DSSU Relativity
–The Lorentz Transformations Applied to Aether-Space

Conrad Ranzan
DSSU Research, 5145 Second Avenue, Niagara Falls, Canada
Email: Ranzan@CellularUniverse.org

Reprint of the article published in **Physics Essays** Vol **23**, No.3, p520-531 (2010 Sept)

(Submitted 2009 May; published 2010 Sept)

Abstract: Assuming that the Universe consists of absolute space, or more properly *aether-space*, (as evidenced by several well-documented experiments, and supported by the DSSU* theory) the transformation of the coordinates from one moving inertial frame to another frame *while retaining the information of their absolute motion* (with respect to aether-space) requires the application of the Lorentz transformation, not once, but twice. The combined transformations are detailed. The resulting expressions for space-and-time coordinates are then used to redefine: absolute velocity, apparent velocity, length contraction, momentum, mass, and kinetic energy —all redefined in terms of *absolute inertial motion*. Each of the resulting expressions are validated by showing that each reduces, under the specified condition, to the Einstein Special Relativity form (as each must) and also reduces, under specified speed restrictions, to the familiar Newtonian-Galilean form (again, as each must).

In effect, DSSU relativity (the relativity of absolute motion) encompasses both Special relativity and Classical relativity.

* DSSU is the acronym for Dynamic Steady State Universe. It is a model based on the premise that all things are processes.

Keywords: DSSU relativity; Lorentz transformation; Special relativity; Classical relativity; absolute motion; absolute space; aether; length contraction; momentum; relativistic mass.

Archimedes's laws of statics and Galileo's laws governing the motions of falling and thrown objects near the surface of the Earth became limiting cases of Newton's theory, which in turn became a limiting case of Einstein's theory, which itself may one day become a limiting case of a still more comprehensive theory. –David Layzer[1]

Contrary to the Einstein assumptions, absolute motion is consistent with relativistic effects, which are caused by actual dynamical effects of absolute motion through the quantum foam, so that it is Lorentzian relativity that is seen to be essentially correct. –Reginald Thomas Cahill[2]

Although Aether Theories has been the subject of a number of contributions, some of the more recent ones that have appeared in Physics Essays being listed in References [3] [4] [5] [6] [7] and elsewhere in References [8] [9] [10] [11] [12], no one has ever attempted, to my knowledge, to make an analysis following different criteria such as the ones reported in this paper.

Relativity has to do with measurements of events, where and when they happen, and by how much any two events are separated in space and in time. Furthermore, relativity has to do with transforming length, time, and other quantities between reference frames that move relative to each other.

Textbooks on the subject tell us that when clocks are compared between relatively moving frames their rate of keeping time will not agree. Also, the length of an object, when measured within the object's frame, does not agree with the same dimension when measured from a relatively moving frame (say moving parallel to the object's length).

The question is, *are such effects real or merely apparent?*

The traveling twin paradox strongly suggests that the time-dilation effect is real. The fact that the orbiting clocks of the GPS navigation system require a predictable compensating adjustment also indicates that the effect is real.

But in some situations the effects are obviously only apparent. Consider a moving observer trying to measure a 'stationary' clock and a 'stationary' measuring rod. The Lorentz equations predict that the clock will appear to run slow and the length of the rod will appear to be contracted. And these effects will vary with the observer's own speed! For instance, the faster he goes the shorter the rod will appear (for a rod parallel to the direction of motion). Furthermore, other observers having different speeds will never be able to agree on the observed clock-time and rod-length. Obviously, these are observer-dependent effects —they must be *apparent* effects.

Now what if the frame, with the target clock and rod, is *also* in motion; might not this motion cause real effects (buried in with the apparent)?

It would seem then, that there are real-, hidden-, and apparent- relativistic effects.

The problem is, how do you distinguish which is which?

For motion within the abstract space of Einstein's special relativity you simply can not make a distinction. Only relative motion between observer and target object matters. More fundamentally, in Einstein's space there is no such thing as absolute inertial motion (no absolute nonaccelerating motion).

For motion within an aether-type space, however, you can make a distinction.

There are three basic relativistic effects that may be associated with motion (regardless of the absolute or relative nature of the motion): the slowing of time, the contraction of length, and the apparent increase in mass. Part of the purpose of a relativity theory is to define the physical descriptions (equations) that depend on the three effects. The equations include those for position, velocity, momentum, kinetic energy, and total energy. The phenomena have long been precisely defined for purely relative situations. But what happens when a preferred background frame of reference is introduced*?* —something strictly forbidden in Einstein's relativity.

What happens when space possesses an absoluteness quality?

What happens when the abundant experimental evidence of aether is incorporated into mainstream physics?

This paper explores how it is possible to relate *relativity* based on aether-space with *relativity* based on non-aether space. It will be shown how one subsumes the other.

1. Traditional Aether versus DSSU Aether

As a first step, let me clarify my use of the terms *absolute space* and *aether-space*. The terms are used synonymously, when, for instance, discussing the absolute frame of reference or aether frame of reference. The *absolute space* of this Paper has nothing to do with the absolute-and-static space of Newton's absolute universe. And the *aether-space*, here, is significantly unlike the classical aether. Thus, I am not in any way suggesting a return to the failed 19th century aether, prior to the development of the *Lorentzian aether theory*.

I am introducing a radically different type of aether. Although the equations to be developed later do not, for the most part, depend on the type of aether, the aether does play several key roles in other aspects of physics and cosmology. In fact, it defines the cosmology of what is called the *Dynamic Steady State Universe* [[a]]. In recognition, the new aether is called *DSSU aether*.

The table (below) compares the new aether with the traditional aether and the aether devised by Hendrik Lorentz (1853-1928).

All three types of aether *permeate all space* and are *luminiferous*, that is, they serve as the conducting medium of electromagnetic waves. It is assumed that these aethers are uniform; thus, light travels with a constant speed with respect to aether. And if the light source is moving (while the observer remains at rest with respect to aether), the measured speed of light will always have the constant value of about 300,000 km/s.

So much for the similarities; now for the differences.

The traditional and the DSSU "aethers" differ significantly in two respects: (i) They make different predictions for the apparent speed of light for moving observers. Even though DSSU aether is the conducting medium, the speed of light remains constant for all observers. In the latter respect, it is compatible with Einstein's relativity. (ii) The traditional aether is a passive medium; the DSSU aether is a dynamic medium.

The Lorentzian aether was an improvement on the traditional aether in that it was not entirely passive; it was designed to interact with objects moving through it and cause relativistic effects. Nevertheless, it was a static medium. Now the DSSU aether, like Lorentz's aether, is

Three Types of Aether Compared			
Property	Traditional Aether	Lorentz's Aether	DSSU Aether
LUMINIFEROUS	Yes	Yes	Yes
Apparent SPEED OF LIGHT Light source at rest in aether. Observer moving with respect to aether.	$v_{light} \neq c$ **(The reason the traditional aether failed)**	$v_{light} = c$	$v_{light} = c$ (Because intervals of distance and time are altered by observer's motion) [*]
Apparent SPEED OF LIGHT Light source moving in aether. Observer at rest with respect to aether.	$v_{light} = c$	$v_{light} = c$	$v_{light} = c$
DYNAMIC or GRAVITATIONAL	No	No	**Yes**

* The proof is given in Reference 14: Ranzan, C. 2010. *Resolving a Paradox in Special Relativity –Absolute Motion and the Unified Doppler Equation.*

[a] The physical cosmology theory of the *Dynamic Steady State Universe* —a spatially infinite cellular universe

involved in the cause of *intrinsic* relativistic effects of moving objects, but, unlike Lorentz's aether, DSSU aether is notably dynamic.

The categorical property that puts DSSU aether into a class of its own is its dynamic activity —two of its manifestations are cosmic-scale *space expansion* and *space contraction*. These two processes occur regionally, simultaneously, and orderly. They determine the shape and structure of the universe.

The expansion and contraction aspects of DSSU aether-space —specifically, as cosmic scale phenomena— are featured in the article, *The Story of Gravity and Lambda – How the Theory of Heraclitus Solved the Dark Matter Mystery*.[13]

Clearly, this is a new class of aether. In fact, it appears that *DSSU aether* (as well as Reginald T. Cahill's *process-aether*) may well be the first luminiferous-and-gravitational aether in the history of astrophysics and cosmology. Not only does this luminiferous-gravitational aether, when interacting with moving objects, cause clock retardation and length contraction, but it also holds the key to the mystery of gravity.

The present paper deals with 'flat' aether space. It is assumed that the frames of reference are in a non-gravitating region in deep space. Therefore, the dynamic aspects of expansion and contraction need not be considered.

The term "aether-space" was selected to underscore the meaning that this aether is to be identified *with* space; so that the properties of space are essentially the properties of the aether. For example, the property of *space expansion* corresponds to an increase in the quantity of aether.

2. Frames of Reference

Relativity is defined as a theory of physics which recognizes the universal character of the propagation speed of light and the consequent dependence of length, time, and other mechanical measurements on the motion of the observer performing the measurements. DSSU relativity obeys this core definition. The DSSU version complies with the definition while at the same time rejecting an assumption of Einstein's *special relativity* (ESR) —the assumption that there is no aether and hence *no preferred frame of reference*.

Whenever there is relative motion, there are at least two frames of reference —the one attached to the observer and the one attached to the object being observed. Sometimes a frame is attached to one observer and another frame to a second observer, while the object of interest has its own motion. The observations of the two frames may be compared by using what are known as the Lorentz transformation equations.[b] They were developed in the latter part of the 19th century for the purpose of converting the position-coordinates, lengths, velocities, and clock-time from one frame of reference into corresponding values for some other (relatively moving) frame of reference.

Each frame has its own space-and-time coordinates, usually designated as x, y, z, t for one frame and x', y', z', t' for the other (the primed frame). Three symbols describe a point location in space and t describes a 'location' in time. Time is a rather abstract concept. The 'time' we will be working with is *clock time*. It is simply what is measured by clocks. Although the aether rest-frame may be considered to possess a *universal time*, it is not this 'time' that moving clocks will register. The progression of clock-time depends on the speed of motion. As a result, it is not a simple matter to relate the coordinates of one system with those of another. When velocities approach a significant fraction of the speed of light, the simple Galilean transformation equations of high school physics are inaccurate. Leaving Einstein's equations out of the picture (for now) we must turn to the Lorentzian equations.

Now, there are two things to note about the Lorentz transformation equations. First, they were specifically designed to ensure that the speed of light is observed to be the same in *all* frames of reference. Second, they place no restrictions on the choice of inertial frame of reference. They may be applied to inertial frames in abstract space, absolute space, static aether, fluid aether, and so on.

Einstein's *special relativity* is based on the Lorentz transformation. But in seeking to make his theory as abstract as possible, Einstein added a restriction —a restriction that altered the course of physics. Onto the unrestricted Lorentzian base, Einstein imposed a restriction that excluded an absolute rest frame. Because Einstein rejected the notions of absolute space and aether space, he could not recognize them as special frames. Hence, there is no *preferred frame of reference* in ESR.

However, the DSSU is a universe of physical aether-space. The existence of aether-space makes a preferred frame of reference explicit. And since the Lorentz transformations place no restrictions on the type of space or the type of 'space medium,' there should be no problem in applying them to the aether-space of the

[b] Although they are known as the Lorentz equations, others were involved in their development. It seems that Woldemar Voigt, in 1887, was the first to write down the transformations. They were later revised by Joseph Larmor (1897, 1900). [As in *History of the Lorentz Transformations* http://en.wikipedia.org/wiki/History_of_Lorentz_transformations] Lorentz used the transformations in his paper of 1899 (and 1904), being the third person after Voigt and Larmor to write them down. The paper showed that the *FitzGerald-Lorentz contraction*, the predicted phenomenon affecting the Michelson apparatus, was a consequence of the Lorentz transformations. [As detailed in *Special Relativity*: http://www-history.mcs.st-andrews.ac.uk/HistTopics/Special_relativity.html] In 1905, on the 5th of June, Henri Poincaré published an important work *Sur la dynamique de l'electron* which claimed that *it was impossible to demonstrate absolute motion* and provided an explanation for the Michelson-Morley "null" result. In that paper *the transformations* are expressed in their modern form and, for the first time, named after Lorentz.[Ibid.]

DSSU. Then, when conversions are made between moving frames in DSSU space, it is the Lorentz transformations that ensure that a connection to the aether-space frame is always retained.

Throughout the discussion, the *aether frame*, the *preferred frame*, and the *absolute frame* all mean the same thing.

In a theory that rejects the concept of absolute space, *all* inertial motion is relative. And since it is not absolute, it must be *apparent* relative motion (of course, this does not make it any less measurable or less real). Everything is symmetrically relative. No absolute or aether space, and no absolute motion. This has been the dominant view for over 100 years.

In a theory that *does* recognize the existence of physical space, inertial motion is both relative *and* absolute. To develop formulas based on absolute motion, it is necessary to first have reference frames related to the 'absolute' frame (the aether frame).

3. Lorentz Transformation Applied to DSSU Aether-Space

We will refer to the absolute rest frame as frame S and the moving frame as *S(double prime)*. As Fig. 1 shows, inertial reference frame S'' is moving with speed υ_B relative to the preferred frame S, in the common positive direction of their horizontal axes (labeled x and x''). Now think of an event such as an electronic flash of a camera. An observer in S designates space-and-time coordinates x, y, z, t for the event, and an observer in S'' designates coordinates x'', y'', z'', t'' for the same event.

By restricting the motion so that it is parallel to the x-axis, the y and z perpendicular coordinates remain unchanged. It is a well understood fact that all observers in rectilinear motion agree on the y- and z-coordinates. Thus it is only the *length* x and the *clock time* t that need to be "transformed."

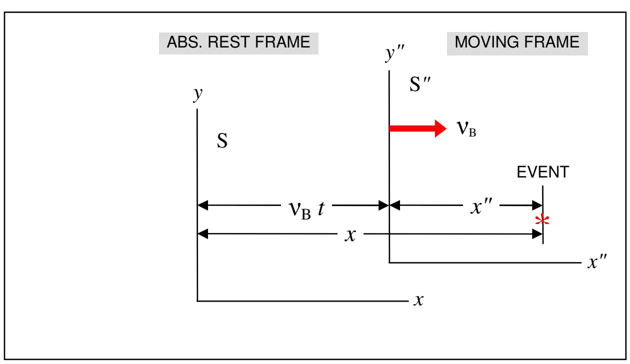

Fig. 1. Inertial reference frame S'' has velocity υ_B relative to the absolute rest frame S.

If, somehow, *clock time* were unaffected by motion, then universal time would be the rule —then t would equal t'' and we would relate the coordinates of the event by using the simple Galilean transformation equations:

$$x'' = x - \nu_B t\,,$$
$$t'' = t\,.$$

But clock time *is* affected by motion. We do *not* use the Galilean transformations. They may only be used when υ_B is quite small compared to the speed of light c.

Instead, we use the Lorentz equations (as found in most physics textbooks), which are valid for all possible speeds:

$$x'' = \gamma_B\left(x - \nu_B t\right)\,, \tag{3-1}$$

$$t'' = \gamma_B\left(t - \nu_B\, x/c^2\right). \tag{3-2}$$

With these an observer in the *absolute rest frame* can calculate the x'' and t'' coordinates of the subject event using measurements x and t from the observer's own frame (in addition to the known velocity ν_B). Gamma γ is the conventional symbol for the Lorentz factor. When subscripted for our example the Lorentz factor is:

$$\gamma_B = \frac{1}{\sqrt{1-\left(\nu_B/c\right)^2}}\,. \tag{3-3}$$

Similarly, the coordinates of the absolute rest frame S can be related to some other frame *S(single prime)* moving in the opposite direction, as shown in Fig. 2. Inertial reference frame S' is moving with speed υ_A relative to the absolute frame S.

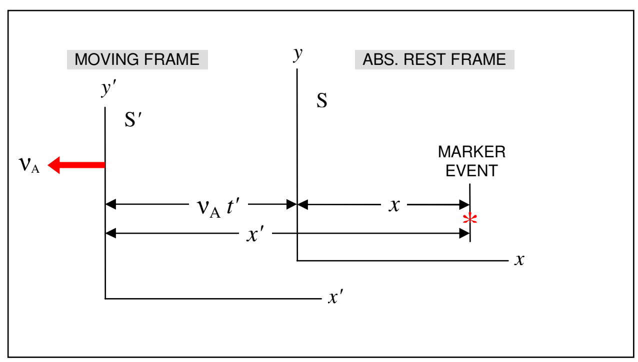

Fig. 2. Inertial reference frame S' has velocity ν_A relative to the absolute rest frame S. The "marker event" marks the x-location where S measured the original event to have occurred.

The *event* in this case can be thought of as another flash marking the location of the original event as measured in the S frame (although it is really the same original flash). The rest frame observer (not shown) is simply saying, "At this x here, I observed the original flash of Fig. 1." The *marker event* is therefore stationary.

(Just as a point of interest, the Galilean transformations give: $x = x' - \nu_A t'$ and $t = t'$. But are valid only when speed ν_A is small.)

The Lorentz equations applicable to the Fig. 2 situation are:

$$x = \gamma_A \left(x' - \nu_A t' \right), \tag{3-4}$$

$$t = \gamma_A \left(t' - \nu_A \, x'/c^2 \right). \tag{3-5}$$

With this pair an observer in the *moving frame* S' can calculate the absolute x and t coordinates of some event occurring in stationary-frame S using measurements x' and t' from the moving observer's own frame (in addition to the known velocity ν_A).

Double Lorentz Transformation. By combining the two sets of Lorentz equations above —by substituting (3-4) and (3-5) into (3-1) and (3-2)— we obtain the equations which directly relate the coordinates of independently moving frames *S(prime)* and *S(double prime)*. See Fig. 3.

$$x'' = \gamma_A \gamma_B \left[x' \left(1 + \nu_A \nu_B / c^2 \right) - t' \left(\nu_A + \nu_B \right) \right], \tag{3-6}$$

$$t'' = \gamma_A \gamma_B \left[t' \left(1 + \nu_A \nu_B / c^2 \right) - x' \left(\nu_A + \nu_B \right) / c^2 \right]. \tag{3-7}$$

Which means, an observer in the moving Frame **A** is able to calculate x'' and t'' coordinates of some event occurring in moving Frame **B** using measurements x' and t' obtained from **A**'s own frame. (Observer **A** determines his own speed ν_A by directly measuring absolute motion with respect to aether-space; and determines ν_B by direct communications or applying the DSSU Doppler formula.[14])

By algebraically rearranging the terms of the previous pair of equations, one obtains the corresponding transformation from S'' to S':

$$x' = \gamma_A \gamma_B \left[x'' \left(1 + \nu_A \nu_B / c^2 \right) + t'' \left(\nu_A + \nu_B \right) \right], \tag{3-8}$$

$$t' = \gamma_A \gamma_B \left[t'' \left(1 + \nu_A \nu_B / c^2 \right) + x'' \left(\nu_A + \nu_B \right) / c^2 \right]. \tag{3-9}$$

Noting again that the y and z coordinates, which are perpendicular to the direction of motion, are not affected by the motion; we state that $y' = y''$ and $z' = z''$. This completes the set of Lorentz transformations applicable to aether-space. They convert the four coordinates of an event for which frame velocities are referenced to aether-space.

As a check on the validity of equations (3-6) to (3-9) we note that when Observer **A**'s absolute speed is zero (when $\nu_A = 0$) these equations reduce to the form used in ESR.

Furthermore, it is a formal requirement of relativistic equations that they must reduce to the classical form if c is allowed to approach infinity. "That is, if the speed of light were infinitely great, *all* finite speeds would be 'low' and classical equations would never fail."[15] If we let c approach infinity in equations (3-6) to (3-9) then γ_A and γ_B will approach 1.0 and $\nu_A \nu_B / c^2$ will approach zero. The equations will then reduce to the simple Galilean expressions.

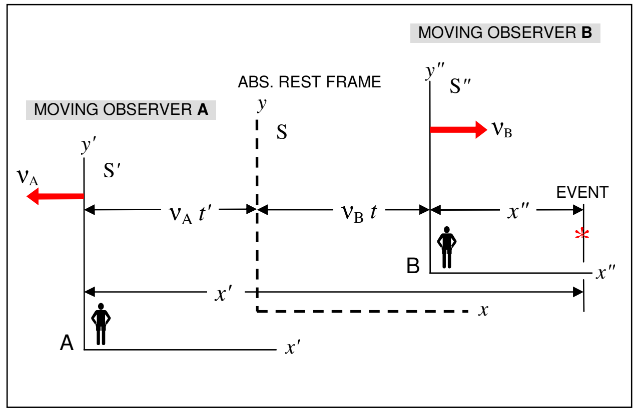

Fig. 3. *Two inertial reference frames each having independent absolute motion.* The Lorentz equations applicable here are given as eqns (3-6) and (3-7) in the text. Under low speed conditions they must reduce to the Galilean relativity equations $t'' = t = t'$ and $x'' = x' - (\nu_A + \nu_B)\, t'$.

Distance and time between two events. Let us say two events occur somewhere along the x''-axis in Frame **B**. Event *1* has coordinates x''_1, t''_1, and event *2* has coordinates x''_2, t''_2. The difference in space and time are represented by,

$$\Delta x'' = \left(x''_2 - x''_1 \right) \text{ and } \Delta t'' = \left(t''_2 - t''_1 \right).$$

By using equations (3-6) and (3-7) for each event, $\Delta x''$ and $\Delta t''$ may be expressed as,

Distance between pair of events:

$$\Delta x'' = \gamma_A \gamma_B \left(\Delta x' \left(1 + \nu_A \nu_B / c^2 \right) - \Delta t' \left(\nu_A + \nu_B \right) \right). \tag{3-10}$$

Time interval between pair of events:

$$\Delta t'' = \gamma_A \gamma_B \left(\Delta t' \left(1 + \nu_A \nu_B / c^2 \right) - \Delta x' \left(\nu_A + \nu_B \right) / c^2 \right). \tag{3-11}$$

With these equations an observer **A** in the moving frame S' is able to calculate the distance and time interval between a pair of events occurring in **B**'s frame using measurements $\Delta x'$ and $\Delta t'$ obtained from **A**'s own frame (and with ν_A and ν_B obtained as previously noted).

Sign rule for parallel and independent absolute (aether-referenced) velocities. Any velocity referenced to the aether medium follows the simple sign convention: Use positive sign when absolute velocity is away from the other frame of reference. Use negative sign when absolute velocity is towards the other frame.

(The rule is much the same as the one used for special relativity except that "relative" is replaced by "absolute.")

4. Relating Apparent Velocities and Absolute Velocities

We now use the aether-referenced Lorentz transformations to compare the velocities that our two observers in two different absolute-motion reference-frames S' and S'' would measure for the same moving object (the red ball shown in Fig. 4). As before, S' has absolute velocity ν_A and S'' has velocity ν_B .

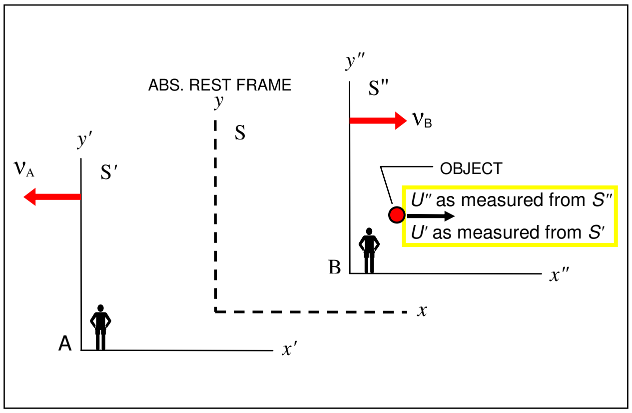

Fig. 4. *Two inertial reference frames each having independent absolute motion.* Observer **A** measures the velocity of the object as u' while Observer **B** measures u''.

Suppose the object moves a distance $\Delta x'$ in a time interval $\Delta t'$ as measured by **A** in S'-frame. Using equations (3-8) and (3-9) we then obtain:

$$\Delta x' = x_2' - x_1',$$

$$\Delta x' = \gamma_A \gamma_B \left[\Delta x'' \left(1 + {}^{\nu_A \nu_B}\!/_{c^2}\right) + \Delta t'' \left(\nu_A + \nu_B\right) \right], \quad (4\text{-}1)$$

and

$$\Delta t' = t_2' - t_1',$$

$$\Delta t' = \gamma_A \gamma_B \left[\Delta t'' \left(1 + {}^{\nu_A \nu_B}\!/_{c^2}\right) + \Delta x'' \left(\nu_A + \nu_B\right) / c^2 \right]. \quad (4\text{-}2)$$

And by a simple division of the two equations we have,

$$\frac{\Delta x'}{\Delta t'} = \frac{\gamma_A \gamma_B \left[\Delta x'' \left(1 + \nu_A \nu_B / c^2\right) + \Delta t'' \left(\nu_A + \nu_B\right) \right]}{\gamma_A \gamma_B \left[\Delta t'' \left(1 + \nu_A \nu_B / c^2\right) + \Delta x'' \left(\nu_A + \nu_B\right) / c^2 \right]}. \quad (4\text{-}3)$$

Then, by dividing the numerator and denominator by $\Delta t''$,

$$\frac{\Delta x'}{\Delta t'} = \frac{\left(\Delta x''/\Delta t''\right)\left(1 + \nu_A \nu_B / c^2\right) + \left(\nu_A + \nu_B\right)}{\left(1 + \nu_A \nu_B / c^2\right) + \left(\Delta x''/\Delta t''\right)\left(\nu_A + \nu_B\right)/c^2}. \quad (4\text{-}4)$$

In the differential limit $\Delta x'/\Delta t'$ is u', the apparent velocity of the object as measured by **A** in S'-frame; and $\Delta x''/\Delta t''$ is u'', the apparent velocity of the object as measured by **B** in S''-frame. The final result then is the *DSSU relativistic velocity transformation equation:*

$$u' = \frac{u''\left(1 + \nu_A \nu_B / c^2\right) + \left(\nu_A + \nu_B\right)}{\left(1 + \nu_A \nu_B / c^2\right) + u''\left(\nu_A + \nu_B\right)/c^2} \quad (4\text{-}5)$$

(transforms an apparent velocity u'' within one frame into an apparent velocity u' for an observer in another frame).

Significantly the transformation of an *apparent* velocity has been accomplished by the use of *absolute* motions. We specified this constraint in the beginning when the Lorentz transformation was applied to DSSU aether-space.

The diagram (Fig. 4) makes it clear that the moving Object has two apparent velocities u' and u'' and the present equation makes it clear that u' is determined by the two absolute velocities ν_A and ν_B.[c] (Incidentally, the use of the rigid term 'absolute velocity' is mainly for clarity of presentation. Recall that DSSU aether-space is not Newtonian absolute. Rather, it is dynamic. It expands or contracts by varying degrees depending on the local region. The more precise term applicable to ν_A and ν_B is *locally aether-referenced velocity*.)

Subjecting the equation to the two tests of validity: When aether-referenced velocities ν_A and ν_B are replaced by *apparent* velocities 0 and ν respectively, then (as shown in the flowchart of Fig. 5.) eqn (4-5) reduces to the ESR eqn (4-6):

$$(u =)\ u' = \frac{u'' + \nu}{1 + \dfrac{u''\nu}{c^2}}. \quad (4\text{-}6)$$

In making these replacements we are simply saying Observer **A** is not moving in his own frame and **B** is moving relative to **A** with speed ν. (We imagine that absolute motion is not measurable, forcing us to replace υ_A and υ_B with apparent motion.) And secondly, when we apply the formal test of allowing the speed of light c to hypothetically approach infinity we witness a reduction to the *Galilean velocity transformation* equation (shown at bottom of the flowchart).

In practical terms, when ν_A and ν_B are much less than light speed then the DSSU equation reduces to the Galilean form. (Similarly, when ν is small the ESR

[c] For Observer **B** the expression for the object's apparent velocity u'' in terms of absolute motion is obtained by applying the *velocity transformation equation* (4-5) to frame **B** (Fig. 4) and to a separate frame attached to, and moving with, the object. The speed of the object in its own frame is then zero. Thus we have,

$$u'' = (\nu_P + \nu_B) / (1 + (\nu_P\, \nu_B/c^2)),$$

where ν_P is the absolute speed of the object (or particle) and the sign rules apply.

equation can be approximated by the Galilean expression.)

Relating Moving Frames

Now what if Observer **A** in Fig. 4 is interested not in the apparent speed of the ball-object but rather in the apparent speed of the subject **B**? ... Traveler **B**'s speed in his own frame is zero; speed u'', now applied to **B**, equals 0. And u', now the apparent speed of **B** relative to **A**, is relabeled as apparent speed ν. With these substitutions eqn (4-5) becomes,

$$v = \frac{v_A + v_B}{1 + \left(v_A v_B / c^2\right)} . \qquad (4\text{-}7)$$

This gives the apparent velocity of one observer (or reference frame) with respect to another observer (or reference frame) expressed in terms of aether-referenced velocities.

The expression is symmetrical and applies to both relatively moving observers (or frames).

With this abbreviated *DSSU velocity transformation equation* any relative velocity can, in principle, be expressed in terms of absolute motion. (In the Fig. 5 flowchart, it serves as a check between DSSU and ESR.)

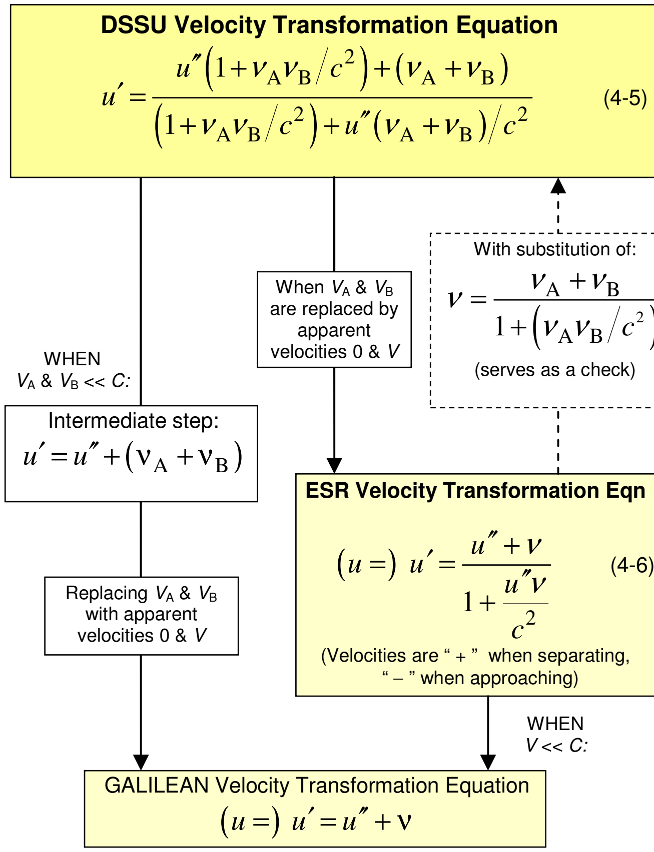

Fig. 5. *The DSSU velocity transformation equation reduces to the Einsteinian and the Galilean expressions*. All three expressions (highlighted in yellow) convert an apparent velocity u'' into apparent velocity u'. DSSU physics does this with aether-referenced motion (v_A and v_B are absolute velocities with respect to aether-space); ESR physics does it with apparent relative motion (ν). For the equation reductions, it is assumed the observer is in frame **A**. Observer **A** considers himself motionless, thus v_A is replaced by zero. Then the motion of frame **B** becomes the relative motion; and so v_B is replaced by ν. (Additional meaning of the symbols is given in Fig. 4.)

An Example

The advantage of the DSSU equation is revealed by the following simple example. Two starships in deep space fly past each other while maintaining radio contact with each other. We imagine ourselves traveling in ship **A**, having previously attained and measured a speed of 0.6 c (i.e., our own speed relative to aether-space is six-tenths of the speed of light). Starship **B** informs us that its own speed relative to space is also 0.6 c . See Fig. 6.

Determining the *absolute* relative speed is but a trivial problem; it is just the magnitude of the vector difference between our own known absolute velocity and the absolute velocity of ship **B** (information we received via radio communications). We wish to know the *apparent* relative speed.

Ship **A** represents inertial moving-frame **A** (with v_A= 0.6 c); ship **B** represents inertial-frame **B** (v_B= 0.6 c) moving in the opposite direction. The apparent velocity of each ship within its own frame is zero. Each ship's occupants do not see their own ship moving (this is equivalent to saying u'' is equal to zero in eqn (4-5)).

Then the applicable equation is (4-7). By substituting the known values, the *apparent* relative speed is,

$$v = \frac{0.6c + 0.6c}{1 + \left(0.6c \times 0.6c / c^2\right)} = 0.88c . \qquad (4\text{-}8)$$

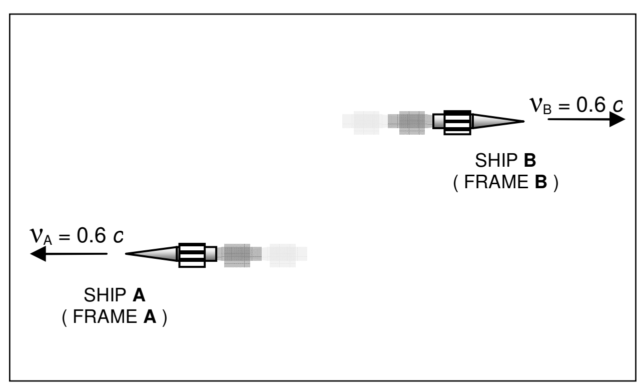

Fig. 6. *Space-travel scenario, involving absolute inertial motion*, analyzed in the text. The absolute relative speed between the starships is 1.2 c. What is the apparent relative speed as observed from either traveling frame?

Note that we used absolute inertial motion to calculate a relative speed.

Now if we try to use the ESR formula (eqn (4-6) in the flowchart) to calculate the *apparent* relative speed we correctly plug in the value $u'' = 0$ but then we run into a problem. What value should be used for ν ?

The absolute separation velocity between the ships is 1.2 c. And since this is greater than lightspeed it is a value that cannot be applied to any special relativity equation! Clearly, ν is not 1.2 c.

When performing the analysis using ESR one is required to introduce a third frame of reference; and if a convenient real frame is not available (as in this example) then an imaginary reference frame is introduced. The answer will, of course, agree with the above value of 0.88c.

The important point is that even though the DSSU analysis uses absolute inertial motion it arrives at the same apparent speed as obtained with ESR —a methodology that does not recognize *absolute inertial motion*.

Summing up this section. While in ESR the rule is *no relative motion of any kind greater than* c; in DSSU theory the rule is *no absolute motion greater than c*.

More specifically, the DSSU version permits neither apparent relative motion of any kind greater than c; nor absolute relative motion greater than *twice* the speed of light. An apparent speed of less than lightspeed (in our answer of 0.88 c above) provides a satisfying compliance with the sacred speed of light postulate. But what happened to the absolute relative difference of 1.2 c? ... It is still there. It is simply the vector difference of the two aether-referenced velocities ν_A and ν_B.

5. DSSU Relativity: Length Contraction

Length Contraction in Aether-Space

The Observers in spaceship **A** want to determine the length of a passing cargo ship. The *proper length*, designated as L_0 in Fig. 7, can only be measured within its own frame. The occupants of the cargo ship can take their time and measure L_0 at their leisure. Not so for Observers in **A**; they must use great care in measuring the coordinates of the endpoints (the front and the back) of the cargo-ship *simultaneously*. They must ensure that the time interval between measurements is zero, making $\Delta t' = 0$.

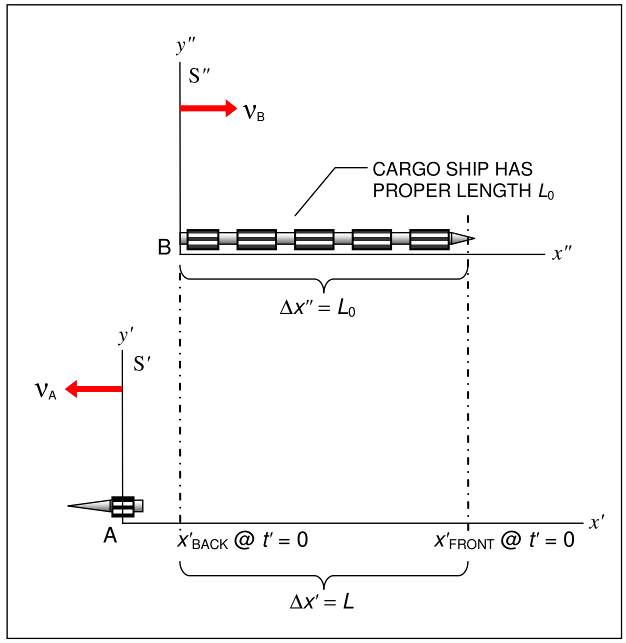

Fig. 7. *Length contraction*. The length of the cargo ship is a *proper length* in frame S''. The length of the cargo ship is a *contracted length* in frame S'. Correct length measuring procedure demands that Observer **A** measures the front and back simultaneously (say at $t' = 0$). Hence making $\Delta t' = 0$

In terms of the transformation equations we wish to transform the length $\Delta x''$ from S'' into an expression that includes $\Delta x'$ which can be measured by observers in S'. This can be accomplished with the transformation equation for absolute moving frames (eqn (3-10)) in which the two events will be the measuring of the front of the ship and (simultaneously) the back of the ship. As shown in Fig. 7: in **B**'s frame the distance between the events is $(x''_{FRONT} - x''_{BACK}) = \Delta x'' = L_0$ and in **A**'s frame the distance between the events is $(x'_{FRONT} - x'_{BACK}) = \Delta x' = L$.

Here, repeated for convenience, is the *absolute-velocities* equation (3-10) for the distance between two events:

$$\Delta x'' = \gamma_A\gamma_B\,[\Delta x'\,(1 + \nu_A\nu_B/c^2) - \Delta t'\,(\nu_A + \nu_B)]\ .$$

Substituting $\Delta t' = 0$, and replacing $\Delta x''$ with L_0 the proper length, and $\Delta x'$ with L the measured contracted length, gives:

$$L_0 = \gamma_A\gamma_B\,(1 + \nu_A\nu_B/c^2)\,L\ . \qquad (5\text{-}1)$$

Then, by rearranging the equation, we can say that Observer **A** measures the length of the cargo ship to be, the contracted length,

$$L = \frac{1}{\gamma_A\gamma_B} \times \frac{L_0}{1+\left(\nu_A\nu_B/c^2\right)}\ , \qquad (5\text{-}2)$$

or in expanded form,

$$L = \frac{\sqrt{1-(v_A/c)^2}\sqrt{1-(v_B/c)^2}}{1+\left(v_A v_B/c^2\right)} L_0 . \qquad (5\text{-}3)$$

Some basic tests. Under conditions of tandem motion one would not expect to observe length contraction. Let us apply this condition to eqn (5-3). Frame S' has absolute motion *away from* the other frame, as shown in Fig. 8; therefore, according to the sign rules, ν_A is positive. Frame S'' has absolute motion *towards* the other frame; thus, according to the sign rules, ν_B is negative. This changes the sign in the denominator. Then, since $|\nu_A| = |\nu_B|$ we replace both with v. The result is that both numerator and denominator in (5-3) are equal to $1-(v/c)^2$. Consequently, $L = L_0$ —confirming there is no apparent length contraction.

When the velocity magnitudes are much less than lightspeed then the equation reduces to Galilean-Newtonian physics. Then L will approximately equal L_0.

And lastly, when aether-referenced velocities ν_A and ν_B are replaced by *apparent* velocities 0 and ν respectively (these being the relative motions that Observer **A** 'sees'), then eqn (5-3) reduces to the ESR equation for *length contraction*:

$$L = (1/\gamma)\, L_0 = \sqrt{1-\left(\nu/c^2\right)}\; L_0 . \qquad (5\text{-}4)$$

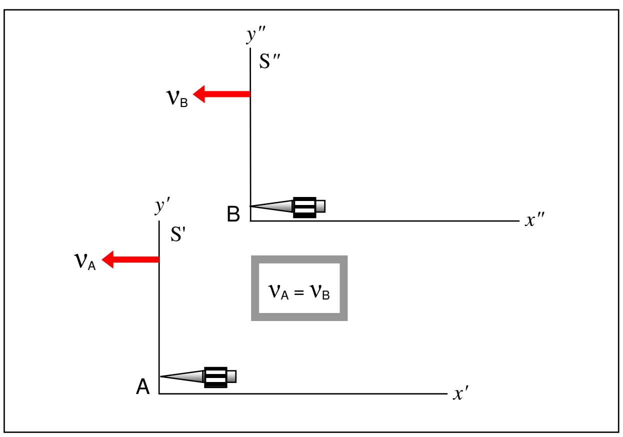

Fig. 8. *No length contraction observed under tandem motion*. Ship **A** has absolute motion away from the other frame; therefore, according to the sign rules, ν_A is '+'. Ship **B** has absolute motion towards the other frame; thus ν_B is '–'. The length contraction equation (5-3) then reduces to $L = L_0$.

The flowchart, in Fig. 9, shows the connectedness of the length contraction expressions for the domain of three classes of physics.

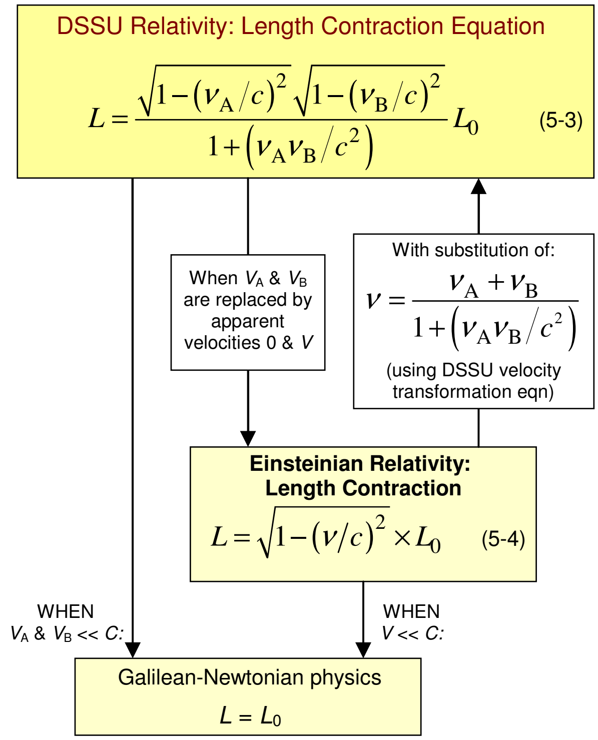

Fig. 9. *Apparent length contraction*. The DSSU length contraction equation reduces to the Einsteinian and the Galilean expressions. For the equation reduction to ESR it is assumed the observer is in frame **A**. Observer **A** considers himself motionless, thus ν_A is replaced by zero. Then the motion of frame **B** becomes the relative motion; and so ν_B is replaced by ν. (L_0 is the proper length; ν_A and ν_B are absolute velocities with respect to aether-space)

Apparent Length Contraction

Assume the cargo ship **B** in Fig. 7 is at rest with respect to aether-space (i.e., $\nu_B = 0$). The length that Obsever **A** measures will depend solely on **A**'s motion. The greater the speed the smaller length L will appear. Other moving observers will measure different values for length L. Obviously, L represents apparent length contraction. Equations (5-3) and (5-4) in the flowchart of Fig. 9 are expressions for apparent length contraction.

Absolute Length Contraction

But what about absolute length contraction? We have an absolute frame of reference —an aether-space that is postulated to interact with objects and cause physical length contraction (with respect to the aether rest frame). How do we express this observer-independent length contraction?

Without giving the proof, the *absolute length contraction* of an object is,

$$L_{abs} = {L_0}\big/{\gamma_{abs}} = \sqrt{1-\left(v_{abs}/c\right)^2} \times L_0 , \qquad (5\text{-}5)$$

where v_{abs} is the measured velocity with respect to aether-space; L_0 is the usual measured *proper length*. The length L_{abs} cannot be directly measured, it can only be calculated.

6. DSSU Relativistic Mass and Momentum

The momentum of an object is defined as the product of its mass times its velocity. The classical expression, suitable for normal speeds, is,

$$\mathbf{p} = m\,\mathbf{v}.$$

When the velocity magnitude is a significant fraction of the speed of light, rest mass m must be replaced by the *relativistic mass*, expressed as $\gamma\, m_o$.

The expression for relativistic mass is a mathematical consequence of the Lorentz transformation and the law of conservation of momentum.[d]

Consider two spaceships passing each other as shown in Fig. 10. Both ships contain identical masses —when measured in their own frame they each have a "rest" value of M_o.

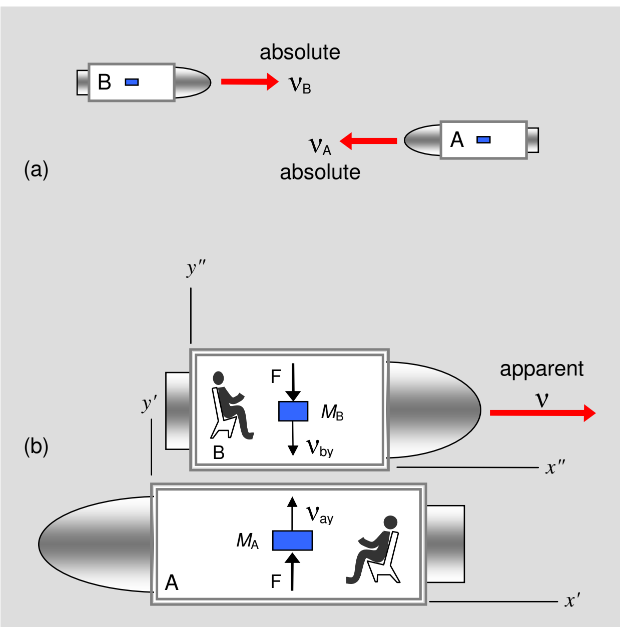

Fig. 10. Determining relativistic mass as described in the text. (a) The procedure as viewed in the aether rest frame; (b) as viewed in Observer **A**'s frame. (The expression for relativistic mass is a mathematical consequence of the Lorentz transformation and the law of conservation of momentum.)

During the moment when the ships are opposite each other, an attractive force between the two masses is momentarily activated. This force induces in each mass a small motion in the *y*-direction —a small velocity perpendicular to the *x*-axis relativistic-motion of the ships. Both observers will see their respective masses move in the *y*-direction with the same vertical component of velocity. In terms of the symbols of Fig. 10,

$$v'_{ay} = v''_{by} \qquad (6\text{-}1)$$

(v_{ay}) as measured by **A** = (v_{by}) as measured by **B**

Now, from observer **A**'s perspective the momentum acquired by M_A is $M_A v'_{ay}$ and that acquired by M_B is $M_B v'_{by}$. Momentum must be conserved, therefore,

$$M_A v'_{ay} = M_B v'_{by}\,. \qquad (6\text{-}2)$$

Replacing (v'_{ay}) with its equal from (6-1) gives,

$$M_A v''_{by} = M_B v'_{by}\,, \qquad (6\text{-}3a)$$

$$M_A \frac{\Delta y''_b}{\Delta t''} = M_B \frac{\Delta y'_b}{\Delta t'}\,. \qquad (6\text{-}3b)$$

According to the Lorentz transformation, lengths that are perpendicular to the direction of motion are unaffected (i.e., $y'' = y'$). If M_B moves a distance Δy_b, both observers measure the same distance. The equation then reduces to,

$$\frac{M_A}{\Delta t''} = \frac{M_B}{\Delta t'}\,, \qquad (6\text{-}4a)$$

$$M_B = \frac{\Delta t'}{\Delta t''} M_A\,. \qquad (6\text{-}4b)$$

Since v_y is assumed to be small, M_A is essentially the rest mass M_o. And from the mathematical analysis of relatively moving "light clocks,"

$$\frac{\Delta t'}{\Delta t''} = \frac{1}{\sqrt{1-\left(\frac{v}{c}\right)^2}}\,. \qquad (6\text{-}5)$$

Thus, $$M_B = \frac{1}{\sqrt{1-\left(\frac{v}{c}\right)^2}} M_o\,. \qquad (6\text{-}6a)$$

That is, $$m_{relativistic} = \gamma\, m_{rest}\,. \qquad (6\text{-}6b)$$

We can express this in terms of the absolute motions (v_A & v_B) of the spaceships by replacing the *apparent* relative velocity $\mathbf{v}$ with its *absolute* counterpart which is given by eqn (4-7) as follows:

[d] The reasoning here is based on an argument used by Jay Orear in the *Programmed Manual of College Physics* (John Wiley & Sons, Inc., New York, 1968) p169. The *Manual* is a supplement to the J. Orear textbook *Fundamental Physics* 2[nd] Edition (John Wiley & Sons, Inc., New York, 1967).

$$m_{\text{rel}} = \frac{1+\left(v_{\text{A}}v_{\text{B}}/c^2\right)}{\sqrt{1-\left(v_{\text{A}}/c\right)^2}\sqrt{1-\left(v_{\text{B}}/c\right)^2}}\, m_{\text{rest}}\,, \tag{6-7a}$$

$$m_{\text{rel}} = \gamma_{\text{A}}\gamma_{\text{B}}\left(1+\frac{v_{\text{A}}v_{\text{B}}}{c^2}\right)m_{\text{rest}}\,. \tag{6-7b}$$

(DSSU relativistic mass)

With eqn (6-7b) we have the DSSU expression for relativistic mass. We are now ready to express the momentum of an observed object in terms of the *absolute inertial motions* of some observer **A** and some object **B**.

Into the definition of momentum,

$$\mathbf{p} = m_{\text{rel}}\,\mathbf{v}\,, \tag{6-8}$$

we substitute eqn (6-7b) and eqn (4-7). Then,

$$\text{p} = \gamma_{\text{A}}\gamma_{\text{B}}\left(1+\frac{v_{\text{A}}v_{\text{B}}}{c^2}\right)m_{\text{rest}}\left(\frac{v_{\text{A}}+v_{\text{B}}}{1+{v_{\text{A}}v_{\text{B}}}/{c^2}}\right), \tag{6-9a}$$

$$\text{p} = \gamma_{\text{A}}\gamma_{\text{B}}\, m_{\text{rest}}\left(v_{\text{A}}+v_{\text{B}}\right). \tag{6-9b}$$

(The DSSU relativistic momentum equation)

Something to keep in mind: m_{rest} does not mean "rest" with respect to aether. One cannot measure one's own mass increase just as one cannot measure one's own clock slowing or length contraction within one's own frame (although they do exist and can be calculated). The mass m_{rest} is simply what is measured by an observer in the object's frame. And so m_{rest} is constant regardless of motion.

The momentum can be generalized to two and three dimensions, in which case the velocity vectors need not be collinear. (The sign rules are still used, and are applied to component vectors.)

We test the equation for compatibility with standard physics: When aether-referenced velocities v_{A} and v_{B} are replaced by *apparent* velocities 0 and v respectively (these being the relative motions that Observer **A** sees), then eqn (6-9) reduces to the ESR equation for momentum,

$$\mathbf{p} = \gamma\, m_{\text{o}}\,\mathbf{v}\,. \tag{6-10}$$

And when (i) the velocity magnitudes are much less than lightspeed and (ii) the aether-referenced components v_{A} and v_{B} are replaced by *apparent* components 0 and v respectively, then the DSSU equation reduces to Galilean-Newtonian physics.

The flowchart, in Fig. 11, clearly demonstrates the connectedness of the three classes of physics.

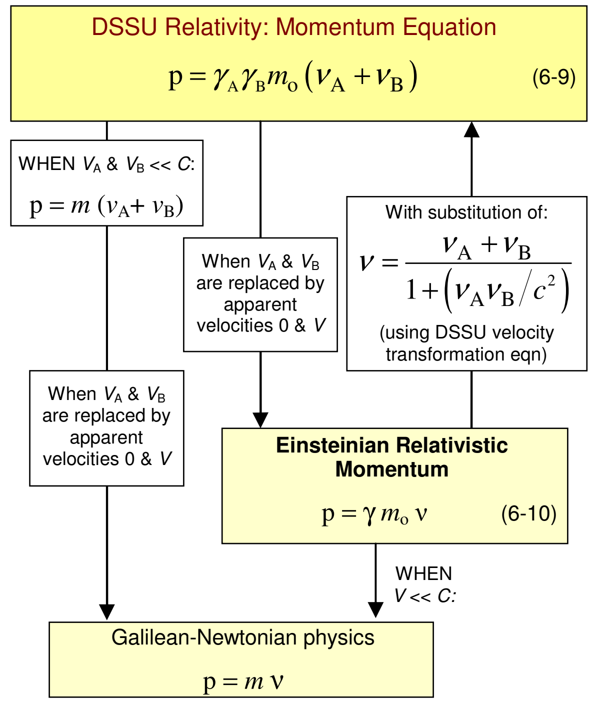

Fig. 11. *The DSSU momentum equation* reduces to the Einsteinian and the Galilean expressions. For the equation reductions it is assumed the observer is in frame **A**. Observer **A** considers himself motionless, thus v_{A} is replaced by zero. Then the motion of frame **B** becomes the relative motion; and so v_{B} is replaced by v. (m_0 is the conventional *rest mass*; v_{A} and v_{B} are absolute velocities with respect to aether-space)

Intrinsic Mass

An expression for *intrinsic mass* can be derived from eqn (6-7a). Let the observer **A** be at rest with respect to aether (i.e., let $v_{\text{A}} = 0$). Then eqn (6-7a) reduces as,

$$m_{\text{rel}} = \frac{1+0}{\sqrt{1-0}\sqrt{1-\left(v_{\text{B}}/c\right)^2}}\, m_{\text{o}}\,,$$

$$m_{\text{rel}} = \gamma_{\text{B}} m_{\text{o}}\,. \tag{6-11}$$

From the point of view of observer **A**, m_{rel} is the apparent mass —as long as **A** is at rest in aether-space. But since the term on the right side ($\gamma_{\text{B}}\, m_{\text{o}}$) is observer-independent (no v_{A} in the expression); and further, since γ_{B} is an aether-referenced Lorentz-factor and m_{o} is constant; then eqn (6-11) also represents intrinsic mass.

$$m_{\text{int}} = \gamma_{\text{abs}} m_{\text{o}}\,, \tag{6-12}$$

where γ_{abs} is the absolute Lorentz factor of the mass object; and m_{o} (as always) is the mass measured in its own frame. Equation (6-12) represents the actual mass in relation to its absolute speed; but, just as with the absolute length contraction, it is not apparent from within the object's frame —it can only be calculated.

The mass formulated here is observer independent but not motion-with-respect-to-aether independent. This intrinsic mass varies only with the object's absolute speed. At present, the implications and applicability of intrinsic mass is open to debate.

7. DSSU Relativistic Total Energy and Kinetic Energy

Rest energy. The rest energy of a particle (or mass) is $E = m_o c^2$, in which m_o is the mass measured in its rest frame (regardless of its absolute inertial motion).

Total energy. The total energy of a relatively moving particle or mass is $E = mc^2$, in which m is the relativistic mass ($m = \gamma\, m_o$). Einstein considered this expression to be the most significant outcome of special relativity.[16] Although Einstein is usually credited with its discovery, $E = mc^2$ was known for a long time before Einstein's work on relativity. It is the expression that uses apparent relative motion.

For *absolute inertial motion*, there is a comparable expression. It uses the relativistic mass given in eqn (6-7b). The result is the DSSU equation for total energy,

$$E_{\text{tot}} = \gamma_A \gamma_B \left(1 + \frac{v_A v_B}{c^2}\right) m_o \times c^2 . \qquad \text{(7-1)}$$

(DSSU equation for total energy)

Kinetic energy. The relativistic kinetic energy of a particle (or mass) is defined as the difference between the total energy, and the rest energy;

$$K = \gamma m_o c^2 - m_o c^2 = m_o c^2 (\gamma - 1) . \qquad \text{(7-2)}$$

Kinetic energy expressed in terms of absolute motion is

$$K = m_o c^2 \left[\gamma_A \gamma_B \left(1 + \left(v_A v_B / c^2\right)\right) - 1 \right] . \qquad \text{(7-3)}$$

(DSSU equation for kinetic energy)

The flowchart, in Fig. 12 below, shows how the DSSU absolute-motion equation can be converted to Einstein's relative-motion kinetic energy and to classical kinetic energy.

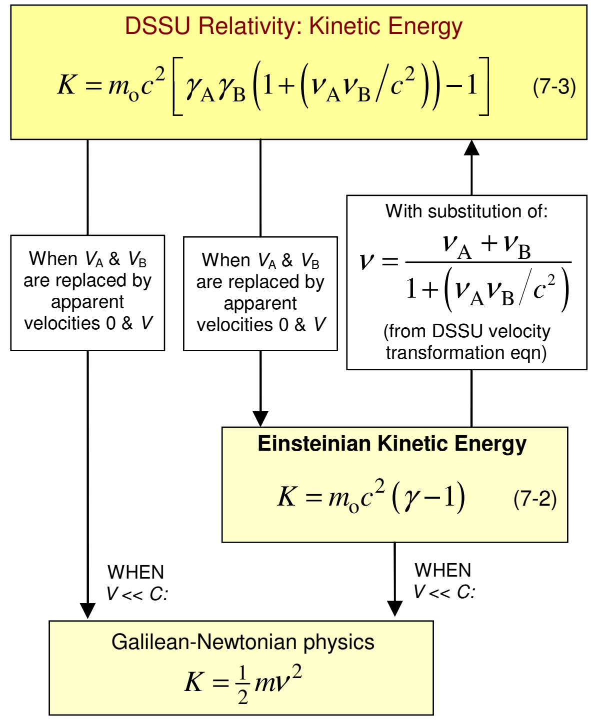

Fig. 12. *The DSSU kinetic energy equation* can be converted to the Einsteinian and the Galilean expressions.

8. Conclusion

In conclusion, DSSU relativity references motion to aether-space, which by its very existence defines a preferred and locally-absolute frame of reference. And therein lies the fundamental difference distinguishing it from Einstein's special relativity—one theory discredits absolute motion the other embraces it. DSSU theory recognizes the reality of aether-space (a quasi-physical quantized foam) and the frame of reference it defines.

> *Most importantly absolute motion is now understood to be the cause of the various relativistic effects, in complete contradiction with the Einstein viewpoint, but in accord with the earlier proposal by Lorentz.* –R. T. Cahill[17]

However, it is important to realize that each ESR equation is *not* a special case of the corresponding DSSU equation (in the flowcharts). It is by no means obvious, but both equations give the same answer; they must because they both represent the same observed or observable phenomena.

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

The process of applying the Lorentz transformations to reference frames moving through an aether medium has led to an extension of relativity theory. Equations —such as those for apparent velocity, length contraction, momentum, total energy, and kinetic energy— formerly defined by *relative* inertial motion are now also defined by *absolute* inertial motion.

In closing, let me underscore the nature of the new aether.

DSSU aether maintains a constant density; hence, electromagnetic waves are conducted at a true constant speed —fixed in terms of past, present, and future. This is in contrast to variable-density aether theories such as the one proposed by Allen Rothwarf in the work, *An Aether Theory of the Universe*.[[18]] As his universe expands, aether dilutes and consequently lightspeed decreases. ... But if the laws of physics are ultimately rooted in the properties of aether (the vacuum) itself, then the issue of constant- versus variable- density medium presents a monumental difference.

The nature of expansion. The DSSU aether expands through spontaneous growth; the Rothwarf aether expands by dilution. DSSU aether expands as a Primary Process; Rothwarf aether expands as a phenomenological process.

As stated earlier, the coordinate transformations are mathematical conversions and are not directly concerned with the type of "space" through which motions occur and in which events happen. Space could be an abstraction or a material substrate; space could be static or dynamic. On the basis of the equations alone it is not easy to compare theories —in particular the aether theory of Lorentz versus the aether theory of the DSSU. Let me, then, end the discussion with several points of significant difference between the Lorentz aether and the DSSU aether:

(i) Hendrik Lorentz accepted, as did Einstein, the "null" result of the Michelson-Morley experiment. Thus, the Lorentzian aether-medium, although it fills all space, was assumed to be *undetectable*. (Einstein, of course, made the whole thing an abstraction.) In contrast, DSSU aether-space *is detectable* —and has been detected in at least 8 well-documented experiments conducted during the last 100 years.[[19]]

(ii) Lorentz's aether conducts light waves and causes relativistic effects. DSSU aether-space, too, conducts light waves and causes relativistic effects. But DSSU aether-space is *sui generis* as the bestower of the property of mass. DSSU aether-space is dynamic in the sense that its interaction with matter particles is the very cause of mass.

(iii) DSSU aether-space is dynamic in the sense that it acts as the causal mechanism through which the effect of gravity is conveyed. Lorentz's aether is static.

(iv) DSSU aether-space is dynamic in the sense that it *physically expands* and thereby acts as The Primary Cause that drives the Universe. Again, Lorentz's aether is static.

REFERENCES

[1] D. Layzer, *Cosmogenesis, the Growth of Order in the Universe* (Oxford University Press, New York, 1991) p13

[2] R. T. Cahill, *Absolute Motion and Quantum Gravity* (2002) (http://www.mountainman.com.au/process_physics/index_of_papers.htm)

[3] Frank M. Meno, *The Photon as an Aether Wave and Its Quantized Parameters*, Physics Essays Vol.**10**, p304 (1997)

[4] R. A. Monti, *Theory of Relativity: A Critical Analysis*, Physics Essays, Vol.**9**, No.2, p238 (1996)

[5] D. J. Larson, *An Absolute Theory for the Electrodynamics of Moving Bodies*, Physics Essays, Vol.**7**, No.4, p476 (1994)

[6] P. Cornille, *On the Meaning of Special Relativity in the Earth Frame,* Physics Essays, Vol.**5**, No.2, p262 (1992)

[7] Young-Sea Huang, *Relativistic Kinematics I: A Theory of Relativistic Kinematics Based on Physical Reality*, Physics Essays, Vol.**4**, No.1, p68 (1991)

[8] J. P. Wesley, *Selected Topics in Advanced Fundamental Physics* (Benjamin Wesley Publisher, Blumberg, Germany, 1991)

[9] P. Beckmann, *Einstein Plus Two* (The Golem Press, Boulder, Colorado, 1987)

[10] T. E. Phipps, Jr., *Heretical Verities* (Classical Non-Fiction Library, Urbana, IL, 1986)

[11] J. G. Fox, *Experimental Evidence for the Second Postulate of Special Relativity*, American Journal of Physics, Vol.**30**, p297 (1962)

[12] J. G. Fox, *Evidence Against Emission Theories*, American Journal of Physics, Vol.**33**, p1 (1965)

[13] C. Ranzan, *The Story of Gravity and Lambda –How the Theory of Heraclitus Solved the Dark Matter Mystery*, Physics Essays Vol.**23**, No.1, pp75-87 (2010 Mar); (www.CellularUniverse.org/Gravity&DarkEnergy-Intro.htm)

[14] C. Ranzan, *Resolving a Paradox in Special Relativity –Absolute Motion and the Unified Doppler Equation*, Physics Essays, Vol.**23**, No.4, pp594-607 (2010)

[15] *Fundamentals of Physics Extended 5th Ed* –D. Halliday, R. Resnick, J. Walker (John Wiley & Sons, Inc., 1997) p969

[16] Harris Benson, *University Physics* (John Wiley & Sons, Inc., New York, 1991) p809

[17] R. T. Cahill, *The Speed of Light and the Einstein Legacy: 1905-2005*, Infinite Energy Vol.**10**, Issue 60, pp28-37 (2005); posted at: http://arXiv.org/abs/physics/0501051v2 and at http://www.mountainman.com.au/process_physics/HPS25.pdf

[18] Allen Rothwarf, *An Aether Model of the Universe*, Physics Essays Vol.**11**, No.3, pp444-466 (1998)

[19] R. T. Cahill, *A New Light-Speed Anisotropy Experiment: Absolute Motion and Gravitational Waves Detected*, Progress in Physics, Vol.**4**, pp73-92 (2006 Oct)