Resolving a Paradox in Special Relativity
–Absolute Motion and the Unified Doppler Equation

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Abstract: One of the great unsolved mysteries in standard cosmology involves the nature of the relationship between absolute motion and relative motion. By the first postulate of *Einstein's special relativity*, one cannot tell if one is at rest or in uniform motion in a straight line. However, one can always recognize accelerated motion. The present paper shows that both *constant circular motion* and *constant linear motion* represent absolute motion. The strange consequences of having oppositely directed absolute motion are dealt with. The paradox is resolved by first introducing aether-space, and then by deriving and applying the *Aether-Referenced Doppler equation*. It is shown how the latter equation, under specified conditions, converts to the Einstein special relativity Doppler expression; and, under another set of conditions, it converts to the General Doppler expression. Also, a *Unified Doppler equation* is presented. This unified equation encodes both the *Absolute Doppler expression* and the *Einstein special relativity Doppler expression*. Absolute relativity and apparent relativity are briefly discussed, and the new relativity postulates are stated. © 2010 Physics Essays Publication. [http://dx.doi.org/10.4006/1.3498902]

Résumé: Un des grands mystères non résolus dans la cosmologie standard implique la nature de la relation entre un mouvement absolu et un mouvement relatif. Par le premier postulat de la *relativité restreinte d'Einstein* on ne peut pas indiquer si on est au repos ou en mouvement uniforme dans une ligne droite. Cependant, on peut toujours identifier le mouvement accéléré. Cet article montre que le mouvement circulaire constant aussi bien que le mouvement linéaire constant représentent le mouvement absolu. Les conséquences étranges d'avoir un mouvement absolu dirigé à l'opposé y sont traitées. Le paradoxe est résolu premièrement en introduisant l'éther-espace, et puis en dérivant et en appliquant l'***équation Éther-Référencée de Doppler***. Il est montré comment cette dernière équation, sous conditions spécifiques, se transforme en *expression de Doppler de la relativité restreinte d'Einstein*; et, sous un autre ensemble de conditions, elle se transforme à l'*Expression Général de Doppler*. En outre, une **équation unifiée de Doppler** est présentée. Cette équation unifiée code l'*expression absolue de Doppler* et l'expression *de Doppler de la relativité restreinte d'Einstein*. La *relativité absolue* et la *relativité apparente* sont discutées, et les *nouveau postulats de relativité* sont énoncés.

Keywords: Special relativity; relative motion; absolute motion; absolute space; Doppler effect; Doppler radar; aether; absolute inertial motion; Dynamic Steady State Universe.

When a larger theory encompasses a narrower one, the paradoxes of the narrow theory disappear. –Joel R. Primack[1]

One of the great unsolved mysteries in standard cosmology involves the nature of the relationship between absolute motion and relative motion. By the first postulate of *Einstein's theory of special relativity* (ESR) one cannot tell if one is at rest or in uniform motion in a straight line. However, one has no problem recognizing the other forms of motion: rotation, linear acceleration, and change-of-direction acceleration. Why not inertial motion!? Jacob Bronowski, writing in Scientific American, posed the question this way,

> *Why does the special theory of relativity single out, of all possible modes of movement, the movement in a straight line at constant speed? Why cannot the traveler tell if he is in this state of movement or at rest?*[2]

And leaves the question unanswered when he states, "As far as we know there is no reason in the world ..." It is a mystery.

1. Change-of-Direction Motion is a Form of Absolute Motion

Is it possible to form a conceptual link between a known type of absolute motion and ordinary inertial motion?

There are three kinds of motion that are considered absolute —absolute in the sense that one is able to experience the motion and it is measurable within the moving frame without reference to external markers.

First, there is rotation on an axis. Not useful in the present context; can't be related to a linear velocity.

Second, there is linear acceleration. Here we have the desired linear velocity but the problem is that its magnitude is changing.

Lastly, there is change-of-direction motion. If configured as constant circular motion, the motion will involve constant speed. This should be useful for gaining insight into the nature of absolute motion. For one thing, the motion is easily measured; it just requires that an accelerometer be attached to the object following the curved path.

Since the motion need not be relative to anything, and it is measurable, it must be a kind of absolute velocity. And the useful feature is that although continually changing direction the velocity magnitude is constant.

2. Absolute Inertial Motion as a Limiting Case of Known Absolute Motion

A case of absolute motion without an absolute frame of reference.

Now let us conceptually link the two types of motion; absolute motion (involving centripetal acceleration) and uniform linear motion.

Imagine a spacecraft navigating a planar circular course (see **Fig. 1(a)**). The motion has an absoluteness quality; and the motion has a measurable centripetal acceleration. This acceleration (lateral to the direction of forward motion) is measured with the ship's on-board accelerometer and is related to the geometry of the navigation path by $\upsilon^2 = Ra_c$. Obviously we can pick and choose the acceleration —*there can be degrees of acceleration*. But, and this is the important point here in the depicted situation, *there cannot be degrees of absolute motion.*

As the radius of the navigation circle is stepwise increased (as in **Fig. 1 (b)** and **(c)**) the acceleration decreases. In fact, the acceleration may be, in this manner, decreased into irrelevancy.

But what we cannot do in the illustrated sequence is this: simultaneously maintain a constant speed and "decrease" absolute motion —that is, we can't make the absoluteness quality of the motion go away!

In part **(d)** of **Fig. 1** the acceleration is gone but nothing has been done to remove "absoluteness."

Question. What is absolute motion devoid of acceleration? ... *It is absolute inertial motion*.

Thus we have, conceptually, transitioned from accelerated motion to inertial motion —without the loss of absoluteness.

Furthermore, it seems logical to conclude that the absoluteness of the motion resides in the speed of the ship and not in its acceleration.

Evidence? ... It is known that absolute motion affects physical processes and "clocks" (they slow down). It is also known that the acceleration component of the motion is not the cause and not a direct contributing factor.

> *That is as it should be because cyclotron experiments have shown that, even at accelerations of 10^{19} g (g = acceleration of gravity at the Earth's surface), clock rates are unaffected.* ***Only speed affects clock rates, but not acceleration*** *per se.* –Tom Van Flanders[3] [Emphasis added]

(The question of how absolute inertial motion is measured is addressed in Section 5.)

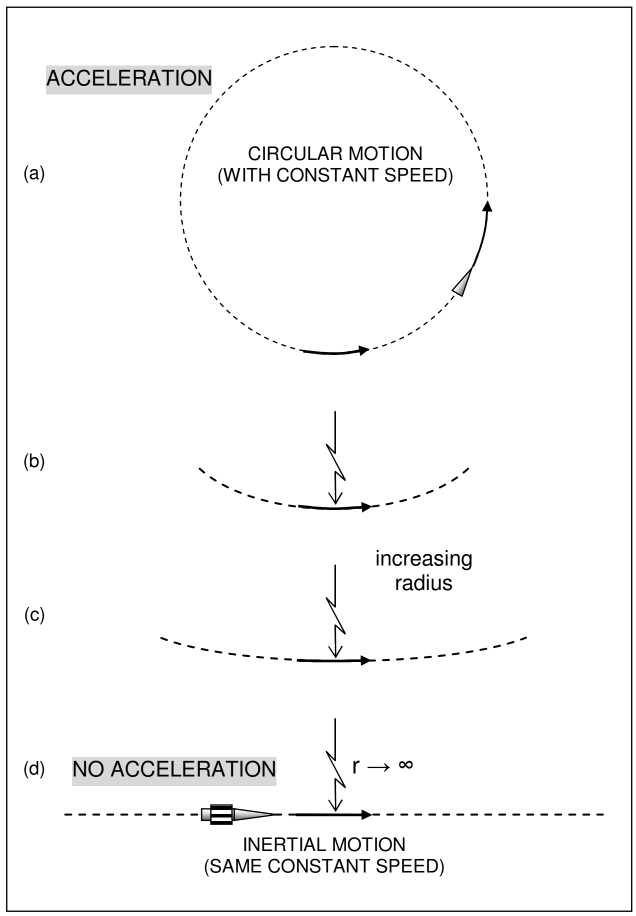

Fig. 1. Accelerated motion transforms (conceptually) into inertial motion by allowing the radius of the curved path to approach infinity, as shown by the sequence (a), (b), (c) and (d).

3. Space Flight Experiment in Earth's Frame

Returning to the spaceship traveling its circular path, let us say, the path is in the astronomical region above the Earth. Imagine that a suitable object (suitable for use as a navigation beacon) exists at a distance of 3/π lightyears far above the Northern sky. The ship is guided by the beacon which is kept at a constant distance during the round trip. This ship-to-beacon distance represents the radius of the circular path.

The pilot wishes to determine the ship's "absolute" speed. He checks the on-board lateral-axis spring-type accelerometer and finds that it is holding steady at, say, 3.59 m/s^2 (or about 37% of normal Earth-surface gravity). The pilot is simply measuring the effects of a known type of absolute motion —a type not dependent on a formal absolute frame of reference.

Note the use of the term "absolute" with quotations; in the present context it refers to what is actually measurable (the acceleration) and what is held fixed (the radius) and what is therewith calculated (the speed). It does *not*, at this stage in the discussion, refer to an absolute frame of reference defined by a background medium. It could be argued, then, that the ship's "absolute" speed —its instantaneous rotational speed relative to the set of inertial frames, notably the center of the circle— is determined by the simple equation,

$$(\text{Speed}_{\text{tangential}})^2 = \text{Radius} \times \text{Acceleration}_{\text{centripetal}} \, .$$

$$\upsilon_{\text{Abs}} = \sqrt{\tfrac{3}{\pi}\,\text{Ly} \times 3.59 \text{ m/s}^2}$$

$$\ldots$$

$$\upsilon_{\text{Abs}} = 0.60\ c$$

The "absolute" speed is determined to be six-tenths the speed of light.

A quick calculation and the pilot finds that a round trip back to Earth will take 10 years.

$$\Delta\ \text{time}_{\text{Abs}} = \frac{\text{circumference}}{\text{speed}_{\text{Abs}}} = \frac{6\ \text{Ly}}{0.60\ c} = 10\ \text{y}\ ,$$

But wait. ... This is a classic twins-paradox situation, and the pilot knows it. And he's the "traveling twin." He has the "absolute" motion to prove it. The just-calculated 10 years, which he can easily confirm later on arrival back at Earth, probably represents Earth-time. Since acceleration is indicative of motion and motion affects clocks, the pilot's measured time is altered. His clock is running slow —slow compared to the calculated "Abs" time. (Not a problem; he can readily calculate his clock-retardation factor and find that the round trip, according to the ship's clock, should take 8 years.)

On his clock it *appears* that the trip takes less time. And *apparent* time must be accompanied by *apparent* speed.

Can the apparent speed be measured? ... Yes, but first a recheck of the change-of-direction acceleration is in order. It is noted that readings taken from the accelerometer is not in any way dependent on time (it simply measures the static deflection of a spring, and in this case, in the direction perpendicular to the forward motion). What is needed is an *apparent* acceleration as measured with a clock.

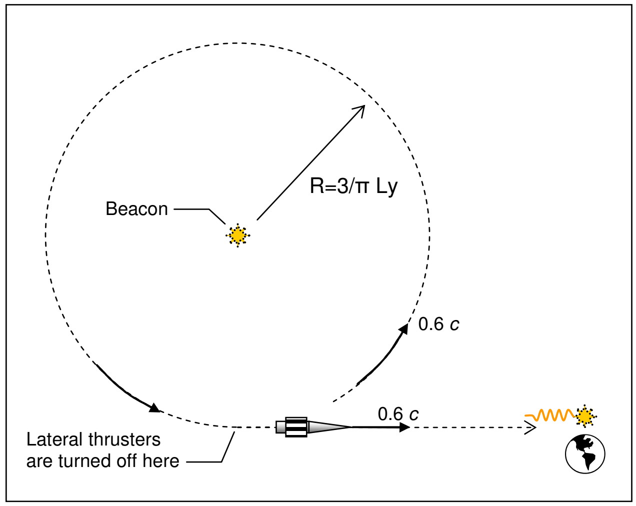

Fig. 2. *Doppler speed check.* As detailed in the text, the ship has acquired (without direct reference to the Earth) an "absolute" speed of 0.6 *c*. Upon returning to Earth a Doppler check reveals that the ship has a relative velocity of 0.6 *c* with respect to Earth. In this scenario "absolute" and relative velocities happen to agree.

Simple. An object is allowed to freefall, from one side of the ship to the other, under the influence of the centrifugal acceleration. From the length[a] and duration of the freefall the *apparent* acceleration can be calculated. It turns out to be 5.60 m/s^2 (or 57% of *g*).

Then the apparent speed is calculated by the same method used earlier. And it turns out to be,

$$(\text{Speed}_{\text{Apparent}})^2 = \text{Radius} \times \text{Acceleration}_{\text{Apparent}}\ ,$$

$$\upsilon_{\text{App}} = \sqrt{\tfrac{3}{\pi}\,\text{Ly} \times 5.60 \text{ m/s}^2} = 0.75\ c\ .$$

Thus the spacecraft possesses an "absolute" speed (0.6 *c*) and an apparent speed (0.75 *c*).

The ship's speed of 0.75 *c* means that the round trip is completed in 8 years of the ship's clock time (compared to 10 years of Earth time). The round trip back to Earth, as judged by an all-seeing distant spectator, takes 10 actual Earth years. The round trip as measured by the pilot using his motion-slowed clock, takes 8 *equivalent* Earth years.

The point of this digression into the time aspect of the journey was to underscore that there really are two kinds of motion involved, one absolute and one apparent.

Granted, no absolute frame of reference has been defined. The question, *Absolute motion with respect to what?* has not yet been addressed. For the present we are

[a] Note that no length contraction is involved because the path of the freefalling test object is perpendicular to the direction of the ship's high speed forward motion.

assuming that the frame of the background space (the vacuum) is neither detectable nor moving.

We now focus on the main purpose. As the ship curves into the vicinity of Earth the lateral thrusters are turned off. In *that* instant the radius of the change-of-direction motion changes from R = 3/π Ly to R = ∞. However, the "absolute" speed does not suddenly change by removing the lateral propulsion. There is no reason for the velocity to change in magnitude and no reason to say it is no longer "absolute." Essentially, and in accordance with the section-2 argument, the circular motion has become "absolute" inertial motion.[b]

Note that the actual final speed matters very little to the ensuing paradox; what matters is that the ship has "absolute" inertial motion (per **Fig. 1** argument) and that the ship has a measurable relative motion with respect to Earth. Let us measure this motion.

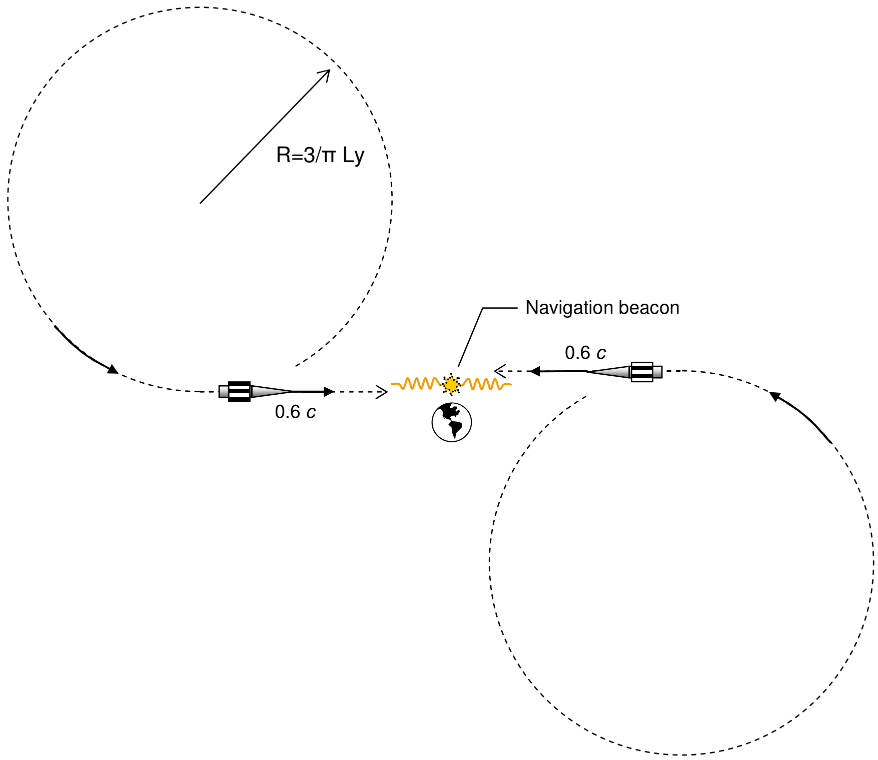

Fig. 3. *A speed paradox.* The motions shown have been proven, in the text, to represent a type of *absolute* motion. The geometry, the logic, and the Earth traffic controller, all say that the ships are coming together with a combined speed of 1.2 *c*. The ESR Doppler equation says no, the ships are coming together with a relative speed of only 0.88 *c*

A Doppler speed check. The ship's antenna picks up the signal from the Earth navigation beacon (as shown in **Fig. 2**). The emission frequency of the beacon is fixed at the frequency of pure yellow light, $f_S = 5.2\times10^{14}$ Hz and is a known quantity for the pilot/navigator.

The ship's detector records the Doppler shifted frequency as $f_D = 10.4\times10^{14}$ Hz. This quantity is then used to calculate the corresponding speed using the standard ESR Doppler equation:

$$f_{\text{DETECTOR}} = \frac{\sqrt{1-(\upsilon/c)}}{\sqrt{1+(\upsilon/c)}} f_{\text{SOURCE}}, \qquad (1)$$

Note: This ESR Doppler equation depends only on the relative velocity υ. When relative motion is *towards* each other then $\upsilon < 0$ in the formula.

which, after isolating the velocity parameter, gives:

$$\upsilon = \frac{1-(f_D/f_S)^2}{1+(f_D/f_S)^2}\times c\,. \qquad (2)$$

[b] Change-of-direction motion transitions to "absolute" inertial motion. If this were not so then we would be faced with a logical absurdity of having to find that one demon-radius, the radius with length somewhere between 3/π and infinity, which caused the destruction of absolute motion and the cessation of clock retardation. Better to accept the more logical conclusion that uniform linear motion, in this case, is a form of absolute motion.

The frequency values are inserted and a velocity magnitude of $\upsilon = |-0.6\,c| = 0.6\,c$ is found. Conveniently this *relative* quantity happens to agree with the ship's "absolute" inertial velocity.

Now what happens when oppositely directed *absolute inertial motion* is measured?

4. The Paradox

What happens when the ship of **Fig. 2** (henceforth called North Ship) encounters another ship —a ship, from the southern astronomical region, that has similarly acquired the quality of absoluteness in its motion—coming from the other direction with the same "absolute" inertial speed? See **Fig. 3**.

Initially, an Earth traffic controller radios a warning to the North Ship of the approaching South Ship. By means of the customary Doppler check, the Earth traffic controller confirms that both ships are approaching Earth with speeds of 0.6 *c*.

The message goes out to the North Ship. *Ship approaching from twelve o'clock. Closing in on a fly-by with a speed of 1.2 c.*

The ships are coming together with a mind-boggling combined speed of 1.2 lightspeed. The pilot/navigator will certainly want to verify this.

Since the immediate situation involves uniform motion, Einstein's special relativity applies. By using the relativistic addition of velocities equation, he "adds" (i) Earth's velocity relative to his ship and (ii) the South Ship's velocity relative to Earth. The ESR interpretation, detailed in **Fig. 4**, tells him, in contradiction to reality, that the relative speed between the ships is only 0.88 c.

What about a Doppler check? ... The pilot/navigator decides to measure the approaching South ship. His frequency detector collects the light from the on-coming "headlight" beacon (which, like the Earth beacon, is transmitting at $f_S = 5.2\times10^{14}$ Hz) and registers $f_D = 20.8\times10^{14}$ Hz (assuming the velocities are as shown for the Earth frame).

When these are substituted into the ESR Doppler eqn (2) the relative speed between the ships is still only 0.88 *c*.

Yet they really are coming together at 1.2 *c*.

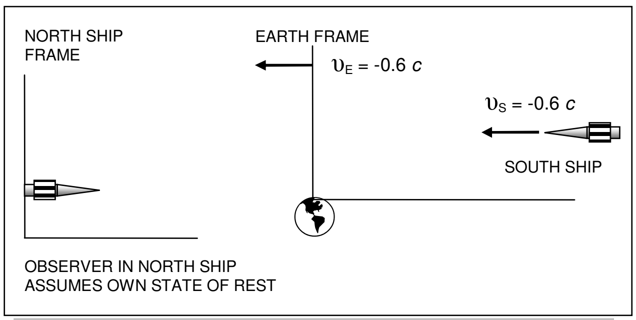

Fig. 4. The *apparent relative* motion between the two ships is given by the ESR textbook method of transforming velocity from one frame to another (the velocity of the South Ship in the Earth frame is converted to a velocity in the North-Ship frame):

$$\upsilon_{S.\text{Apparent}} = \frac{\upsilon_E + \upsilon_S}{1+\left(\upsilon_E \upsilon_S / c^2\right)} = -0.88\ c\ .$$

However, by ignoring the *absolute motion* of the observer, a vital connection with reality is lost.

The *apparent* relative motion is a consequence of ESR methodology; the *absolute* motion is an unavoidable consequence of circular motion. Both are measurable with instruments. Both are supported by experimental evidence. Both claim to represent reality —reality being what you can measure. But when taken together they lead to a paradox.

On the one hand, ESR theory insists that you cannot measure the relative speed to be greater than lightspeed.

On the other hand, the existence of *absolute inertial motion* leads to a situation in which *absolute relative speed* is greater than lightspeed!

We have a paradox —a *speed paradox*.

The Paradox is: The fact of an *absolute* relative speed greater than *c*, versus a *calculated* (via ESR) relative speed less than *c*.

We have already established that motion involves an apparent quantity and an absolute quantity (and the two need not agree). Obviously, ESR restricts itself to what is apparent. (Unfortunately, this restriction makes ESR an incomplete theory.[4])

The mystery in the paradox, then, narrows down to the question, *Why can't the absolute motion be extracted from the Doppler reading?* ... Surely the detected frequency of 20.8×10^{14} Hz contains the information, not just for the apparent speed, but also for the absolute.

What is needed is a Doppler equation that uses absolute velocities while retaining the validity of the ESR interpretation. What is needed is a dual purpose Doppler equation.

But first —if absolute inertial motion is to be a workable concept— we need an absolute frame of reference.

5. Resolving the Speed Paradox

Absolute motion with an absolute frame of reference

To know, or to say, there is absolute motion is not, in itself, very useful. There must be some way to define it, to measure it, to compare it with other instances of like motion. A *measurable* preferred frame is needed.

There is a cosmology theory called the *Dynamic Steady State model of the Universe* (DSSU). It has two preferred, or absolute, frames of reference. One is a Euclidean cosmic-scale frame of reference defined by the cosmic-scale cellular structure of a non-expanding universe. (It is in this cosmic frame that the CMBR is isotropic.) The second frame is defined by the luminiferous-and-gravitational aether that fills all space. The aether of this frame is in motion with respect to the cellular-universe frame. (This aether's grand-scale dynamic activity actually sustains the cosmic cell structure.[5]) Since the aether possesses bulk motion of varying degrees and directions, including the motions that manifest as gravitation, it can serve only as a local frame. The local absolute frame is the aether rest-frame —the one in which the speed of light is isotropic. Importantly, this DSSU aether is measurable, making it very near ideal as a local or limited-region reference frame.

The *DSSU aether*, as well as what is known as *Process aether*,[6] represents a precedence (as of the year 2002) for the use of a luminiferous-and-gravitational aether. But note, the cosmological and gravitational aspects of the proposed aether are merely mentioned to provide a deeper perspective and have no bearing on the equations or concepts in this article. The only vital aspects are the luminiferous nature of the aether and its detectability.

The incorporation of aether into a relativity theory involves the recognition of a certain degree of absoluteness in the nature of space and the acceptance of a preferred frame of reference. Interestingly, a preferred frame of reference also plays a role in electromagnetic theory.

> *... [T]he foundation of electromagnetic theory taught that a particular inertial system must be given preference, namely that of the luminiferous aether at rest.* –Albert Einstein[7]

Yet amazingly Einstein, in 1905, rejected that very foundation.

If ever there was a pivotal moment in the long history of relative-motion theory —a pivotal moment when things could have turned out radically different— then this is it. Einstein knew the 19th-century aether was seriously flawed (see **Table I**, below). He rightfully rejected it. But he went further. In formulating his theory of relativity he more or less discarded all versions of the aether concept and —being of key importance to the present discussion— *he rejected the preferred frame of reference*. Having thrown out the notion of a space medium (the *luminiferous aether*), Einstein, a true 20th-century Pythagorean,[8] had no choice but to also sacrifice the preferential frame. The consequences of his fateful action, associated with the year of 1905, are broad and deep. However, it is my contention that the aether concept only needed to be modified —not discarded!

What were the grounds for the condemnation of the old aether concept? One is the fact that it did not possess dynamical properties. (I merely mention this fact but do not discuss it.) The real transgression that offended Einstein, as we may well imagine, is the fact that it predicts a variable speed of light. Specifically, according to the traditional aether theory, if the light source is at rest with respect to the aether, the measured speed of light will depend on the velocity of the observer![9] If, however, the observer is at rest with respect to aether then the speed of light will be recorded as *c* even if the source is moving with respect to aether.[9]

The proposed space medium does not have the above problem. For a quick comparison between the traditional aether and DSSU aether, please see **Table I** below. Both types are considered luminiferous; that is, both serve as the medium for conducting electromagnetic waves. Note, however, they make different predictions for the apparent speed of light. Even though DSSU aether is the conducting medium, the speed of light appears constant for *all* observers. The 19th-century version does not —specifically when the observer is moving with respect to the aether. The ancillary difference is that DSSU aether is dynamic while the 19th-century version is primarily static. (Another aspect of DSSU aether is that it causes intrinsic relativistic effects such as clock slowing and length contraction.)

Let me emphasize two features: (i) The speed of light *is* intrinsically constant in DSSU aether. (ii) The speed of light appears constant (i.e., it is measurably constant) for all uniformly moving observers. How does this compare to Einstein's 2nd postulate? Einstein's version of the principle of "the constancy of the speed of light" states: The speed of light in free space *is* the same in all inertial frames and is independent of the motion of the source or the observer. The DSSU version states: The speed of light *is* constant in the aether medium. The speed merely APPEARS the same in all other inertial frames, ... etc.

Before continuing with the paradox resolution, let me confirm that the DSSU aether does indeed overcome the fatal flaw of the 19th-century version. The proof, that the observed speed of a light pulse —a pulse that is conducted by the aether medium— is constant for all observers, follows.

The absolute speed of any light pulse through aether is always $c \approx 300{,}000$ km/s. Therefore, the speed of the pulse's own frame of reference (the S″ frame moving with the pulse) is $\upsilon_B = c$ as shown in **Fig. 5**. However, in the frame of the light pulse, the pulse speed is zero. That is, $u'' = 0$ as in **Fig. 5**.

Consider a representative observer "A" having motion axial to the light beam. Let observer A's velocity magnitude (with respect to aether) be some fraction of the speed of light. That is, let $\upsilon_A = a\,c$, $(a < 1)$.

What velocity magnitude does the observer measure for the light pulse? What does observer A determine for the value of u' in **Fig. 5** ?

The necessary conversion, between the aether frames, is made with the DSSU velocity transformation equation.[10] It is derived from the famous *Lorentz transformation equations*, and therefore shares their validity. The equation is:

$$u' = \frac{u''\left(1+\upsilon_A\upsilon_B/c^2\right)+\left(\upsilon_A+\upsilon_B\right)}{\left(1+\upsilon_A\upsilon_B/c^2\right)+u''\left(\upsilon_A+\upsilon_B\right)/c^2}\ . \qquad (3)$$

Table I. Properties of traditional aether and DSSU aether are compared.

Property	Traditional Aether	DSSU Aether
LUMINIFEROUS	Yes	Yes
Apparent SPEED of LIGHT Light source at-rest w.r.t. aether. Observer moving w.r.t. aether.	$\upsilon_{light} \neq c$ (The reason the traditional aether failed)	$\upsilon_{light} = c$ (Because intervals of distance and time are altered by observer's motion)
Apparent SPEED of LIGHT Light source moving w.r.t. aether. Observer at-rest w.r.t. aether.	$\upsilon_{light} = c$	$\upsilon_{light} = c$
DYNAMIC or GRAVITATIONAL	No	Yes

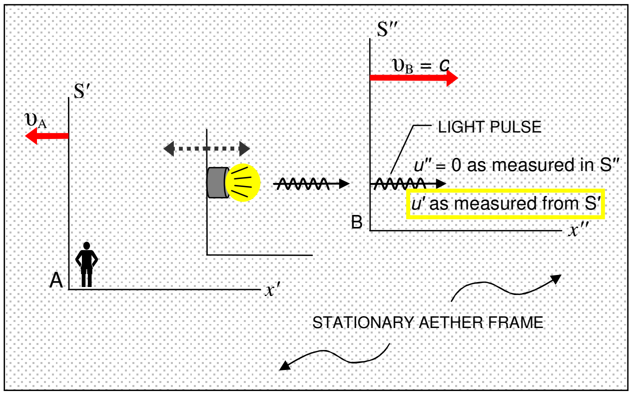

Fig. 5. The speed of light *is* constant through aether —and *appears* constant for all observers. The velocity υ_A of the observer and the velocity υ_B of the light pulses are *absolute velocities with respect to aether-space*. Motion of the light source does not, in any way, affect the speed of the light pulses through aether. Light pulses (or waves) are conducted by the aether at a constant rate of $c \approx 300{,}000$ km/s. Observer **A** measures the velocity of the light pulse as (u') —as predicted in the text, its value is always c.

Its purpose is to take the velocity u'' of an object (even a light pulse) observed/measured from frame S″ and transform it into the velocity u' of the same 'object' as measured from frame S′. Loosely speaking, it allows a comparison of what observer A in moving frame S′ sees with what observer B in moving frame S″ sees. These frames, of course, are moving with respect to aether.

After making the appropriate substitutions, including $\upsilon_A = a\,c$, ($a < 1$), and $\upsilon_B = c$,

$$u' = \frac{0 + (ac + c)}{\left(1 + (ac)c/c^2\right) + 0} \;,$$

$$u' = c\;.$$

Thus, the aether equation predicts that all observers will measure the same constant value for the speed of light —regardless of observers' motion *and* regardless of light-source motion.

A progress report. The change-of-direction motion discussed earlier represents *absolute motion without an absolute frame of reference*. So does the associated absolute inertial motion. But for all we know the circular path of the spacecraft may actually have been in uniform motion with respect to some other frame of reference. (So too the Earth.) An awareness of that other frame was missing. To resolve the speed paradox it is necessary to have the type of absolute motion that accompanies an absolute frame of reference. That frame has now been defined. Henceforth, absolute motion means motion referenced to aether-space —the medium that fills all space.

Now, just one more ingredient and all will be ready to resolve the paradox.

As stated earlier, what is needed is a Doppler equation that uses absolute velocities —an equation that works in the defined aether while at the same time retaining the capacity to deal with pure relative situations.

The derivation procedure, based on the Lorentz transformations, is detailed in Appendix A1. The end result is the (DSSU) **absolute longitudinal Doppler equation**:

$$f_{\substack{\text{MOVING}\\\text{DETECTOR}}} = f_{\substack{\text{MOVING}\\\text{SOURCE}}}\sqrt{\frac{1-(\upsilon_S/c)}{1+(\upsilon_S/c)}}\sqrt{\frac{1-(\upsilon_D/c)}{1+(\upsilon_D/c)}} \qquad (4)$$

The collinear speed (through aether) of the light Source is υ_S, and of the light Detector is υ_D. When values are assigned, the sense of direction must be included. The "+ and –" sign rules are given in Appendix A1.

This equation may also be expressed in terms of the wavelengths of the Source and Detector by simply substituting $f = c/\lambda$ with the appropriate subscripts.

Returning now to the pilot/navigator who is trying to extract a more fundamental meaning from the frequency of the light beam received from the on-coming South Ship (of **Figs. 3** and **4**). His procedure is, first, to measure his ship's absolute velocity with respect to the absolute frame of reference. This is but a technical concern, since it is now possible to measure one's own velocity (speed and direction) *even in a sealed lab.* The direction and magnitude of aether flow can be determined with a gas-mode Michelson-Morley interferometer[6] and more recently with a combination optical and radio frequency interferometer.[11] Say, he finds his own ship's velocity to be $\upsilon_D = -0.6\,c$ (negative because it is in the direction of the other ship).

Second, he confirms the frequency picked up by the ships Detector antenna ($f_D = 20.8\times10^{14}$ Hz). And as mentioned earlier, the source-frame frequency, $f_S = 5.2\times10^{14}$ Hz, emitted by the on-coming ship is a continuous signal of known value (i.e., the North pilot is aware of the originating frequency).

Third, apply the absolute Doppler equation. The values are inserted into eqn (4), which is then solved for υ_S . The result is the absolute motion, $\upsilon_{\text{SOURCE}} = -0.6\,c$.

The final step is to sum the two absolute values and obtain $-1.2\,c$. The two ships are coming together (indicated by the negative sign) with a combined speed of 1.2 times the speed of light —in total agreement with reality.

Similarly, once the ships have passed each other and are separating, the Detector measures a frequency of 1.3×10^{14} Hz and the speed of the ships will be $+0.6\,c$ and $+0.6\,c$ giving an absolute separation speed of 1.2 times lightspeed.

By introducing an aether reference frame and a redefined Doppler equation, the Paradox is resolved.

Although the absolute Doppler and ESR Doppler equations seem quite different in that one uses absolute velocities while the other uses only relative velocities, they can be combined into a single expression. The "unified" expression is detailed in Appendix A5.

6. Doppler Radar Method to Determine Absolute Inertial Motion

More absolute motion with an absolute frame of reference

The previous method requires that an observer knows the frequency of the source. We had earlier noted that all the beacons were emitting the same frequency —a frequency supposedly selected by mutual agreement on the rules of space travel. But since the necessary information is easily communicated between space travelers, any convenient frequency could be used.

But what if the oncoming object is not a spaceship? What if it is an asteroid-like object and one wishes to measure its absolute speed? One must then apply a Doppler radar method.

A suitable expression may be obtained by applying the Doppler eqn (4) two times to the situation shown in **Fig. 6**, first to the emitted frequency f_{em} and the impacting frequency f_{imp} and, second, to the reflected frequency f_{ref} and the detected frequency f_{det}. The two expressions are then combined. The result is the DSSU Absolute Doppler radar equation:

$$\frac{f_{\mathrm{em}}}{f_{\mathrm{det}}}=\frac{\left(1+\upsilon_{\mathrm{A}}/c\right)}{\left(1-\upsilon_{\mathrm{A}}/c\right)}\frac{\left(1+\upsilon_{\mathrm{B}}/c\right)}{\left(1-\upsilon_{\mathrm{B}}/c\right)}, \qquad (5)$$

where υ_A and υ_B are collinear velocities with respect to aether.

Solving for υ_B gives an expression for the absolute velocity of the radar's target (labeled "B" in **Fig. 6**):

$$\upsilon_{\mathrm{B}}=\frac{\left(f_{\mathrm{em}}/f_{\mathrm{det}}\right)\left(1-\upsilon_{\mathrm{A}}/c\right)-\left(1+\upsilon_{\mathrm{A}}/c\right)}{\left(f_{\mathrm{em}}/f_{\mathrm{det}}\right)\left(1-\upsilon_{\mathrm{A}}/c\right)+\left(1+\upsilon_{\mathrm{A}}/c\right)}\times c\,. \qquad (6)$$

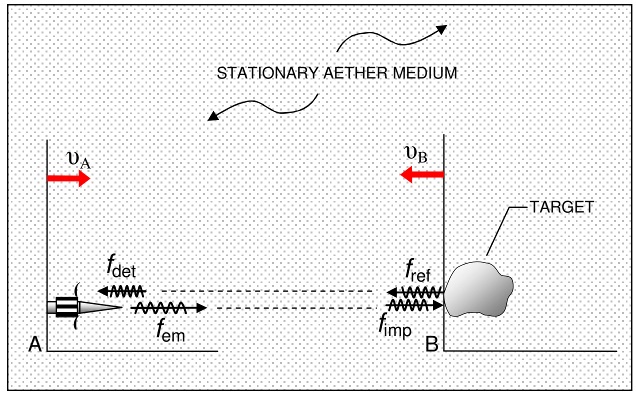

Fig. 6. Doppler radar scenario within aether-space. Spacecraft "A" emits radar signal with frequency f_{em} and detects the return signal as frequency f_{det}. The signal impacts the target with a frequency f_{imp} and is reflected with frequency f_{ref}. In the reference frame of "B", frequency f_{imp} equals f_{ref}.

The spacecraft velocity is the same as before (0.6 c). So is the emitted frequency (5.2×10^{14} Hz). Assume now that the return signal measures $f_{det} = 82.2\times10^{14}$ Hz. What is the absolute velocity of the target object? Substituting $-0.6\,c$ for υ_A and 1/16 for the frequency ratio into the above equation gives:

$\upsilon_B = -0.6\,c$,

where the negative sign indicates motion towards the observer.

In the aether frame, the spacecraft and asteroid are heading towards each other with a combined speed of,

$$\left|-0.6c+\left(-0.6c\right)\right|=1.2\times\text{lightspeed}\,.$$

7. Absolute Relativity and Apparent Relativity

Absolute relativity, in the context of space travel, may be defined as relating the motion of "objects" to each other by first referencing them to the aether-space frame (each object's local absolute frame). Absolute relativity involves absolute motion *with respect to the aether medium.*

Table II. Postulates of Einstein's relativity are compared to those of DSSU relativity.

EINSTEIN relativity	DSSU relativity
(1) The relativity postulate. The laws of physics are the same for observers in all inertial frames. All uniform motion is relative; absolute uniform motion does not exist. (2) (The time relativity postulate is not explicitly stated because it leads to ambiguity.) (3) The speed of light is constant. Light is always propagated in a vacuum with a velocity independent of the motion of the source or the observer.	(1) **Relativity postulate.** The laws of physics are the same for all inertial observers. All uniform motion is both apparently relative and absolutely relative. Motion can be measured relative to aether (the preferential frame of reference). (2) **The time relativity postulate.** Clocks run fastest when absolute motion is zero. Clocks slow down in relation to speed through aether. (3) **The speed of light postulate.** Since aether serves as the conductor of electromagnetic waves, the speed of light is absolute and constant through aether; and is independent of the motion of the source. Furthermore, the measured (apparent) speed of light is independent of the motion of the observer.
ESR is, in part, a theory of apparent inertial motion.	DSSU relativity is, in part, a theory of absolute and relative inertial-motion.

Apparent relativity, in the same context, involves relating the motion of "objects" using their apparent velocities with respect to any arbitrarily chosen frame.

Case in point, when the conventional ESR formulation was used to find the relative velocity between the ships to be 0.88 c, the pilot arbitrarily assumed his frame to be at rest. In the same calculation he also assumed the Earth is racing towards him at 0.6 c. Obviously, these are only assumptions of convenience, they may or may not represent real motion. Without an absolute frame, one cannot tell.

Ordinary relative motion is simply *apparent relative motion*. When we designate our moving ship as arbitrarily being a "rest" frame we are free to measure *apparent* relative velocities —in accordance with the ESR formalism. With *apparent relativity* the speed of light is not fixed with respect to some preferred frame but is constant with respect to any observer.

Absolute relative motion is aether-referenced motion. When measuring, or dealing with, absolute motion, the velocities with respect to aether are always less than c. The aether is the conductor of light; its property determines the speed of light (and its speed constancy). Even though the speed of light is fixed with respect to aether, all observers, regardless of motion, measure the same speed. It is only when absolute velocities are combined in order to determine the absolute *relative* motion that speeds exceed c. And the maximum permissible absolute-relative-motion can approach twice the speed of light. If υ_A and υ_B are collinear velocity components:

$$\text{absolute relative velocity} = \upsilon_A + \upsilon_B\,, \tag{7}$$

where $-2\,c < (\upsilon_A + \upsilon_B) < 2\,c$, and the usual sign-rule applies.

The **Table II** above compares the postulates of conventional relativity and DSSU relativity.

One of the problems with ESR is that it is not a complete theory.[4] Einstein's theory of special relativity is, in the present context, a theory of *apparent motion*. It states clearly you cannot "see" something moving towards

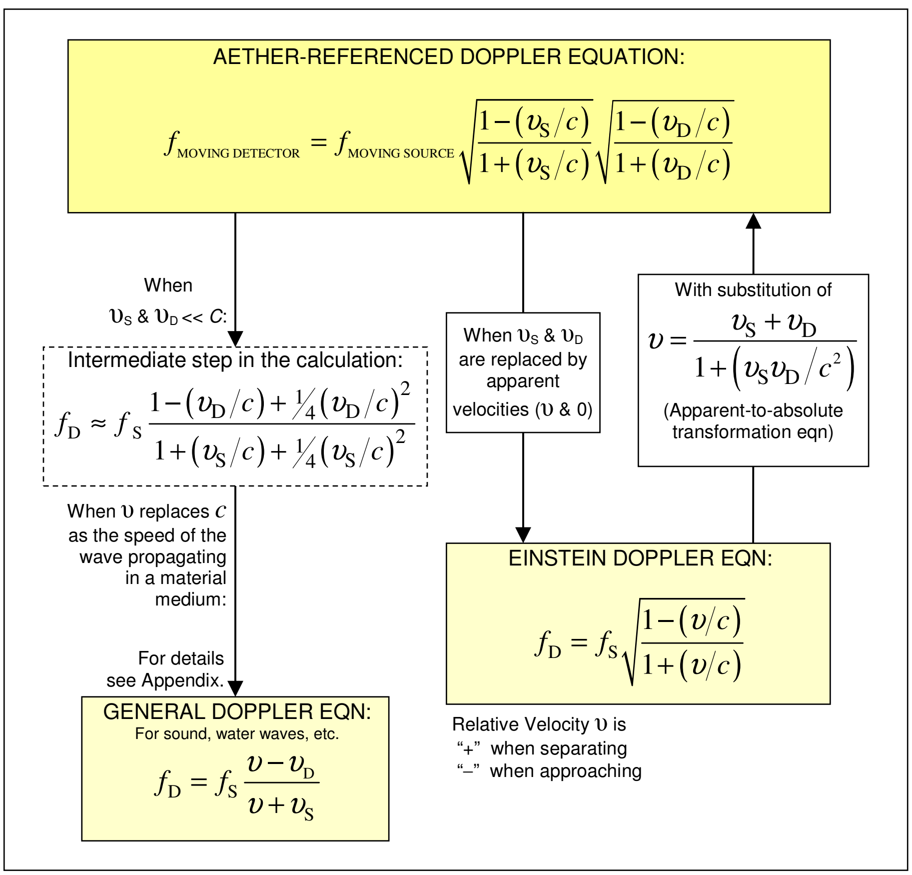

Fig. 7. The Absolute Doppler equation reduces to the General Doppler and converts to the ESR Doppler. All subscripted speeds/velocities are referenced to the wave propagating medium —aether in the case of the Absolute equation, and air, water, etc., in the case of the General Doppler. It is important to note that (i) the Absolute equation is completely general within its domain of absolute (aether referenced) motion, and (ii) the Einstein Doppler is completely general within its domain of pure relative motion. f_S and f_D are the wave frequencies emitted by the Source and received by the Detector, respectively. (For more detailed sign-rules, see Appendix.)

you, or away from you, with a speed greater than lightspeed —even though it may actually be so moving as in the speed paradox scenario.

DSSU relativity is a theory of absolute as well as relative motion. It recognizes that absolute inertial motion exists. Motion can be measured relative to aether-space which acts as the preferred frame of reference. When two absolute inertial motions are combined they present an example of absolute relative motion. By measuring one's own absolute motion and combining it with the Doppler-radar-acquired absolute-motion of some target object, it is theoretically possible to determine speeds greater than *c*. (The only requirement is that the object and the observer must be moving in opposite directions with an average speed greater than one-half the speed of light).

8. Unifying Aspects of the Aether-Referenced Doppler

The DSSU Doppler equation is coded in terms of absolute motion, but knowing the absolute motions of the two frames means that the apparent relative motion can also be determined. The key is the aether-referenced *velocity transformation* equation. By following the procedure outlined in the **Fig. 7** flowchart (and detailed in the Appendix) it is possible to convert from the absolute Doppler equation to the special relativity Doppler equation, and *vice versa*. Furthermore, the absolute Doppler equation can be reduced to the general Doppler equation. The latter is the one used for sound waves and water waves, and density waves in a material medium. It is quite possible that within the DSSU formula lies the conceptual unification of the two Doppler phenomena of physics.

I should explain one of the equations in the **Fig. 7** flowchart —the one labeled "apparent-to-absolute transformation eqn." This is the same equation displayed earlier as the "DSSU velocity transformation equation" eqn (3) in Section 5. Let me clarify that I am not taking one of Einstein's relativity equations and presumptuously applying my own label. My equation is derived from an aether theory and achieves the conversion by using the *absolute motion* of two reference frames. The Einstein velocity transformation equation (shown in **Fig. 4** caption, and also known as the *relativistic law of addition of velocities*) achieves the conversion by using the relative motion of the reference frames. In both cases the purpose of the transformation is to extract an apparent relative speed/velocity.

The highlight of the flowchart is the two-way link between the Absolute Doppler and the ESR Doppler equations. The link whereby one can be transformed into the other is fully explained in Appendix A3 and A4.

It is important to realize that the ESR Doppler is *not* a special case of the DSSU Doppler equation. It is by no means obvious, but both equations give the same answer; they must because the frequency Detector displays the actual frequency and does not care which equation the detector-frame observer decides to use as a check.

Then it must be that *both* expressions are general. The DSSU expression always uses aether-referenced velocities; within its domain it is general. The ESR Doppler expression always uses purely relative velocities and within its domain it, too, is completely general.

Why is this so important? ... It means that within its domain, within its sphere of applicability, there is nothing wrong with the practicality of Einstein's special relativity. There is, however, an incompleteness problem.

The problem with ESR is that it treats all frames as having equal status; no frame is intrinsically better, or intrinsically different, than another. Even if one of the frames is chosen to be a preferred frame it is still treated as just another frame. Motion and the effects of motion are all treated as being apparent —measurable, but still apparent. Then when absolute effects crop up, they are either not recognized as such, or they lead to apparent paradoxes —such as the actual clock slowing arising in the *twin paradox*. In this sense, the ESR paradigm is incomplete.

The preferred frame paradigm, on the other hand, describes what is actually happening. When the preferred frame is a measurable medium, then motion immediately acquires an absoluteness quality. Even better, when the measurable medium is an energy-conducting aether, then *light* immediately acquires a physical speed (not merely apparent), and the phenomenon of *length contraction* of mass objects acquires a physical meaning (as mass is simply energy confined to "particles" while being conducted by aether),[c] and *clock retardation* becomes a real phenomenon, and *inertial motion* becomes absolute inertial motion.

Although the DSSU and ESR Doppler expressions are characteristically restricted by the type of velocity employed in each, there is a way to unify them under one equation. As pointed out above, the DSSU Absolute Doppler equation contains the necessary information to also express the purely relative situation. It is therefore possible to recast the Absolute equation as a *Unified Doppler equation* —one which reduces to either the aether-referenced Doppler or the relative-motion Doppler. The recasting and reduction are discussed in Appendix A5.

In conclusion, when ESR formulates inertial motion, it deals with pure relative motion. Subject "A" is permitted to assume himself to be at rest and declare that "B" is the one that is moving and the one experiencing time dilation. Subject "B" can make the same claim. With a theory devoid of an absolute frame of reference —with only

[c] The implication of having *energy conducting aether* is that objects/particles in motion are not simply moving through the aether but are conducted *by* the aether. There is an interaction taking place between matter and aether —even when there is no macroscale motion.

relative motion by default— two subjects are given license to make paradoxical assertions!

DSSU theory incorporates an aether medium, which, in turn, becomes the essential ingredient of a theory of absolute relativity. With little more than a relative Doppler measurement and an extended Doppler equation the true and absolute motions of A and B are made known. Furthermore, with the *DSSU Traverse Doppler Effect expression* it is possible to make an absolute comparison of moving clocks (see Appendix A2).

What should be seen as truly remarkable, if one reflects on the long-standing neglect and outright disparagement of absolute motion and aether, is that it has taken over 100 years (far too long) for Physics to move beyond the unnatural restrictions imposed by Einstein's relativity.

Long ago, a young Albert Einstein developed a radically austere conceptualization of space —upon which he built a far-reaching theory. In 1905 Einstein introduced a theory that ignores aether-space and the preferred frame. Tentatively at first, then whole-heartedly, Physics and Philosophy embraced his unnatural and incomplete theory of space and motion. The consequences have been profound. Although Einstein's non-absolute view had, for the most part, little detrimental effect on the field of particles physics, *it long delayed the discovery of the process that bestows the fundamental property of mass.* But the omission of aether and the preferred frame in his general-relativity theory was disastrous. The unquestioned acceptance of the almost sacred formalism of Einstein and the religious-like zeal to condemn any meaningful challenge to fundamentals has *prevented the development of a fully functional theory of gravity.*

In a recent special report[12] detailing the eighth successful experiment (since 1887) of light-speed anisotropy, Professor Cahill of Flinders University, Australia, expressed the view that the failure to recognize the existence of absolute motion (and the physical dynamic 3-space that defines it) "would have to be the biggest blunder ever in the history of science." □

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Appendix

A1. Derivation of Absolute Doppler Equation for Light

Consider an observer at rest with respect to aether-space (the absolute-rest frame-of-reference). He detects repeated "events" of light pulses, or wave peaks, being emitted from a receding beacon (such as the one attached to the starship commissioned earlier). He analyses the following two events (each of which has a space-and-time "location" in the moving frame):

Event 1. A wave crest is emitted at the origin of the moving frame in **Fig. 8**.

Event 2. An instant later the same wave crest reaches x_2' on the horizontal axis of the moving frame.

The distance between the events is $\Delta x'$ and the time interval between the events is $\Delta t'$. The $\Delta x'$ increment represents the source wavelength. The $\Delta t'$ increment represents the period of the light wave.

The position coordinates of the two events must be converted into the coordinate system of the observer. This is immediately accomplished with the Lorentz transformation equations:

For Event 1, $x_1 = \gamma\left(x_1' + \upsilon_S\, t_1'\right)$;

For Event 2, $x_2 = \gamma\left(x_2' + \upsilon_S\, t_2'\right)$;

where υ_S is the recession speed of the source and gamma, γ, is the Lorentz factor $(1-(\upsilon_S/c)^2)^{-1/2}$.

The distance, in the observer's frame, between the two events is:

$$\begin{aligned}\Delta x &= x_2 - x_1\\ &= \gamma\,(x_2' + \upsilon_S\, t_2') - \gamma\,(x_1' + \upsilon_S\, t_1')\\ &= \gamma\,(x_2' - x_1' + \upsilon_S\, t_2' - \upsilon_S\, t_1')\end{aligned}$$

$$\Delta x = \gamma\left(\Delta x' + \upsilon_S\,\Delta t'\right). \qquad \text{(a1)}$$

Noting that:

Δx represents the wavelength detected: $\lambda_{DETECTED}$ or λ_D

$\Delta x'$ represents the emission wavelength: λ_{SOURCE} or λ_S

$\Delta t'$ represents the period of the wave:

$$\Delta t' = \Delta t_{SOURCE} = T_{SOURCE} = \lambda_S/c$$

By substitution, eqn (a1) is restated as,

$$\lambda_{DETECTED} = \gamma\,(\Delta x_{SOURCE} + \upsilon_{SOURCE}\,\Delta t_{SOURCE}),$$

$$\lambda_{DETECTED} = \frac{1}{\sqrt{1-(\upsilon_S/c)^2}}\left(\lambda_S + \upsilon_S\lambda_S/c\right). \qquad \text{(a2)}$$

Then, by performing some algebraic manipulation, it becomes,

$$\lambda_{DETECTED} = \lambda_S\sqrt{\frac{1+(\upsilon_S/c)}{1-(\upsilon_S/c)}} \quad \text{(source receding).} \qquad \text{(a3)}$$

Note that when the source is receding, υ_S is positive; when the source is approaching, υ_S is negative. Since the wavelength equals the speed of light divided by the frequency f (that is, $\lambda = c/f$), it follows that

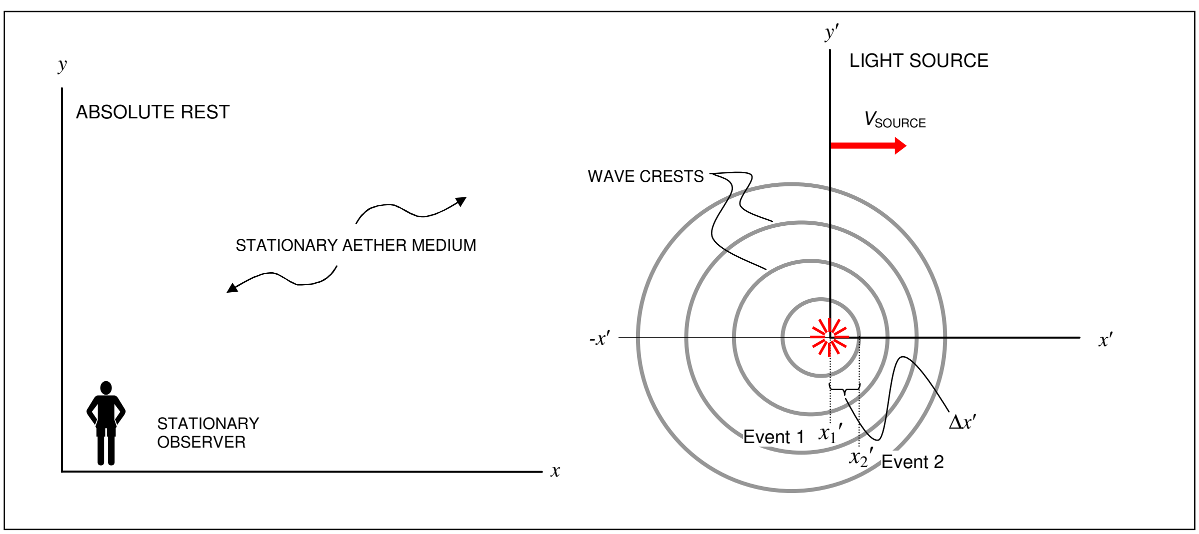

Fig. 8. Wavelength $\Delta x'$ emitted by the moving light source is analyzed by the absolute-rest observer. The analysis requires the transformation, of events *1* and *2*, *from* the coordinate system of the light source and *to* the coordinate system of the detector (or observer). Event *1* (having position coordinate x_1' and time coordinate t_1') is the emission of a wave crest; event *2* (having coordinates x_2' and time t_2') is the arrival of the wave crest at x_2'.

$$f_{\text{DETECTED}} = f_{\text{S}}\sqrt{\frac{1-(\upsilon_{\text{S}}/c)}{1+(\upsilon_{\text{S}}/c)}} \quad \text{(source receding).} \quad \text{(a4)}$$

Doppler shifts for light (but not for sound), are always symmetrical; observer and source could switch frames. The observer could be placed in the moving frame and the source placed in the rest frame. The detected frequency will be the same. The same equation (with altered subscripts) applies:

$$f_{\text{MOVING DETECTOR}} = f_{\text{REST SOURCE}}\sqrt{\frac{1-(\upsilon_{\text{D}}/c)}{1+(\upsilon_{\text{D}}/c)}} \; . \qquad \text{(a5)}$$

Now if an observer at rest re-transmits the identical frequency just received from a moving source, in accordance with (a4), then *the re-transmission represents a new rest source*. That is,

$$f_{\text{REST DET}} = \underbrace{f_{\text{MOVING SOURCE}}\sqrt{\frac{1-(\upsilon_{\text{S}}/c)}{1+(\upsilon_{\text{S}}/c)}} = f_{\text{(NEW) REST SOURCE}}}_{\text{substitute into (a5)}} \qquad \text{(a6)}$$

Finally, a third-party moving observer detects the "new rest source" which is actually the Doppler-modified signal of the original moving-source transmission of **Fig. 8**. In fact, the third-party *moving* observer can relate directly to the original moving-source by simply combining eqns (a5) and (a6). It is through this combination of (a5) and (a6) that we obtain the *(DSSU) absolute Doppler equation*:

$$f_{\substack{\text{MOVING}\\ \text{DETECTOR}}} = f_{\substack{\text{MOVING}\\ \text{SOURCE}}}\sqrt{\frac{1-(\upsilon_{\text{S}}/c)}{1+(\upsilon_{\text{S}}/c)}}\sqrt{\frac{1-(\upsilon_{\text{D}}/c)}{1+(\upsilon_{\text{D}}/c)}} \; . \qquad \text{(a7)}$$

The velocities of Detector and Source are entirely independent. Their scalar values, υ_{D} and υ_{S}, with respect to aether-space, are assigned positive or negative signs according to the following simple rule:

Sign rule for collinear and independent absolute velocity components:
Use positive sign when *absolute velocity* is away from Detector or Source.
Use negative sign when *absolute velocity* is towards Detector or Source.

A2. The Aether-Referenced Traverse Doppler Equation for Light

As two ships approach each other during a "fly by" (as previously described) the Doppler effect rapidly diminishes as the ships' alignment changes from being collinear to being side-by-side. In fact, during the instant when the ships are just passing each other (going in opposing directions) the basic Doppler effect vanishes. However, there remains what is known as the *traverse Doppler effect* which can still be measured —being measurable during this brief moment of close passage. It is described as the change in the frequency f at Source or Detector caused solely by the slowing of clocks due to motion.

We begin with the *standard traverse Doppler equation* for light:

$$f = f_0\sqrt{1-(\upsilon/c)^2} \; ,$$

where f_0 is the *proper time* frequency.

When the relative speed is due entirely to the absolute motion of the Source then the relative speed υ may be replaced by the absolute speed υ_{S} of the Source, so that,

$$f_{\text{REST DETECTOR}} = f_{\text{MOVING SOURCE}}\sqrt{1-(\upsilon_{\text{S}}/c)^2} \; . \qquad \text{(a8)}$$

When the relative speed is due entirely to the absolute motion of the Detector then the relative speed υ may be replaced by the absolute speed υ_{D} of the Detector, so that,

$$f_{\text{REST SOURCE}} = f_{\text{MOVING DETECTOR}}\sqrt{1-(\upsilon_{\text{D}}/c)^2} \; . \qquad \text{(a9)}$$

Obviously the frequency f emitted by a rest Source will be the same as that frequency detected by a rest Detector. That is,

$$f_{\text{REST DETECTOR}} = f_{\text{REST SOURCE}}$$

and from (a8) and (a9),

$$f_{\substack{\text{MOVING}\\ \text{SOURCE}}}\sqrt{1-(\upsilon_{\text{S}}/c)^2} = f_{\substack{\text{MOVING}\\ \text{DETECTOR}}}\sqrt{1-(\upsilon_{\text{D}}/c)^2} \, .$$

Thus, the *(DSSU) traverse Doppler equation* is:

$$f_{\substack{\text{MOVING}\\ \text{DETECTOR}}} = f_{\substack{\text{MOVING}\\ \text{SOURCE}}}\frac{\sqrt{1-(\upsilon_{\text{S}}/c)^2}}{\sqrt{1-(\upsilon_{\text{D}}/c)^2}} \; . \qquad \text{(a10)}$$

This aether-referenced traverse Doppler equation serves as a basic test for clock slowing.

The above equation may be rewritten in terms of T the time period of oscillation of the emitted light wave instead of the frequency. Since $T = 1/f$,

$$T_{\text{MOVING DET'R}} = T_{\text{MOVING SOURCE}} \frac{\sqrt{1-(\upsilon_D/c)^2}}{\sqrt{1-(\upsilon_S/c)^2}} . \qquad \text{(a11)}$$

It is evident in (a10) and (a11) that when Detector and Source have the same speed then there will be no traverse Doppler effect and clock rates will be identical in both frames. This is to be expected for motion in tandem. Remarkably, it is also true when Detector and Source are racing in opposite directions.

Understand that the equation gives a ratio of clock times as each of those clock times is affected by motion through aether. Even though the velocities may be in opposing directions, as long as the magnitudes are identical, the intrinsic clock-rates must also be identical. The ratio depends only on *two* absolute velocities. That is the reality situation. The ESR traverse Doppler, in contrast, will give only the ratio of apparent clock-rates (a ratio that depends only on *one* common relative velocity).

A3. How the Absolute Doppler Equation Converts to the Special Relativity Equation

The DSSU Doppler is an equation using absolute velocities/speeds (aether-referenced motion).

The ESR Doppler is an equation using apparent relative velocities/speeds (self-referenced motion).

The DSSU equation reduces to the ESR equation by converting the absolute motion to apparent motion.

Consider the point of view of the observing pilot. His own frame of reference, his spaceship (with the frequency Detector), does not appear to be moving (with respect to Observer). Thus, υ_D in (a7) is discarded and replaced by zero. (This does *not* mean $\upsilon_D = 0$.)

Next, the absolute speed υ_S of the signaling spaceship is discarded and replaced by its *apparent* speed υ. Implementing these changes converts the *DSSU Doppler* (a7) into the ESR Doppler expression:

$$\frac{f_D}{f_S} = \left(\frac{1-(\upsilon_S/c)}{1+(\upsilon_S/c)}\right)^{1/2} \left(\frac{1-(\upsilon_D/c)}{1+(\upsilon_D/c)}\right)^{1/2}, \qquad \text{(a7)}$$

$$\frac{f_D}{f_S} = \left(\frac{1-(\upsilon/c)}{1+(\upsilon/c)}\right)^{1/2} \left(\frac{1-0}{1+0}\right)^{1/2},$$

$$\frac{f_D}{f_S} = \sqrt{\frac{1-(\upsilon/c)}{1+(\upsilon/c)}} \quad \text{(for light as in } \textit{special relativity}\text{)}, \qquad \text{(a12)}$$

in which, the relative speed υ is "+" when separating and "−" when approaching.

A more general ESR Doppler equation often appears in textbooks. “By a postulate of relativity, the velocity of light is the same relative to all observers. The theory of relativity yields the frequency”[13]:

$$\frac{f_D}{f_S} = \frac{1+(\upsilon/c)\cos\theta_0}{\sqrt{1-(\upsilon^2/c^2)}} . \qquad \text{(a13)}$$

For collinear motion (separating), angle θ_0 equals 180° and, therefore, cos θ_0 equals −1. Then with a bit of algebra eqn (a13) reduces to eqn (a12) which is the one that appears in the **Fig. 7** flowchart in Section 8.

Now here is something interesting. Assume that the source frequency is unknown. Under Einstein’s relativity there is no way to calculate υ —it therefore must be measured somehow. However, with *absolute relativity*, unknown υ can be calculated, given absolutes υ_D and υ_S. This is done by applying the DSSU relativistic velocity transformation equation (see eqn (3)),[10]

$$\upsilon = \frac{u\left(1+\left(\upsilon_S\upsilon_D/c^2\right)\right)+\left(\upsilon_S+\upsilon_D\right)}{\left(1+\left(\upsilon_S\upsilon_D/c^2\right)\right)+u\left(\upsilon_S+\upsilon_D\right)/c^2} , \qquad \text{(a14)}$$

(which transforms an apparent velocity u within one frame into an apparent velocity υ for an observer in another frame), which is used to determine υ as follows:

Since the frequency Source is not moving within its own frame (the Source spacecraft) u is equal to zero. Then

$$\upsilon = \frac{\upsilon_S+\upsilon_D}{1+\left(\upsilon_S\upsilon_D/c^2\right)} . \qquad \text{(a15)}$$

This equation serves three purposes: (i) converts the absolute speeds υ_D and υ_S to a relative speed; (ii) ensures the predicted observable relative speed υ is always less than c; (iii) links the ESR Doppler to the (DSSU) Absolute Doppler equation.

A4. How the ESR Doppler Converts to the Absolute Doppler Equation

The conversion simply involves substituting the velocity transformation eqn (a15) into the ESR equation,

$$\frac{f_D}{f_S} = \left(\frac{1-(\upsilon/c)}{1+(\upsilon/c)}\right)^{1/2} . \qquad \text{(a16)}$$

After some basic algebra, the Absolute Doppler appears.

This serves as a verification of the proof, for the Doppler equation, given in the Appendix Section A1.

A5. The Unified Equation and How it Reduces to the Absolute and Relative Expressions

There are two types of velocities. All objects, all frames of reference, can be thought of as having two simultaneous velocities: one relative to the observer (or some point chosen by the observer) and one absolute with respect to the aether rest-frame. One is observer dependent, the other is observer independent.

What this means is that all instances of motion can be expressed in two ways. The motion of the Source (and the Detector) can be expressed as absolute *and* as relative. In terms of symbols, the motion S_V of the Source can be expressed as absolute velocity υ_S *and* as relative velocity $\upsilon_{apparent}$. And the motion D_V of the Detector can be expressed as absolute velocity υ_D *and* as relative velocity $\upsilon_{apparent}$.

Metaphorically, S_V and D_V are "fruit" velocities. Each can represent itself as an apple-type velocity or as an orange-type velocity.

The DSSU Absolute Doppler equation is obviously coded in terms of absolute velocities. However, the equation contains the necessary information to express the purely relative situation. That is, from the two absolute-velocity parameters, in the equation, the desired relative velocity can always be determined. (It can be done with eqn (a15).) The Absolute equation deals with apples, but it also contains the information of the oranges. This dual information can be formalized. In **Fig. 9** the Absolute Doppler is rewritten as a proper Unified Equation that codes for both types of velocities.

The symbols S_V and D_V in the Unified expression are the undifferentiated "fruit" velocities of the Source and the Detector respectively. The flowchart above shows how the Unified equation reduces to the Absolute- and ESR- Doppler expressions. The only rule involved is that one must be consistent —no mixing of apples and oranges.

Note that for any given set of S- and D- frame motions, the Absolute and ESR equations give the same numeric result. The mathematical confirmation that the reduced equations agree with each other is provided by the fact that, according to egn (a15), $\upsilon = (\upsilon_S + \upsilon_D)/(1+ \upsilon_S\upsilon_D/c^2)$. If one substitutes this term into the ESR expressions, one ends up with the Absolute Doppler.

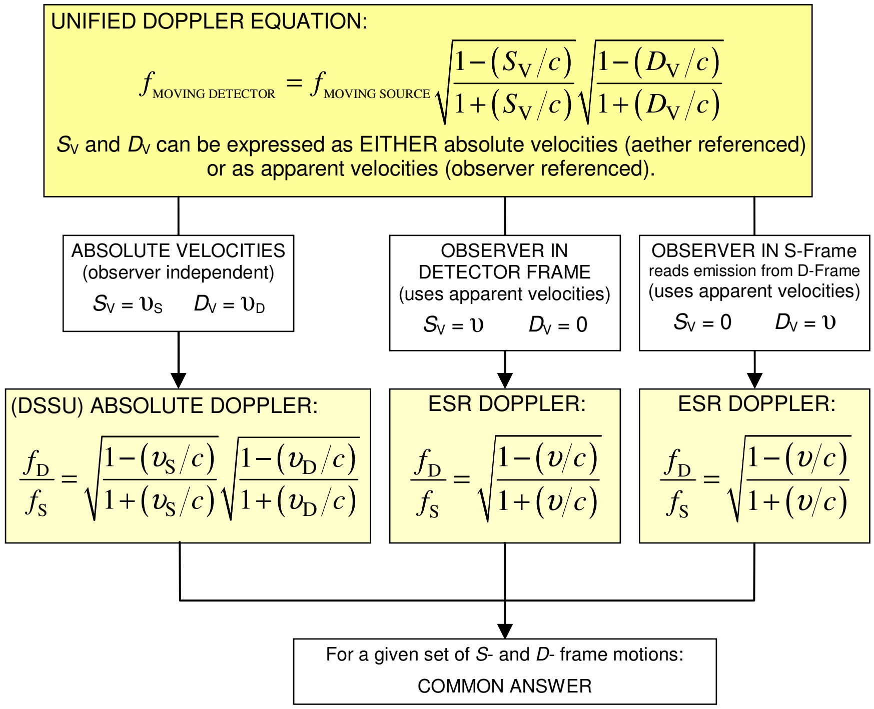

Fig. 9. The Unified Doppler equation reduces to the DSSU- and ESR- Doppler expressions. When the substitutions are made, they must be consistent. The two velocities must both be aether referenced or they must both be apparent (i.e., relative). For a given set of *S*- and *D*- frame motions, all the reduced equations give the same numeric result.

A6. How the Absolute Doppler Reduces to the General Doppler Effect

Start with the Absolute Doppler eqn (a7):

$$f_D = f_S \frac{\left(1-(\upsilon_S/c)\right)^{1/2}}{\left(1+(\upsilon_S/c)\right)^{1/2}} \frac{\left(1-(\upsilon_D/c)\right)^{1/2}}{\left(1+(\upsilon_D/c)\right)^{1/2}} .$$

Then rearrange terms so that

$$f_D = f_S \frac{\left(1+(\upsilon_D/c)\right)^{-1/2}}{\left(1+(\upsilon_S/c)\right)^{1/2}} \frac{\left(1-(\upsilon_D/c)\right)^{1/2}}{\left(1-(\upsilon_S/c)\right)^{-1/2}} . \quad \text{(a17)}$$

When υ_D and υ_S have values much less than c then (υ_D/c) and (υ_S/c) are considerably less than unity. Apply the binomial expansion to obtain:

$$f_D \approx f_S \frac{\left(1-\tfrac{1}{2}(\upsilon_D/c)\right)}{\left(1+\tfrac{1}{2}(\upsilon_S/c)\right)} \frac{\left(1-\tfrac{1}{2}(\upsilon_D/c)\right)}{\left(1-\tfrac{1}{2}(\upsilon_S/c)\right)} , \quad \text{(a18)}$$

$$f_D \approx f_S \frac{1-(\upsilon_D/c)+\tfrac{1}{4}(\upsilon_D/c)^2}{1+(\upsilon_S/c)+\tfrac{1}{4}(\upsilon_S/c)^2} . \quad \text{(a19)}$$

The two squared terms are quite insignificant since the motions of Source and/or Detector will never be much above the speed of sound. The squared terms are dropped, to give the non-relativistic form:

$$f_D = f_S \frac{c-\upsilon_D}{c+\upsilon_S} . \quad \text{(a20)}$$

We let υ replace c as the speed of the wave propagation in its medium. (For example υ could be the speed of sound through air of a certain density, or waves on the surface of a pond.) The result is the *General Doppler effect* expression:

$$f_{\mathrm{D}} = f_{\mathrm{S}} \frac{\upsilon - \upsilon_{\mathrm{D}}}{\upsilon + \upsilon_{\mathrm{S}}} \quad \text{(for sound, water waves, etc.),} \qquad \text{(a21)}$$

where υ is a positive constant with a value that depends on the properties of the medium. The sign rules for the velocities of the Detector and the Source are: **Negative** when motion (with respect to medium) is towards the other; **Positive** when motion (with respect to medium) is away from the other.

Although the Absolute Doppler (a7) has been reduced to the General Doppler (a21), when we attempt to apply these two equations to an acoustic scenario they will not necessarily give the same results. (In such an attempt the c in eqn (a7) is no longer the speed of light but is replaced by the speed of sound.) If the magnitudes of the velocities (of Source and Detector) are equal then the two equations *do* give the same result. Otherwise they do not. The General Doppler will, of course, give the correct value; the misapplied Absolute Doppler will do so only for the special case (of equal speeds).

The reason for the discrepancy is straight forward. The Absolute Doppler is so designed that when the speed of a wave Source, or of a wave Detector, approaches the speed with which the medium "conducts" the waves then the clock-slowing approaches infinity. This feature is built into the equation by the Lorentz transformations. The Doppler equation for sound is not so restricted.

What this means is that light-pulse generators stop emitting waves when traveling at the speed of light. But sound-pulse generators do not stop emitting waves when traveling at the speed of sound. Clock-time affects one but not the other. It is for this reason that the Absolute equation cannot be used directly for material-medium Doppler applications.

The trick is to reverse or remove the Lorentz restriction at some stage in the process of the reduction. The step between eqn (a19) and eqn (a20) is an attempt to do this.

In closing, with the discovery and repeated experimental confirmation of the existence of a luminiferous-and-gravitational aether,[14][15] the need arises for a theory of absolute motion —absolute motion *through* aether permeated space. The need is for a theory in which *relative* motion is joined to a theory of aether-referenced motion; a theory in which Einstein's theory of relativity is subsumed by a more general theory of *absolute and relative* motion. □

REFERENCES

1 Joel R. Primack and Nancy E. Abrams, *The View from the Center of the Universe* (Riverhead Books, New York, 2006) p38.

2 J. Bronowski, *The Clock Paradox*, Scientific American Vol.**134** (Feb 1963) p144.

3 Tom Van Flanders, *What the Global Positioning System Tells Us about Relativity*, as in *Open Questions in Relativistic Physics* (p81-90), edited by Franco Selleri (Apeiron, Montreal, 1998).

4 C. Ranzan, *Why Einstein Did Not Receive the Nobel Prize for His Theory of Relativity*, Physics Essays Vol.**22**, No.4, pp564-576 (2009 Dec). Doi: http://dx.doi.org/10.4006/1.3252983

5 C. Ranzan, *The Story of Gravity and Lambda –How the Theory of Heraclitus Solved the Dark Matter Mystery*, Physics Essays Vol.**23**, p75-87 (2010 Mar). Doi: http://dx.doi.org/10.4006/1.3293983

6 R. T. Cahill, *Absolute Motion and Quantum Gravity*, (2002). Posted at: http://xxx.lanl.gov/abs/physics/0209013
(Also posted at: www.mountainman.com.au/process_physics/ index_of_papers.htm).

7 A. Einstein, *Relativity, The Special and the General Theory* (Wings Books, New York, 1961) p168.

8 E. R. Harrison, *Masks of the Universe, Changing Ideas on the Nature of the Cosmos* (2nd ed. Cambridge University Press, Cambridge, UK, 2003) p49.

9 J. Orear, *Programmed Manual of College Physics* (John Wiley & Sons, Inc., New York, 1968) p159.

10 C. Ranzan, *DSSU Relativity –The Lorentz Transformations Applied to Aether-Space*, Physics Essays Vol.**23**, No.3, p520-531 (2010 Sept). Doi: http://dx.doi.org/10.4006/1.3476412

11 R. T. Cahill, *A New Light-Speed Anisotropy Experiment: Absolute Motion and Gravitational Waves Detected*, Progress in Physics Vol.**2**, Issue 4, pp73-92 (Oct 2006). Posted at: http://www.ptep-online.com/

12 Ibid., p74.

13 *Van Nostrand's Scientific Encyclopedia*, Fifth Edition (Van Nostrand Reinhold Company, New York, 1976) p822.

14 C. Ranzan, *The Aether Experiments and the Impact on Cosmology*, (2009). Posted at www.CellularUniverse.org/AA1Aether&Cosmology.htm

15 C. Ranzan, *The History of the Aether Theory*. Posted at: www.CellularUniverse.org/AA3AetherHistory.htm