propagation (as defined, above, with respect to aether), it follows that for an observer in motion there must be a nonsymmetrical speed of light. There must be a *variant* speed of light with respect to the observer. The variance is not detectable by the two-way-path method (as demonstrated above). The variance is detectable only by the one-way-path method.

For the third component of the speed-of-light postulate we will consider three configurations.

4.1 First Configuration

The first setup is shown in Fig. 2. For this arrangement, the light source is attached to the far end of the rigid platform —the same one that was used earlier. Identical clocks are positioned at both ends of the one-directional light-path. We assume that the difficult task of clock-synchronization at both ends of the path interval has somehow been overcome.

Consider the equation for the observed speed of the one-way motion of a light pulse;

$$c_{\text{apparent}} = \frac{L}{\Delta t} \, . \tag{7}$$

As in the previous section, the light pulse has an absolute speed c with respect to aether. The speed υ is the flow of the aether itself. And again, to be consistent, length L and clock time Δt must also be expressed in terms of their motion *through* aether.

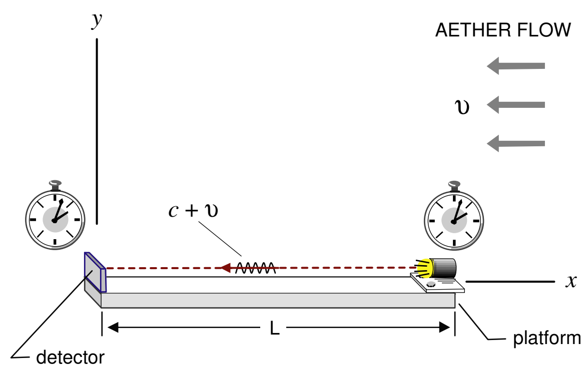

Fig. 2. *"One-way" method for measuring lightspeed.* With respect to an observer stationed near the detector, what is the measured (the apparent) speed of the light pulse?

To be consistent with "absolute" c and "absolute" υ, everything on the equation's right side, the *apparent* length and *apparent* time-interval, must be converted into intrinsic terms. This means that we must use the *contracted length* of the platform and the *retarded time* of the clocks, expressed in eqns (2) and (3) respectively.

By substituting eqns (2) and (3) into (7),

$$c_{\text{apparent}} = \frac{L_{\text{int}}\gamma}{\Delta t_{\text{int}}/\gamma} = \frac{L_{\text{int}}\gamma^2}{\Delta t_{\text{int}}} \, . \tag{8}$$

The one-way-trip time can now be formulated using the velocities shown in Fig. 2,

$$\Delta t_{\text{int}} = \frac{L_{\text{int}}}{c+\upsilon}, \tag{9}$$

which allows eqn (8) to be simplified to:

$$c_{\text{apparent}} = \left(c+\upsilon\right)\gamma^2 \, . \tag{10}$$

As υ increases and approaches the value c, c_{apparent} increases without limit.

However,

$$c_{\text{apparent}} \approx (c+\upsilon) \qquad \text{for } \upsilon << c. \tag{11}$$

When the motion through the aether is much less than c, then the *apparent* speed of light equals $c \pm \upsilon$ —where the sign depends on the direction of the aether wind along the x-axis.

4.2 Second Configuration

The second configuration for predicting the one-way speed of light is similar to the previous set-up but without the rigid platform. This means there is no apparatus length contraction involved. A region of aether does not contract merely because it is in a state of bulk motion. (The fact is that aether contraction only occurs during gravitational inflow.) However, in addition to the clock synchronization problem, there is the problem of maintaining distance stability (in, for instance, a tandem space-travel scenario).

The practicality of the setup, shown in Fig. 3, is not addressed here. Our main concern is the fundamental aspect of the setup. The important point is that —although there is the ESR appearance of distance contraction— the separation distance is *not* length contracted.

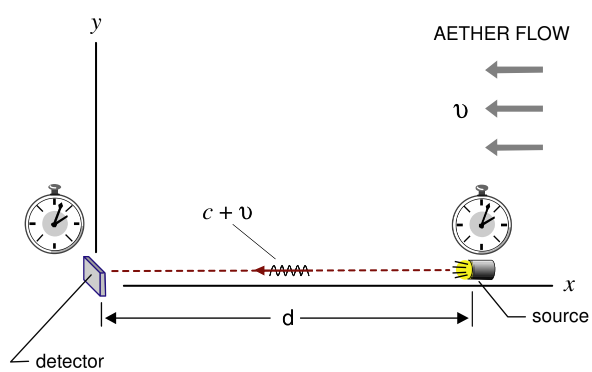

Fig. 3. *Second configuration* for determining the one-way speed of light. Separation distance d is held constant.

Consider, again, eqn (7) for the observed speed of the one-way motion of a light pulse,

$$c_{\text{apparent}} = \frac{d}{\Delta t}. \tag{12}$$

The right-hand side of the expression must be expressed in terms of intrinsic quantities. Since there is no distance contraction, the proper length d equals the absolute or intrinsic distance:

$$d = d_{\text{uncontracted}} = d_{\text{abs}}. \tag{13}$$

Clock time Δt is subject to clock retardation and must again be expressed as, $\Delta t_{\text{int}}(1/\gamma)$. Then,

$$c_{\text{apparent}} = \frac{d_{\text{int}}}{\Delta t_{\text{int}}/\gamma} = \frac{d_{\text{int}}\gamma}{\Delta t_{\text{int}}}. \tag{14}$$

The one-way-trip time can be formulated using the velocities shown in Fig. 3,

$$\Delta t_{\text{int}} = \frac{d_{\text{int}}}{c+\upsilon}, \tag{15}$$

which allows eqn (14) to be simplified to

$$c_{\text{apparent}} = (c+\upsilon)\gamma = c\sqrt{\frac{(c+\upsilon)}{(c-\upsilon)}}. \tag{16}$$

As υ increases and approached the value c, c_{apparent} increases without limit.

However,

$$c_{\text{apparent}} \approx (c+\upsilon) \qquad \text{for } \upsilon << c. \tag{17}$$

When the aether flow is much less than c, then the *apparent* speed of light equals $c \pm \upsilon$ —where the sign depends on the direction of the aether wind along the x-axis.

4.3 The Third Configuration

Here, the problem of clock-synchronization is not an issue. Only a single clock is used.

Instead of timing a one-way light pulse over a known distance using two clocks, the following arrangement will time the duration of the pulse itself. The pulse source will be from a "light beacon" with a known, or determinable, frequency.

The technique is analogous to measuring the speed of a passing train by recording the time it takes for its full length to roll past the observer and combining the time with knowledge of the train's length. The train's average speed can be found from the basic expression,

$$Speed = \frac{Length}{Time\ period}. \tag{18}$$

Consider the situation shown in Fig. 4. The Earth is moving through the aether to the left and a pulse source (say an interplanetary navigation beacon) is moving through the aether to the right. Although the flashing beacon is moving through the aether it would logically be stationary with respect to some planet or asteroid.

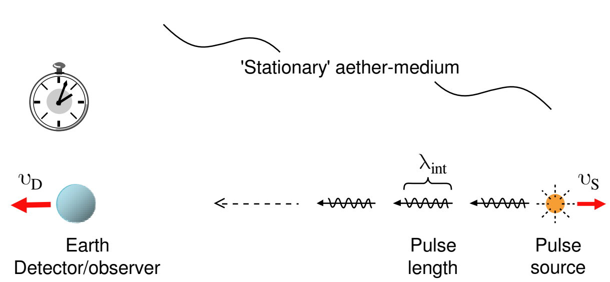

Fig. 4. *Third configuration for determining the one-way speed of light.* As described in the text, the apparent lightspeed is the measured pulse length (λ) divided by the clocked duration of the light pulse. The overall distance that the pulse has traveled is *not* important. (Recession velocities are considered to have positive direction; as shown, both υ_D and υ_S are positive.)

An observer on Earth should be able to predict the speed of the pulse as follows. Start with eqn (18),

$$Speed_{\text{pulse}} = \frac{Pulse\ length}{Time\ period}. \tag{19}$$

The observed speed of the pulse, on the left-hand side of the expression, is basically the same as c_{apparent} and will be replaced accordingly. The *pulse length* will be denoted by λ_D, and the *time period* by T_D. In relativity theory these are known as the *proper length* and *proper time* which means they are measured in the "D" (detector) reference frame.[e]

$$c_{\text{apparent}} = \frac{\lambda_D}{T_D}. \tag{20}$$

Since we are using an aether theory, we again convert everything on the right-hand side of the expression into equivalent intrinsic notation —aether-referenced notation. First, we will deal with the *pulse length*.

The pulse that travels from the source to the detector has some intrinsic (absolute) length that does not change as it travels through the aether (assuming aether-space is neither expanding nor contracting). *The intrinsic length, λ_{int}, is the same at the Source and at the Detector* (i.e., at the beacon and at the Earth in the diagram).

According to a basic equation of Extended relativity, the *intrinsic length* is related to the *proper length* by the Lorentzian factor.[f]

$$\text{In the Source's moving frame, } \lambda_{\text{int}} = \frac{\lambda_S}{\gamma_S}. \tag{21}$$

$$\text{In the Detector's moving frame, } \lambda_{\text{int}} = \frac{\lambda_D}{\gamma_D}. \tag{22}$$

$$\text{We may then agree that, } \frac{\lambda_D}{\gamma_D} = \frac{\lambda_S}{\gamma_S}, \tag{23}$$

$$\text{which gives, } \lambda_D = \frac{\gamma_D}{\gamma_S}\lambda_S, \tag{24}$$

which is then substituted into eqn (20) to give,

$$c_{\text{apparent}} = \frac{(\gamma_D/\gamma_S)\lambda_S}{T_D}. \tag{25}$$

Next, we make use of the basic equation that says $\lambda = c\times T$. For the *proper pulse length* λ_S, we substitute its equivalent: c times the period T_S. Then,

$$c_{\text{apparent}} = \frac{\gamma_D}{\gamma_S}\frac{cT_S}{T_D}. \tag{26}$$

Next, we make use of the fact that the time period is equivalent to the reciprocal of the frequency ($T = 1/f$).

$$c_{\text{apparent}} = c\frac{\gamma_D}{\gamma_S}\frac{f_D}{f_S}. \tag{27}$$

Now, from the aether-referenced Doppler equation [Fig. 7 in ref [10]], it is known that the frequency ratio,

$$\frac{f_D}{f_S} = \sqrt{\frac{1-(\upsilon_S/c)}{1+(\upsilon_S/c)}}\sqrt{\frac{1-(\upsilon_D/c)}{1+(\upsilon_D/c)}}. \tag{28}$$

We are now in a position to express the speed equation, eqn (27), entirely with aether-referenced speeds. With the frequency-ratio substitution and the expanded Lorentz factors, the equation is,

$$c_{\text{apparent}} = c\frac{\sqrt{1-(\upsilon_S/c)^2}}{\sqrt{1-(\upsilon_D/c)^2}}\sqrt{\frac{1-(\upsilon_S/c)}{1+(\upsilon_S/c)}}\sqrt{\frac{1-(\upsilon_D/c)}{1+(\upsilon_D/c)}} \tag{29}$$

and simplifies to,

$$c_{\text{apparent}} = c\frac{(c-\upsilon_S)}{(c+\upsilon_D)}. \tag{30}$$

This represents the predicted *apparent* speed of light under certain defined conditions. In the applications of this equation it is particularly interesting to note the lack of symmetry between the situations #2 and #3 in Table I.

Contrary to text-book assertions regarding the Doppler effect for light, it *does* matter as to who is in motion —the detector or the source. Observations actually depend on the individual (intrinsic) motions of the observer *and* the distant signal-source —unlike the symmetrical relativity of ESR where individual motions of observer and source are *not* important and only the *relative* motion is important.

Situations #2 and #3, in Table I, justify the reason for referring to *the third postulate component* as the ***non-symmetrical*** postulate (as in the last row of Table II).

Now what if you wanted to apply the c_{apparent} equation but did not know the two aether-referenced velocities (or say you were a skeptic of the aether concept)? Let us say that the only piece of information available is the conventional relative speed υ. Then, you would take eqn (30) and simply discard one of the frame speeds and replace the other with the pure relative speed. And it matters not in the least which you discard υ_S or υ_D, and which you replace υ_S or υ_D —provided that υ is considerably less than the speed of light. The equation simply reduces to the approximation shown in the 4th and 5th rows of Table I.

In any event, equation (30) is what the aether theory predicts. Let us now look at some experimental evidence.

Consider the Earth-Jupiter-Io planetary system. As Earth revolves around the Sun, the innermost satellite of Jupiter, Io, is observed to undergo regular variations in its orbital period. Because Io, as observed from Earth, is periodically eclipsed by Jupiter, Io's occultations represent an emission of what may be described as

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[e] A "period" refers to, for example, the time for one wavelength of light to impact a detector; or the duration of a cycle of some periodic action. The *proper period* of a pulse is the Δt time recorded by a clock at-rest with respect to the detector (and without regard to the clock's motion with respect to aether).

[f] The aether-referenced Lorenzian factors for the Source frame and the Detector/Earth frame are independent of each other. They are denoted by γ_S and γ_D respectively.

"pulses of darkness." These pulses travel through the aether, with speed c, toward the Earth.

What makes these occultations —these pulses of darkness— both interesting and useful is the distinct variation in the pulse period. This variation was first discovered by Ole Roemer in 1675 and formed the basis of his attempt to measure the speed of light. Astronomers readily understood that the variance was not occurring *at* the Jovian system (Io was not changing its orbital speed and not changing its orbital period) but rather was related to the orbital motion of the Earth. The variance was caused by the motion of the observers.

Table I Applications of the lightspeed equation (30)

	Application situations	Equations
1	Both Detector and Source are moving with respect to aether.	$c_{\text{app}} = c\dfrac{(c-\upsilon_S)}{(c+\upsilon_D)}$ [*] Valid at all speeds
2	Source is stationary (i.e., $\upsilon_S = 0$), then υ_D may simply be treated as the relative speed υ.	$c_{\text{apparent}} = \dfrac{c^2}{c \pm \upsilon}$ "+" separating "–" approaching Valid at all speeds
3	Detector is stationary (i.e., $\upsilon_D = 0$), then υ_S may simply be treated as the relative speed υ.	$c_{\text{apparent}} = (c \mp \upsilon)$ "–" separating "+" approaching Valid at all speeds
4	Assume *no* knowledge of aether and declare the observer/detector is in motion. (υ_D is replaced by υ; υ_S is replaced by 0)	$c_{\text{apparent}} = \dfrac{c^2}{c \pm \upsilon}$ $\approx (c \mp \upsilon)$ [**] Will always be valid for $\upsilon \ll c$.
5	Assume *no* knowledge of aether and declare the Source is in motion. (υ_S is replaced by υ; υ_D is replaced by 0)	$c_{\text{apparent}} = (c \mp \upsilon)$ "–" separating "+" approaching Will always be valid for $\upsilon \ll c$.

Table notes: It is assumed that space is Euclidean. It is neither expanding nor contracting.
* Sign rules for aether-referenced velocities: If the intrinsic motion of "A" is away from "B" then υ_A is positive. If the intrinsic motion of "A" is toward "B" then υ_A is negative. DSSU extended-relativity equations generally assume υ_A and υ_B are positive.
** Per binomial theorem approximation.

A detailed analysis of Io's pulses-of-darkness variation has been made by Professor Stephen Gift.[11] He describes the analysis as "Light speed measurement using a one-way signal pulse train." In addition to Earth's orbital speed, he uses three critical pieces of information. The measured Δ-time of the occultations during (i) Earth's maximum approach speed (toward Jupiter), (ii) Earth's maximum recession speed (away from Jupiter), and (iii) Earth's swing across the line joining the Sun and Jupiter (i.e., when the Earth is neither approaching nor receding). These time measurements represent minimum T_D, maximum T_D, and constant T_S, respectively (using our previous terminology D for detector and S for source).

Gift reports that "for the movement of the Earth directly away from Jupiter the relative light speed … for light emitted by Io and detected on Earth is given by … $c - \upsilon$." The measured light speed "is almost exactly equal to the classical value of relative light speed $c - \upsilon$ for the receding Earth, which using $\upsilon = 29{,}790$ m/s for Earth is"[11]

$$c - \upsilon = (299{,}792{,}458 - 29{,}790)\ \text{m/s}$$
$$= 299{,}762{,}668\ \text{m/s}\,.$$

Similarly, Gift reports "the experimentally determined light speed value … is almost exactly equal to the classical value of relative light speed $c + \upsilon$ for the advancing Earth, which using $\upsilon = 29{,}790$ m/s for the Earth is"

$$c + \upsilon = (299{,}792{,}458 + 29{,}790)\ \text{m/s}$$
$$= 299{,}822{,}248\ \text{m/s}\,.$$

"On the basis of the experimentally demonstrated classical light speed variations … relative to the moving Earth, we conclude that the change in the period of the planetary satellite Io measured by an observer on the Earth, is a direct indication of a change in light speed relative to that moving observer."[11]

5. Discussion

There is a significant difference between configuration 1 (and 2) and configuration 3. Configurations 1 and 2 do not involve motion between the observer/detector and the source. Configuration 3 does.

Configuration 1 (and 2) is designed to reveal lightspeed variance *associated with absolute motion*.

Configuration 3 is designed to reveal lightspeed variance *only when there is relative motion between the observer/detector and the source*. But this is not relative motion in the conventional sense! With configuration 3, there has to be a *difference in two absolute motions* —in the sense of aether-referenced motion.

There is also a difference in the details of what is measured: One method measures a pulse travelling between two points, while the other measures a pulse travelling past a single point.

5.1 Nonsymmetrical Effects

Configuration 3 is clearly not relative motion in the conventional sense. As the separation speeds of observer and light source increase c_{apparent} decreases —but it does not decrease symmetrically. Look at the equation in the first row of Table I; it reveals that a change in υ_D is NOT the same as an equal change in υ_S. *The motion of the observer/detector dominates* over that of the source. This is the essence of the nonsymmetrical domain.

In absolute terms (and with equal speeds) a receding light source is not the same as an observer receding from the source. They do not produce the same quantitative effect. But at low speeds the difference is negligible and an approximation of the relative speed, as described in Table I (rows 4 & 5), may be used.

5.2 Extended Relativity

For a description of physical reality, three definitions of the speed of light are required. One is required for each of the domains of an extended theory: The conduction definition for the *absolute domain*. The two-way definition for the domain of *symmetrical relativity*. The one-way definition for the domain of *asymmetrical effects*.

Symmetrical relativity is derived directly from the Lorentz transformation equations applied to the aether space-medium.[12]

The "three domains" are encompassed by what is called *extended relativity*.

The relationship of these ideas, and some additional detail, is shown in the Fig. 5 flowchart.

6. Summary and Conclusion

6.1 Symmetry Lost

Extended relativity theory involves a preferred frame. Motion occurs within a preferred frame —within a detectable aether. This makes it possible to have *absolute inertial motion*. The presence of aether implies absolute (or intrinsic) motion with respect to it. However, this entails a partial loss of symmetry of relative motion between two independent frames of reference. When velocities are aether-referenced, there occurs a loss of symmetry. If "A" is stationary in the aether then the *intrinsic* "relativistic" effects (clock slowing, length contraction) that "A" determines for "B" need not agree with such effects that "B" determines for "A."

When there is relative motion, apparent effects arise and absolute (or intrinsic) effects manifest. When the motion is aether-referenced, the intrinsic effects (clock slowing, length contraction, lightspeed variance) become quantifiable. When such intrinsic effects are quantified, ***the symmetry of the relative motion is lost***. Let me emphasize, this only arises when velocities are aether-referenced. (When the aether frame, however, is not referenced, then relative motion simply means *apparent* relative motion; which, in turn, means that Einstein's equations remain valid.)

If a relativity theory based on aether is to represent physical reality then *that* theory must somehow retain *the symmetry of apparent relative motion*.

6.2 Symmetry Lost but Illusion of Symmetry Gained

For Einstein, special relativity represented a real symmetry —the coding of the real symmetry of nature. In his view there was no symmetry-breaking aether.

DSSU theory introduces a nonmaterial aether medium. The very act of introducing aether into the world picture destroys the symmetry of nature —the Einsteinean symmetry.

In the presence of aether, Einstein's essential pure symmetry *becomes but an illusion of symmetry! —with its remarkable illusion of lightspeed invariance.*

Extended relativity, because of the mere fact that it is an aether theory, abandons the symmetry; however, it retains the *illusion of symmetry*.

What is remarkable is that it retains this illusion of symmetry even with aether-referenced velocities in the theory's various equations. Here is what I mean by this: Take any ESR equation, convert it to an "Extended"

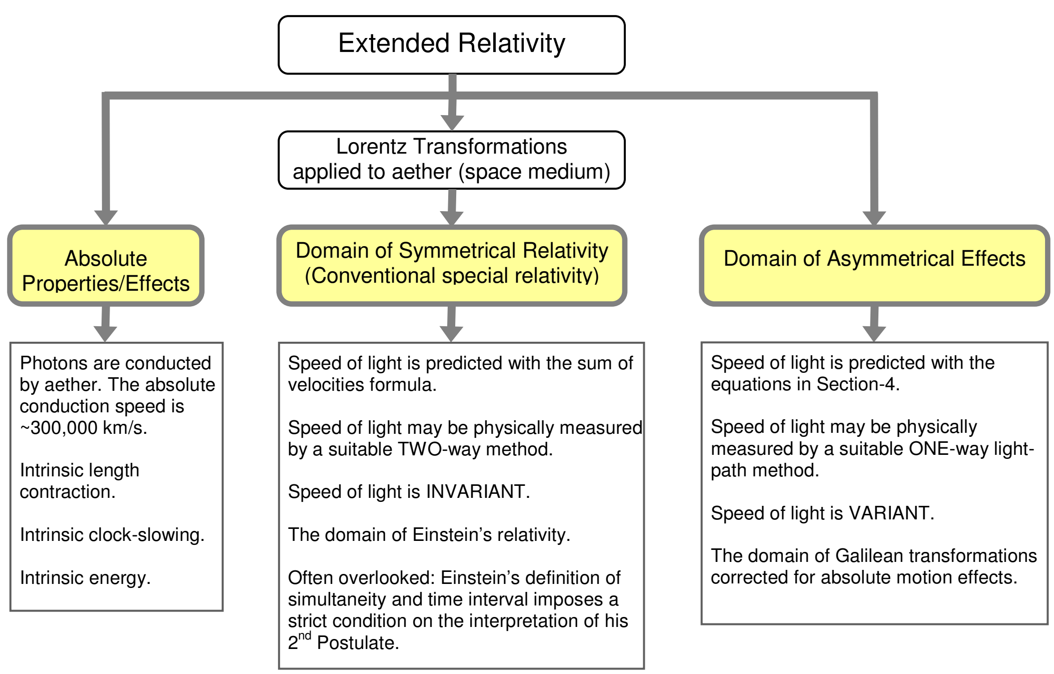

Fig. 5. *Extended relativity* encompasses three domains, each defines the speed of light differently.

equation, and one obtains the same predicted or observable results. The difference? … The ESR result would represent a *theoretical* natural symmetry; whereas the Extended result would represent an illusion of symmetry.

How the illusion of symmetry is achieved was demonstrated in Section 3, above.

6.3 Realistic Aether Theory

Any realistic aether theory must incorporate three elements: (1) constant c with respect to aether, (2) the ESR *illusion* of constant lightspeed, and (3) the experimentally determined *nonconstant* speed of light.

A functional aether theory must be able to explain all the apparent relativistic effects coded in Einstein's special relativity. It must retain the symmetry of apparent relative motion. The theory must also be able to explain all the absolute effects imposed by aether and detectable by experimentation.

The DSSU aether theory fulfills all the above requirements. The theory includes the *apparent* effects due to motion as well as the corresponding *intrinsic* effects. In a practical sense, it serves to extend traditional *special relativity* into a very special frame of reference.[13]

6.4 The Extended Speed-of-Light Postulate

Table II, below, gives the three component parts of the speed-of-light postulate for the new theory. The first component defines the absolute speed of light. Then there are two definitions for the apparent speed of light.

The invariance definition: The observed speed of light when measured by the *two-way method* does not depend on the motion of the observer. This is the ESR-compatible definition. The supporting equation is,

$$c' = \frac{c+\upsilon}{1+\left(c\upsilon/c^2\right)} = c\,, \tag{31}$$

which is simply an application of the sum-of-velocities formula of special relativity. As applied here, the variable c' represents the observed speed of a photon (or light pulse) which has a speed of c with respect to its source; the source itself is moving with speed υ with respect to the observer. **Regardless of the value of υ the expression always reduces to the constant *c*.** Essentially, this is the mathematical expression of Einstein's lightspeed invariance postulate.

Incidentally, all the experiments based on this method have, for over 100 years, given consistent results. There is no question as to the validity of Einstein's postulated speed of light —with the important proviso that the postulate (and equation) be interpreted with Einstein's own restrictive definition discussed earlier.

The variance definition: The observed speed of light when measured by the *one-way method* depends on the motion of the observer. The applicable equation, for "low" speeds, is

$$c' = c \pm \upsilon\,, \qquad \upsilon \ll c\,. \tag{32}$$

The speed of light is *variant* in agreement with the presence of aether and experimental evidence (Gift's analysis of the Roemer effect[14]; DeWitte[15]; Cahill[16]; and [17,18,19]).

The presence of aether provides the core meaning to the speed of light. Without aether, or some sort of space medium, we would be faced with a choice between two highly unrealistic options: First, a speed of light that is zero, since without a conducting medium photons would not be able to propagate. Second, a speed of light that is infinite, a speed supported by the Aristotelian viscosity argument presented earlier.

Table II The speed-of-light postulate for the new theory (DSSU Extended relativity) comprises three components or definitions.

Speed-of-Light Postulate			
Three ways to define the speed of light	Speed relationship	Motion of observer	Remarks
Constant with respect to the light-conducting medium:	$v_{\text{intrinsic}} = c$	Irrelevant	Speed is determined by the properties of aether (notably its constant "density")
Constant and symmetrically relative (Einstein's Postulate):	$v_{\text{rel}} = c$ The propagation speed of light as a remarkable illusion!	Any uniform motion	Requires Einstein's defined measuring method: **Two-way light-path**
Nonconstant and nonsymmetrically relative (Not ESR compliant):	$\upsilon_{\text{rel}} \begin{cases} < c \\ = c \\ > c \end{cases}$	Away from source At rest within aether Towards source	Measuring method: **One-way light-path**

Table notes: The two-way-light-path method involves light pulses beamed out and reflected back to the observer. The Michelson interferometer uses this method. With the other, the *one-way*-light-path method, no reflection is involved. An example of the one-way method is S.J.G. Gift's analysis [20] of the Roemer effect (the variation in the period of Jupiter's moon Io as observed from Earth from opposite sides of Earth's Solar orbit).
Of course, c ≈ 300,000 km/s.

It is the presence of aether —by inducing physical length contraction and physical clock slowing— that makes possible the remarkable illusion of light speed invariance.

It is the presence of aether —by giving meaning to aether-referenced velocity/speed— that makes possible the reality of light speed variance.

In conclusion, it is the presence of aether that gives concordance to the three diverse definitions of the speed of light and underpins the Extended Postulate. □

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