

# RELATIVITY OF TIME IN THE AETHER-SPACE OF THE DSSU —ABSOLUTE MOTION AND INTRINSIC TIME

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... time is either the same as motion or a condition of motion. —Aristotle, *On Man in the Universe*

*While motion is real; time is merely an abstracted aspect of motion (change). Time serves as part of the description of what is real ---and what is real must involve motion (or change). When the motion of one object is compared to some repeating internal motion of a clock (even if the motion is at the atomic scale) we call the correspondence "a measurement of time." In agreement with Aristotle, time without motion has no meaning. —CR*

**Abstract:** In a simple and traditional manner the DSSU time-relativity equation is derived and compared with Einstein's *special relativity theory* (ESR). The DSSU is, of course, an aether-space model. This means there is a preferred frame-of-reference —a frame in which absolute motion becomes meaningful. In fact both absolute motion and intrinsic time become meaningful. Absolute motion has been detected.<sup>1</sup> Absolute motion is now a scientific fact. With the DSSU time-relation it becomes possible to calculate the intrinsic-time corresponding to the absolute motion. To illustrate the method, a hypothetical space-travel experiment is described. It is shown that the DSSU equation reflects the reality of the situation —a reality totally lacking in ESR. Remarkably, the DSSU time-relation can also be used to calculate apparent *relative* time, thereby encompassing Einstein's *special relativity* motion.

The DSSU time-equation is also applied to a gravitational-aether situation —the clocks of the GPS navigation system moving within the Earth's gravitational-aether. The intrinsic time of clocks subjected to aether-flow while in Earth orbit is compared to the intrinsic time of a clock subjected to aether-flow while stationary on the Earth's surface.

The paper compares three World Views of space & time and concludes with a summary of *DSSU relativity* with its three postulates.

**Keywords:** Aether space, Absolute motion, Absolute space, Intrinsic motion, Relative motion, Special relativity, Time, GPS clocks, Dynamic space, DSSU, Dynamic Steady State Universe.

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The present paper further develops DSSU theory<sup>2</sup> by exploring the affects on clocks resulting from motion in a universe consisting of aether-space.

Since there are many kinds of aether<sup>3</sup> let us first clarify what kind of aether-space or *space* we are talking about.

The *space*, of the *Dynamic Steady State Universe* (DSSU) is a physical space.

It has absoluteness qualities; but it is not absolute. It is unlike the absolute space of the Newtonian universe. While Newtonian space is static, DSSU space is dynamic. While Newtonian space is merely a container, DSSU space is the essence-substance of the universe. While Newtonian space is a nothingness vacuum, DSSU space is an interacting quantized aether-space.

It is interesting to note the manner in which Isaac Newton tried to make his *space* more useful. His idea was to place an *aether* substance into all that emptiness. Newton had suggested that *some sort of ether transfers the action of gravity by its currents*.<sup>4</sup> Useful indeed. It may well have been the first historical expression of a dynamic gravitational aether. Unfortunately the idea was not pursued.

DSSU aether-space must obviously be unlike Einstein's *relative*-space. As we all know Einstein tried to do away with the aether concept. But let's take a closer look.

The name alone —*relative* space— makes it clear; it is *not* an absolute space and Einstein intended no absolute qualities. At least that's what was in the master plan of the theory of relativity. But the absoluteness qualities of the vacuum were difficult to discard. In fact, Einstein could not entirely reject the aether concept. He merely discredited the 19<sup>th</sup> century version with its Galilean-Newtonian relativity. His general theory of relativity, which makes gravitational fields its central concept, does not preclude the existence of aether.<sup>5</sup> Albert Einstein, in his essay *On the Aether (1924)*, commented to the effect that relativity theory could be said to ascribe physical properties to spacetime itself and *involve a kind of "aether."*

Nevertheless, the denial of physical space has deep roots extending into the very foundation of general relativity theory.

In the real world *space* is dynamic. Whether *space* is deemed to be physical or non-physical —*space* must be dynamic.<sup>6</sup>

The proponents of general relativity (the devotees of Einstein's space) believe *space* is non-physical. They advertise this by describing the dynamic activity of space by employing the term *geometro-dynamics* thereby underscoring the fact that Einstein's *space* is a mathematical construct —a 4-dimensional geometrized space-time. The foundation of general relativity is *four-co-ordinate-space* not aether-space.

In contrast DSSU space is physically dynamical —it measurably flows, expands, and contracts.

While physicists preach the redundancy of aether, in practice, they repeatedly fill so-called 'empty space' with all kinds of things such as fields, strings, loops, energy fluctuations, and a zoo of virtual particles —effectively turning the vacuum into an aether-space. Physicists are forever denying the existence of aether but find it ever so useful!

Another important feature of DSSU aether-space: it is consistent with the historical evidence of the detection of aether. There have been over six well documented experiments during the twentieth century. But the most famous and most misunderstood was the Michelson & Morley Experiment of 1887. Contrary to popular belief, the existence of aether was NOT disproved. The interferometer tests did not give null results. Michelson and Morley did not report null results.<sup>7</sup> Their measurements of aether flow were, for reasons unknown at the time, considerably less than what had been expected. The mystery behind these historically important experiments was finally resolved more than a century later.<sup>8</sup>

It seems reasonable then, in fact it is imperative, to postulate the physical existence of a 'space' fluid. In the Dynamic Steady State Universe, *space*, consists of some sort of *fundamental discrete entities*; that is to say, the entities are not in space but actually compose space giving it a certain degree of absoluteness. DSSU theory takes the bold step of combining an essence-substance space, with the constancy-of-the-speed-of-light-for-all-observers *space* of Einstein's special relativity.

DSSU space is a fluid; but not an ordinary fluid. This space 'stuff' is superlatively tenuous, without significant viscosity, offering no measurable resistance to the motions of material bodies (except when they approach light speed). Calling this space fluid the *aether* (or *aether-space*), may sound somewhat archaic; but it has the distinct advantage that everyone knows what you're talking about.

Without some kind of aether, the following questions become unanswerable (as they are unanswerable in Standard Cosmology): What is the basic substratum of our universe? What could be the agent whose presence impedes acceleration and thus produces inertia? What could be the agent whose presence imposes a strict speed

limit on all motion through space? What is the agent that contracts objects in motion? What is the agent that alters the time measured by moving clocks?

Let us deal with the physical and apparent change in clocks due to absolute and relative motion in aether-space.

## 1 THE BASIC TIME-RELATIVITY EXPRESSION

The classical relativity-of-time expression —this is the same one used in Einstein's *special relativity*— is surprisingly easy to derive.

Consider two observers moving with constant speed relative to each other. We may say with certainty that they will agree on their relative speed (the speed with which they are approaching each other or receding from each other); however, they will not necessarily agree on the timing between two events. If the relative speed is significant, each will measure a different time interval between the same two events. Each will observe the other's clock running slower.

To demonstrate this *time dilation effect*, it has become a tradition to bring Einstein's relativistic train-coach into service. One observer, appropriately called the Traveler, occupies the car's window seat adjacent to the train-station platform. In our thought experiment he is having his picture taken by a photographer, on the other side of the coach, who triggers the shutter and flash just as the train races through the station. The other observer is standing on the station platform and notices the flash inside the coach in front of him. A split second later and a little further down the track he sees the Traveler 'light-up' as the flash of light reaches him (the Traveler).

The Traveler sees the light coming directly across the width of the coach —perpendicular to the long axis of the coach. The station-platform Observer on the other hand 'sees' a diagonal lightpath. Now according to Einstein's great insight —known as the speed of light postulate— **both observers measure the same speed of light!** **Even though the path clearly appears to have two different lengths** the speed of light remains constant at  $3.0 \times 10^5$  km/s.

Both observers use the same simple relationship:

$$\text{path length} = \text{speed of light} \times \text{time} .$$

If there is disagreement on the path length, as is the case, (and light speed is constant) then there must be a compensating disagreement on the time interval. The equation makes it explicit.

The agreement of observed light-speed is accomplished only by the fact that time does not run at the same pace. Simply stated the longer path takes a longer time, the shorter path a shorter time. For the Traveler (who obviously sees a shorter path) time *must* run slower. For the bystander the path of the light beam looks longer, and the time the beam takes along its path also seems longer. Referring to Fig. 1: More time increments or clock-ticks are required for light to go from source *S* to *O'* in the

bystander's frame of reference than from  $S$  to  $O$  in the Traveler's frame.

The Traveler and Observer do not agree on elapsed time; but what about  $x$ -axis displacement. As far as the Traveler is concerned the two events involved no movement in the  $x$ -direction and he will readily admit that he kept perfectly still while seated during the picture-taking sequence —the two events, initial flash and subsequent illumination. In his frame-of-reference the camera is fixed at  $S$  and he remained in his seat at point  $O$ . The bystander on the other hand sees the second event displaced by an amount he readily calculates: the train's speed multiplied by the brief interval of time between the events ( $\Delta x = v \times \Delta t$ , where  $x$  is the distance parallel to the railway tracks). Thus, they agree neither on elapsed time nor on  $x$ . However, they do agree on the length  $SO$  (as they would for any length perpendicular to the direction of travel).

Line  $SO$  has the same apparent length in both frames; although each measures it differently. Using the elementary equation by which *distance = (speed  $\times$  time)* the Traveler will find that the length  $SO$  equals the speed of light multiplied by a measured time interval as determined by his own clock (which gives his own relative time). He finds:

$$SO = c \Delta t_{\text{TRAVELER}} \tag{1}$$

The Observer, in turn, applies the same elementary equation. But first he calculates the altitude of the *velocity triangle* (shown in Fig. 1) by applying the theorem of Pythagoras to the triangle's two known values: the hypotenuse,  $c$  the speed of light; and the base,  $v$  the speed

of the train. And so, using the speed component  $\sqrt{c^2 - v^2}$ , and a time interval measured with his own clock (which gives his own relative time), he determines that:

$$SO = \sqrt{c^2 - v^2} \Delta t_{\text{OBSERVER}} \tag{2}$$

Combining the results of (1) and (2) allows one to state:

$$\text{Length } SO = c \Delta t_{\text{TRAVELER}} = \sqrt{c^2 - v^2} \Delta t_{\text{OBSERVER}}$$

$$\frac{\Delta t_{\text{TRAVELER}}}{\Delta t_{\text{OBSERVER}}} = \frac{\sqrt{c^2 - v^2}}{c} \tag{3}$$

This is the classical formula of relativity. It means: *Time literally passes slower for the traveler in the ratio  $\sqrt{c^2 - v^2}$  to  $c$ .* It may be further simplified to:

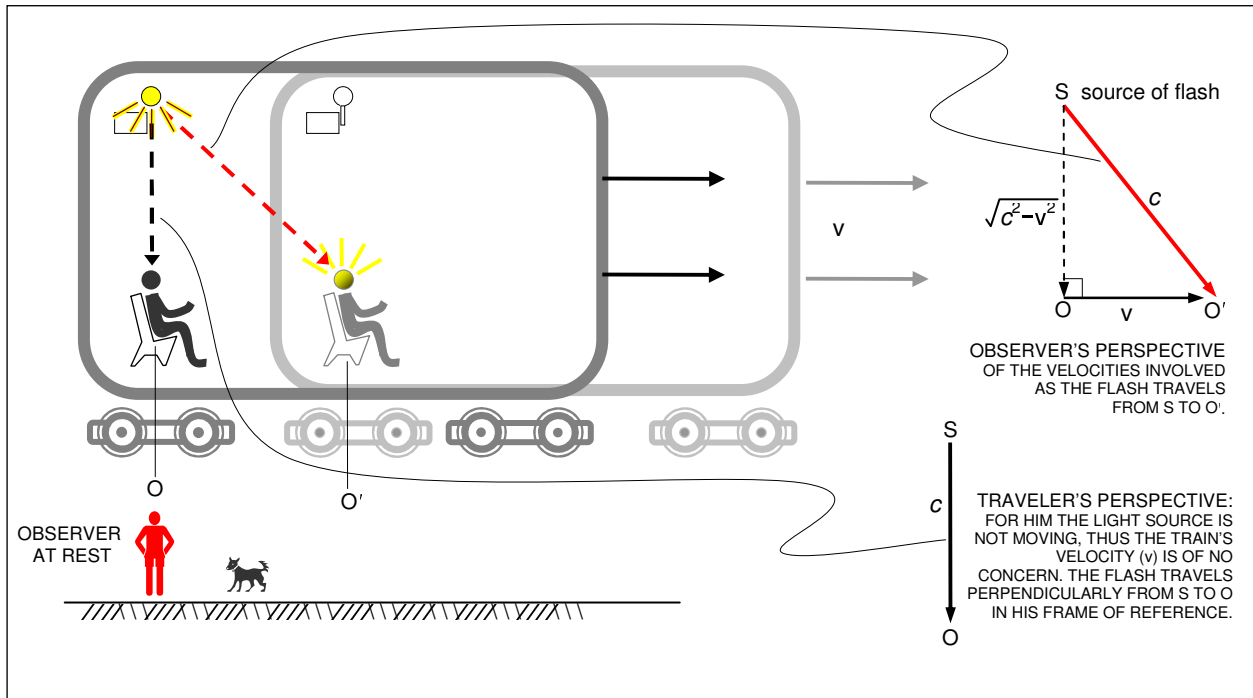
$$\Delta t_{\text{TRAVELER}} = \sqrt{1 - (v/c)^2} \Delta t_{\text{OBSERVER}} \tag{4}$$

Using the binomial theorem the equation may be expressed as.

$$\Delta t_T \cong \Delta t_O (1 - \frac{1}{2}(v/c)^2)$$

$$\Delta t_T \cong \Delta t_O - \frac{1}{2}\Delta t_O(v/c)^2$$

Thus, one tick on the Traveler's clock is equivalent to one tick on the Observer's clock less  $\frac{1}{2}\Delta t_O(v/c)^2$ . It means that the Traveler has lost  $\frac{1}{2}\Delta t_O(v/c)^2$  seconds by comparison with the stationary clock. It may be best to think of it this way: While Observer's clock makes a full tick, the



**Fig. 1.** The path of light joining two events (the camera flash and the subsequent illumination of subject) are described differently by two observers when one is moving, with significant speed, relative to the other. Although the Traveler and the Observer both agree on a fixed speed of light ( $c$ ), **they do not agree on the path length.** The bystander clearly 'sees' a longer lightpath (dashed red arrow) and analyses the observations as in the vector triangle above, right.

Traveler's clock makes a fractional tick.

It is a fundamentally important equation, and as stated at the outset, surprisingly easy to derive. What is truly amazing is that the derivation is based on a theorem of the geometry of a right-angled triangle —on a theorem which may be well over 3500 years old.

## 2 EQUATION DEVELOPMENT AND COMPARISON WITH CLASSICAL FORMULA

*The concept of absolute space incorporates the notion that rest and motion are defined with respect to it. — Henning Genz<sup>9</sup>*

**The fundamental difference between ESR and DSSU relativity.** Einstein's relativity uses only the relative difference in motion (recall, by his own postulate absolute inertial motion does not exist) while DSSU relativity *insists* on the use of the difference between absolute motions. In the context of ESR, both Observer and Traveler may be in motion (inertial motion) but only the difference is important. It means, in practical terms, that the Observer's own frame, moving or not, is automatically designated as the rest frame from which  $v$  is measured. However, in the DSSU the intrinsic motions of both Observer and Traveler must be used.<sup>10</sup>

Thus when using equation (4) we need to be specific about the speed. The Observer's speed will be subscripted with 'a' for aether and also a letter (or number) for identification. In those instances when we are dealing with simple relative speed, the symbol  $v$ , by itself, will be

used.

Equation (4) is the *classical relativity-of-time expression*. But we are interested not so much in relative time as in intrinsic time. If we specify that the Observer's clock is *at rest* with respect to the **absolute rest** frame (aether-space) and the Traveler's clock is moving with speed  $v_a$  **through** aether-space, then we can rewrite (4) as:

$$\Delta t_{\text{MOVING CLOCK}} = \sqrt{1 - (v_a/c)^2} \Delta t_{\text{ABS REST CLOCK}}, \quad (5)$$

and thereby define intrinsic time intervals for any moving clock. *Intrinsic time* means that the rate of the clock's ticks (or events) depends solely on the physical speed through aether-space in which the clock is moving.

The "absolute rest clock" may be thought of as a hypothetical timekeeping device floating in deep space. Technically speaking its state of motion is described as *comoving freefall*.

Let us apply the definition to **any two moving clocks**, so that:

$$\Delta t_1 = \sqrt{1 - (v_{a1}/c)^2} \Delta t_{\text{ABS REST}},$$

$$\Delta t_2 = \sqrt{1 - (v_{a2}/c)^2} \Delta t_{\text{ABS REST}}.$$

Clock 1 and clock 2 may be related by simple division to obtain the DSSU intrinsic-time equation:

	DSSU RELATIVITY All velocities are with respect to aether.	CLASSICAL EINSTEIN RELATIVITY All velocities are relative to observer.
Basic Equation:	$\Delta t_{\text{MOVING CLOCK}} = \sqrt{1 - (v/c)^2} \Delta t_{\text{ABS.REST}} \quad (5)$	$\Delta t_{\text{MOVING CLOCK}} = \sqrt{1 - (v/c)^2} \Delta t_{\text{OBSERVER}} \quad (8)$
Time interval recorded on clock 1:	$\Delta t_1 = (1 - (v_1/c)^2)^{1/2} \Delta t_{\text{ABS.REST}}$	$\Delta t_1 = (1 - (v_1/c)^2)^{1/2} \Delta t_{\text{OBSERVER}}$
Time interval recorded on clock 2:	$\Delta t_2 = (1 - (v_2/c)^2)^{1/2} \Delta t_{\text{ABS.REST}}$	$\Delta t_2 = (1 - (v_2/c)^2)^{1/2} \Delta t_{\text{OBSERVER}}$
Ratio of the two intervals:	$\frac{\Delta t_1}{\Delta t_2} = \frac{\sqrt{1 - (v_1/c)^2} \Delta t_{\text{ABS.REST}}}{\sqrt{1 - (v_2/c)^2} \Delta t_{\text{ABS.REST}}}$	$\frac{\Delta t_1}{\Delta t_2} = \frac{\sqrt{1 - (v_1/c)^2} \Delta t_{\text{OBSERVER}}}{\sqrt{1 - (v_2/c)^2} \Delta t_{\text{OBSERVER}}}$
The derived expression relating ANY TWO CLOCKS:	$\Delta t_1 = \frac{\sqrt{1 - (v_1/c)^2}}{\sqrt{1 - (v_2/c)^2}} \Delta t_2 \quad (6)$	$\Delta t_1 = \frac{\sqrt{1 - (v_1/c)^2}}{\sqrt{1 - (v_2/c)^2}} \Delta t_2$
Time Equations:	We give the clocks useful names. $\Delta t_{\text{TRAVELER}} = \frac{\sqrt{1 - (v_T/c)^2}}{\sqrt{1 - (v_O/c)^2}} \Delta t_{\text{OBSERVER}} \quad (7)$	Designating $t_2$ as the new Observer's clock requires $v_2 = 0$ resulting in: $\Delta t_{\text{TRAVELER}} = \sqrt{1 - (v/c)^2} \Delta t_{\text{OBSERVER}} \quad (8)$
Speed qualifier:	The speeds $v_T$ and $v_O$ are the magnitudes of velocities measured with respect to aether-space.	$v$ is simply the magnitude of the apparent velocity of the Traveler.

$$\Delta t_1 = \frac{\sqrt{1-(v_{a1}/c)^2}}{\sqrt{1-(v_{a2}/c)^2}} \Delta t_2 \quad (6)$$

And for convenience we could give the clocks the useful names we have been using:

$$\Delta t_{\text{TRAVELER}} = \frac{\sqrt{1-(v_{aT}/c)^2}}{\sqrt{1-(v_{aO}/c)^2}} \Delta t_{\text{OBSERVER}} \quad (7)$$

Again, the speed of each clock *with respect to aether* must be used.

The summary box above shows how, starting with the basic equation involving a moving clock and a reference clock, the DSSU intrinsic-time equation is obtained. Alongside each step I have shown the comparable one in Einstein's theory.

Let us assume, in the scenario of Section 1 above, that the Observer and his frame of reference are *at rest* in the absolute sense. Then when the DSSU time-equation (7) is applied  $v_{aO}$  will, of course, be zero and  $v_{aT}$  will equal the relative speed  $v$ ; and the equation simplifies becoming indistinguishable from the ESR eqn (8). The two theories predict the same time dilation. However, they agree **only** for the special case when the Observer has NO intrinsic motion—the observer is at rest with respect to the local aether-space. More commonly the DSSU and ESR equations will disagree, sometimes substantially, as the following thought experiment demonstrates.

### 3 SPACE TRAVEL AND APPARENT TIME-DILATION VERSUS REAL TIME-DILATION

Einstein's historic 1905 paper on special relativity contains the axiom that two observers, each of whom appears to the other to be moving with a constant speed in a straight line, cannot tell which of them is moving.<sup>11</sup> Einstein based this axiom on the assumption that aether (or local absolute space) does not exist.

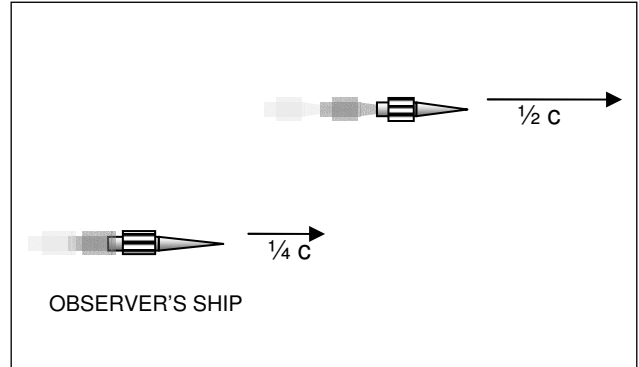
The comparable uniform-motion postulate in DSSU theory states that: Relative to aether-space, intrinsic motion can be measured; consequently there exists a preferred local frame of reference.

Since absolute motion does not exist in ESR, then neither does absolute time dilation. And if absolute time dilation does not exist then what ESR measures must be assumed to be **apparent time dilation**.

DSSU theory acknowledges the existence and detectability of absolute motion. And absolute motion implies **real time dilation**.

To test the two theories we launch a hypothetical space journey. We are the Observers aboard a starship that has successfully escaped the gravitational well of the solar

system. Gradually a steady cruising speed of 1/4 of the speed of light is attained. We are now in deep space far from any gravitational interference and ready to take measurements. In less than the blink of an eye a second starship races past us at 1/2 lightspeed (heading in the same direction, as shown in Fig. 2). Doppler measurements of the rapidly receding tail-lights confirm the two ships are separating with a speed of  $(\frac{1}{2}c - \frac{1}{4}c =) \frac{1}{4}c$ . Also Doppler readings on the Sun verify our own speed to be  $\frac{1}{4}c$ . We are now ready to apply the time relativity equations.



**Fig. 2.** *Inertial space-travel scenario analyzed in the text.* When the two starship crews compare clocks, DSSU theory demands that both speeds be used in the time relationship calculation; ESR requires only one speed—their relative speed.

The DSSU eqn. (7), with  $v_{aT} = 0.5c$  and  $v_{aO} = 0.25c$  gives,

$$\Delta t_{\text{TRAVELER}} = \frac{\sqrt{1-(0.5/c)^2}}{\sqrt{1-(0.25/c)^2}} \Delta t_{\text{OBSERVER}}$$

$$\Delta t_{\text{TRAVELER}} = 0.894 \Delta t_{\text{OBSERVER}} \quad (9)$$

We note that the Traveler's time is a fraction of our own time. It makes perfect sense, they're moving faster so their clock runs slower. Furthermore if the Traveler wants to determine our ship's passage of time it would be very easy to do. The Traveler (knowing he is on the faster ship) can similarly measure the speeds and calculate,

$$\Delta t_{\text{SLOWSHIP}} = \frac{\sqrt{1-(0.25/c)^2}}{\sqrt{1-(0.5/c)^2}} \Delta t_{\text{FASTSHIP}}$$

$$\Delta t_{\text{SLOW SHIP}} = 1.12 \Delta t_{\text{FAST SHIP}} \quad .$$

Significantly, the Traveler is able to find and report that more time passes on our clock than on his own. No disagreement. **Both Traveler and Observer are able to agree on the reality of the situation.** (Here is one way to physically compare the times: Clocks are synchronized at

instant of passing, then later compared at some common destination.)

Now when *classical relativity* is applied in this experiment, **only** the relative speed between the two ships is considered to be important. The ships approach then separate with speed  $v = 1/4 c$ . The classical relativity eqn. (8) predicts:

$$\Delta t_{\text{TRAVELER}} = \sqrt{1 - (0.25 c/c)^2} \Delta t_{\text{OBSERVER}}$$

$$\Delta t_{\text{TRAVELER}} = 0.968 \Delta t_{\text{OBSERVER}} . \quad (10)$$

Once again the Traveler's time is a fraction of our own time —the Traveler's clock runs slower. But the predicted value in (10) is considerably at odds with DSSU theory in (9). ESR *understates* the time difference (the time dilation). What is even more dramatic is that those on the faster ship (who perform the symmetrically identical calculation) predict that the slower ship's clock runs slower. This is contrary to reality! The reality is that the slower the motion, the faster the clock ticks. Clearly ESR can only provide information on the *apparent time dilation*.

On the basis of this thought experiment, and the inconsistencies and paradoxes that others have exposed over the years, one must conclude that ESR is, in some way, incomplete. At the least level of criticism, ESR is an unfinished theory.

As stated earlier, ESR agrees with DSSU reality only in the special case when the observer is at rest —where “at rest” is defined by DSSU theory. It would seem that DSSU is the broader theory that encompasses ESR. It makes perfect sense: relative motion can never encompass absolute motion BUT absolute motion can always be described in relative terms. An absolute motion equation can always be converted to a relative motion equation (not *vice versa*). This idea will be expanded in section 5.

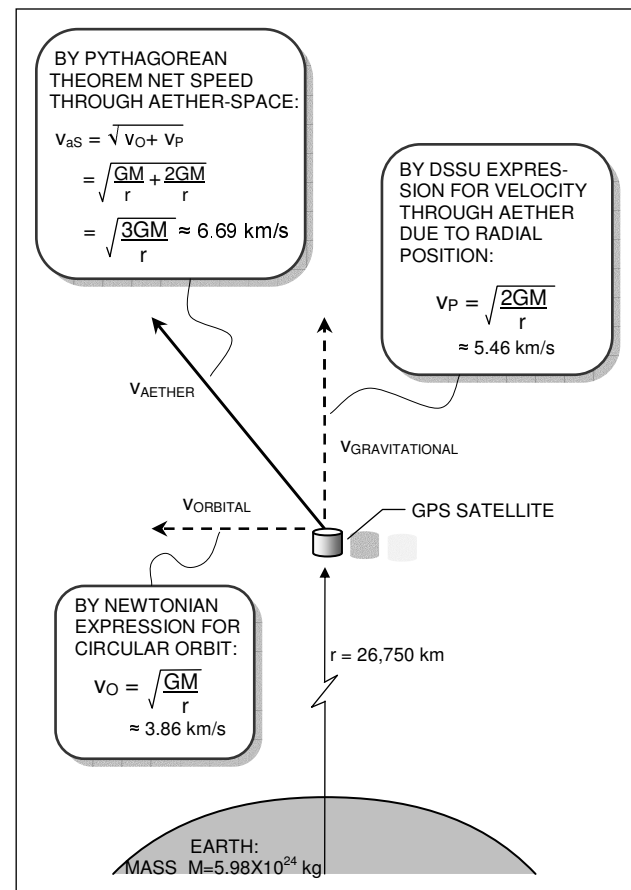
#### 4 EARTH CLOCK AND ORBITING CLOCK COMPARISON

Let us apply the DSSU intrinsic-motion equation to a gravitational-aether situation. We will consider the intrinsic time of clocks subjected to aether-flow while in orbit as compared to the intrinsic time of a clock subjected aether-flow while stationary on the Earth's surface. (We will be considering only the aether flow of a pure gravitational situation.)

In this ‘experiment’ we compare the beacon clocks of a fully functional navigation system operating 24 hours a day, every day of the year, and find that they agree with the DSSU equation to an astounding degree of accuracy.

The navigation system is known as the Global Positioning System (GPS) —one of the world's great modern marvels. Primarily meant to serve the United States military, the GPS was developed and tested in the

1970's. During the following two decades the system evolved and its applications expanded. The GPS, by offering unprecedented position as well as chronometer accuracy, has revolutionized the transportation industry and greatly benefited field researchers involved in biology, botany, ecology, geology, and natural resources exploration, among others. The operation of the system involves a constellation of 24 Earth orbiting satellites, each transmitting coded signals. The signals are decoded by ground receivers, and used in a process called *trilateration*. The purpose of the system, of course, is to allow users with a GPS receiver to determine their location on the Earth, including altitude, latitude, longitude, and to be informed of the precise *universal coordinated time* maintained by a reference atomic clock at the U.S. Naval Observatory in Bethesda, Maryland. If the user is in a moving land vehicle, aircraft, or vessel the coded signals also provide speed and bearing.<sup>12</sup>



**Fig. 3.** Two motion-components of a GPS Earth orbiting satellite. Their vector addition determines the *net speed through-the-aether*,  $v_{as}$ , which as it turns out is equal to 6.6897 km/s. The overriding importance of a speed relative to aether is that this, and only this, motion determines the actual clock rate. In the text,  $v_{as}$  is used to calculate the time dilation factor which gives a measure of how much slower the satellite clock runs when compared to an ideal at-rest clock.

The System's designers tell us the functional details are complex. In the words of Chris Hillman, “the devil is in

the details.” When physicists say that something is complex, believe it. Fortunately the details of the system do not concern us. We need only focus on the system’s clocks—their moving speeds and their ticking rates.

In the following analysis one clock, the Earth surface clock, is located at the Bethesda Observatory, while the other (actually there are 24 others) is in an inclined polar orbit 26,750 km from the center of the Earth. The time intervals recorded are  $\Delta t_{\text{GROUND}}$  and  $\Delta t_{\text{SATELLITE}}$  respectively.

The first challenge is to calculate the speed of the orbiting satellite—not with respect to the Earth, but with respect to the aether. This means determining and combining the orbital motion (tangential velocity through aether) and the gravitational motion (radial velocity through aether associated with elevation) to obtain the *net speed through-the-aether* of the satellite and its on-board atomic clock(s). The calculations, using Newtonian mechanics, the DSSU aether velocity expression (per DSSU theory<sup>13</sup>), and the Pythagorean Theorem, are shown in Fig. 3.

Here again is the DSSU time relativity equation:

$$\Delta t_{\text{SATELLITE}} = \frac{\sqrt{1 - (v_{aS}/c)^2}}{\sqrt{1 - (v_{aG}/c)^2}} \Delta t_{\text{GROUND}} \quad (7)$$

Expressed in words it means:

$$\begin{array}{l} \textit{elapsed time} \\ \textit{recorded on} \\ \textit{satellite clock} \end{array} = \begin{array}{l} \textit{time} \\ \textit{dilation} \\ \textit{factors} \end{array} \times \begin{array}{l} \textit{elapsed time} \\ \textit{recorded on} \\ \textit{ground clock} \end{array}$$

Since the  $(v_a/c)^2$  terms have values considerable less than unity, the binomial theorem can be applied, thereby simplifying the equation to:

$$\Delta t_S \approx \frac{1 - \frac{1}{2}(v_{aS}/c)^2}{1 - \frac{1}{2}(v_{aG}/c)^2} \Delta t_G \quad (7a)$$

Two of the values are ready to be plugged in. The speed of light  $c = 2.9979 \times 10^5$  km/s. The speed of the satellite  $v_{aS}$  is equal to 6.6897 km/s. Next we need  $v_{aG}$  the speed of the ground clock. In conventional relativity this would mean its speed as it (and the city of Bethesda) spins with the Earth on a daily schedule. However, according to DSSU theory the direction is vertical to the Earth’s surface. Of course, the clock does not move away from the Earth’s surface; it is the aether that is flowing vertically downward and streaming through the clock. The ‘ground’ clock has a speed that is constant and is determined by its radial position from the Earth’s center of mass. The speed is found by substituting values for  $G$  ( $6.673 \times 10^{-11}$  Nm<sup>2</sup>/kg<sup>2</sup>), Earth mass  $M$  ( $5.98 \times 10^{24}$  kg), and Earth radius

$R$  ( $6.38 \times 10^6$  m) into the DSSU aether-speed equation.<sup>14</sup> The calculation gives the surface clock *speed through-the-aether* as,

$$v_{aG} = \sqrt{2GM/R} = \sqrt{125.09 \times 10^6} = 11.184 \text{ km/s.}$$

The three speeds are substituted into eqn. (7a) to give the predicted elapsed time that the satellite clock should record:

$$\begin{aligned} \Delta t_S &\approx \frac{1 - \frac{1}{2}(6.6897 / 2.9979 \times 10^5)^2}{1 - \frac{1}{2}(11.184 / 2.9979 \times 10^5)^2} \Delta t_G \\ &= \frac{1 - (0.248,97 \times 10^{-9})}{1 - (0.695,91 \times 10^{-9})} \Delta t_G \\ &= 1.000,000,000,446,940 \Delta t_G \\ &= [1 + (446.94 \times 10^{-12})] \Delta t_G \end{aligned}$$

We could also have done the calculation using eqn. (5) for each clock separately and formed an expression<sup>15</sup> of the difference. Conceptually it might be easier. It makes the same prediction and serves as a check:

$$\text{Difference in elapsed time} = \left[ \begin{array}{l} \text{satellite clock} \\ \text{(the faster clock)} \end{array} - \begin{array}{l} \text{surface clock} \\ \text{(the slower clock)} \end{array} \right] \times \left[ \begin{array}{l} \text{rest clock} \\ \text{elapsed time} \end{array} \right]$$

When speeds are much less than  $c$  the expression simplifies to:

$$\Delta t_S - \Delta t_G \approx \frac{v_{aG}^2 - v_{aS}^2}{c^2} \Delta t_{\text{ABS REST}} \quad (11)$$

$$\begin{aligned} &= \frac{(11.184 \text{ km/s})^2 - (6.6897 \text{ km/s})^2}{2 \times (2.9979 \times 10^5 \text{ km/s})^2} \times \Delta t_{\text{ABS.REST}} \\ &= 446.90 \times 10^{-12} \times \Delta t_{\text{ABS.REST}} \end{aligned}$$

And this is the *elapsed-time difference* that the DSSU aether model predicts: The satellite clock should run faster than the Bethesda clock—faster by 446.90 clock ticks per trillion. And what was the *actual* clock difference?

*When the first atomic clock was sent into orbit in June 1977 [aboard a GPS test satellite] there were some who doubted that relativistic effects were real. A frequency synthesizer was built into the satellite clock system so that after launch, if in fact the rate of the clock in its final orbit was that predicted by general relativity, then the synthesizer could be turned on bringing the clock to the coordinate rate necessary for operation. The atomic clock was first operated for about 20 days to measure the clock rate before turning on the synthesizer. The frequency measured during that interval was +442.5 in 10<sup>12</sup> faster than the clocks on the ground; if left uncorrected this would have resulted in timing errors of about 38,000 nanoseconds per day. —Neil Ashby<sup>16</sup>*

Now the next question is, what was the actual correction incorporated into the synthesizer to synchronize the faster clocks with the Earth-base clock? The GPS system will not and cannot work unless all the clocks are synchronized (with each other and with *universal coordinated time, UTC*) and periodically readjusted to maintain synchronicity. Chris Hillman explains:

*The major way in which the ... discrepancy due to relativistic effects is accounted for is by building into the GPS software, used to keep the satellite clocks in synch with each other and to synchronize GPS time with UTC, an effective downward frequency shift of 446.47 parts per trillion in the orbiting atomic clocks.*<sup>17</sup>

The satellites reduce the frequency (the number of clock ticks) by 446.47 parts per trillion **before** transmitting the ‘time’ signal down to Earth. Compare this with our 446.90 parts per trillion figure —our pocket calculator approximation. Remarkable! Particularly, when one considers that there are, as Chris Hillman warns, “numerous extremely complex *Newtonian* physical issues ... also about a dozen distinct str [special relativity] and gtr [general relativity] effects which must be taken into account in the design and operation of the system.”<sup>18</sup> Also, this predicted value matches, within a remarkable 0.1% accuracy, the actual experimental measured time difference.<sup>19</sup> The value is extraordinarily close in spite of the numerous real and potential, fixed and transient, sources of errors. “And of course, orbital injection is never perfect,” as Hillman points out, “and none of the GPS satellites are in perfect circular orbits, or aligned precisely as designed.”

Significantly, we used nothing more than the DSSU intrinsic-time expression applied to the respective clock motions which are referenced solely to aether-space. Note that we did *not* treat the ground based clock as stationary. In general, the relative velocity between two clocks is, in

itself, an incomplete concept. ***Each clock’s speed relative to aether must be considered.***

We conclude that the DSSU aether theory in general and the DSSU time-relativity equation in particular are evidentially supported by the ‘slow’ Earth clock and the ‘fast’ orbital clocks of the Global Positioning System.

### 5 DSSU RELATIVITY OF TIME AS AN ENCOMPASSING THEORY

*The vindication [of a predictive theory] by experiment is rare but exciting and is the signal that we really have a very good theory in our hands.* —Heinz Pagels<sup>20</sup>

DSSU theory includes a *time-relativity postulate*. It simply states that **time**, as measured by any kind of mechanical- biological- or quantum- clock, runs fastest when the clock’s absolute motion is zero. And **time**, similarly measured, slows down as a consequence of increasing speed through aether-space.

The fact is that time dilates. Time slows for the ‘traveler’ in relation to the intrinsic motion through aether-space. The traveler’s *time* is proportional to absolute-rest *time* by the factor  $(1 - (v_a/c)^2)^{1/2}$ , where  $v_a$  is the speed of the traveler with respect to the traveler’s local aether-space. Acceleration in itself is irrelevant. Acceleration is *not* the determining factor or characteristic in time dilation —the speed *through* aether is the sole criterion.

DSSU theory, as a model of the universe, is highly effective —not just in its ability to explain the relativity of time (the subject of this paper) but also in explaining the many other phenomena and observations to which it has been applied. The theory’s success is rooted in the definition and properties of *space*.

The success of DSSU theory is not simply that it incorporates a kind of absolute space —since absolute

Three world Views of Space & Time		
NEWTON (18 <sup>TH</sup> & 19 <sup>TH</sup> CENTURIES)	EINSTEIN (20 <sup>TH</sup> CENTURY)	DSSU (21 <sup>ST</sup> CENTURY)
Absolute space & time Space is static	NO absolute spacetime (Spacetime is mathematically curved)	Quasi-Absolute aether-space. Aether-space is dynamic. Time without motion has no meaning.
Universal space & time	NO universal frame-of-reference (No preferred frame-of-reference)	No universal frame-of-reference. Aether-space is local preferred frame-of-reference. Cosmic-scale cell structure serves as a Euclidean frame-of-reference on largest scale.
Absolute motion: yes	Absolute motion: no	Absolute motion: yes
Galilean rules of relativity	ESR rules of relativity (but incomplete)	DSSU rules of relativity
Space is a continuum	Space is a continuum	Space is quantized

space was the backdrop of Newton’s system and it actually contributed to the system’s failure.

Success is not simply due to the incorporation of *special relativity* —since ESR is based on the relativity of time and motion but is somehow incomplete and plagued by contradictions.

DSSU *space* is defined as being both physically quantized and physically dynamic (it expands and contracts).

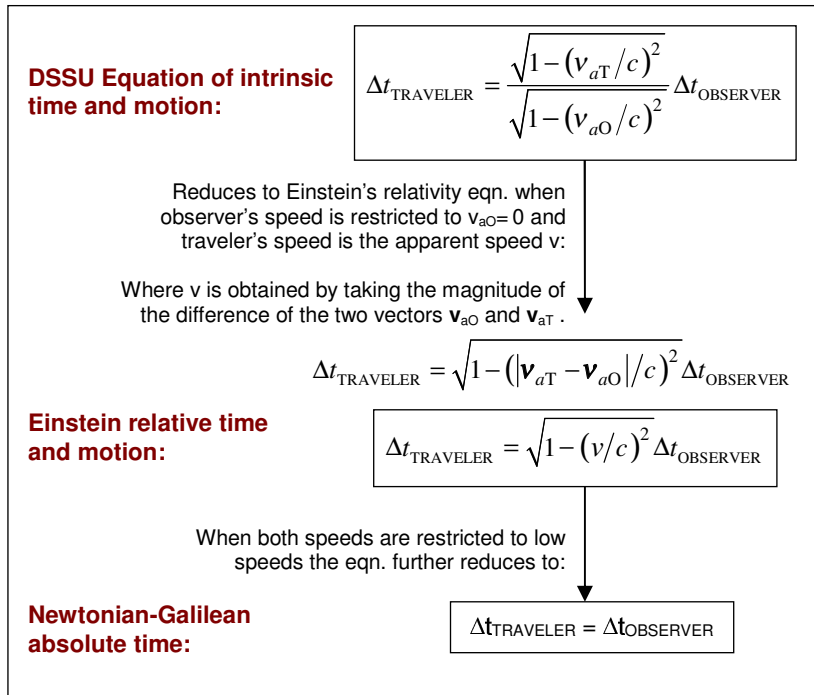
DSSU *space* is quantized and therefore noncontinuous. Discreteness, no matter how small and simple the units may be, is essential. Any successful cosmology theory must postulate discrete entities for the composition of *space*. Neither Newton nor Einstein recognized this. Newton’s space is a continuum —a continuum of emptiness. Einstein’s space is a continuum<sup>21</sup> —a continuum of geometry. The Newtonian and Einsteinian universes lacked the essential entities that could cause motion-induced intrinsic-time changes.

Because of the dynamic nature of aether-space, there can be no universal frame-of-reference —in harmony with Einstein’s view. However, on the largest scale of the Universe, DSSU theory presents a spatial universal frame-of-reference in agreement with Newton’s view. More properly called the *cosmic frame-of-reference*, it does not refer to space itself but rather to the DSSU’s cosmic-scale cellular structure —a quasi-static pattern sustained by dynamic aether-space.

The chart above organizes the relevant concepts of space and time by placing them into historical perspective. It summarizes the essential similarities and differences of three world views of space and time.

... [O]ne reaches the conclusion that the old picture according to which space and time are continuous must be abandoned. On the Planck scale, space appears to be composed of fundamental discrete units. —Lee Smolin<sup>22</sup>

For a new theory to be valid it must encompass those related theories that have been proven to work in their particular domain of application. In other words DSSU theory, in addition to breaking new ground, must also explain what ESR already explains and ESR in turn must explain what Newton’s theory explains. The DSSU equation (having the widest application) under restricted conditions must reduce to the ESR form which also under further restricted conditions must reduce to the Newtonian-Galilean form. The procedure is detailed in the flowchart above.



Let me clarify an important point. In the DSSU equation the directions of motion do not matter at all —only their intrinsic magnitudes are important. However, in the procedure of reducing the DSSU equation to the ESR equation, the directions of motion *are* important; since they, as vectors, enter into the calculation of the magnitude of the relative speed. The Einstein equation then processes this relative speed (to obtain relative time).

To illustrate the fact that intrinsic time (DSSU) can be totally different from apparent time (ESR) consider a situation in which Traveler and Observer are both speeding at 1/4 lightspeed in opposite directions. There would then be no *intrinsic time* difference between the clocks. But the *apparent time* difference —a consequence of a relative speed of  $0.25c + 0.25c$ — would be substantial.

The three theories correspond only where their realms of validity overlap.

## 6 DSSU RELATIVITY POSTULATES

*Exactly how relativity is to be modified is a subject of hot debate at the moment. Some people argue that special relativity theory must be modified to account for the [discrete] structure of spacetime ...* —Lee Smolin<sup>23</sup>

DSSU relativity has a postulate for each of motion, time, and light.

(1) **The motion relativity postulate.** Relative to aether-space, absolute motion can be measured. There exists a preferred frame of reference —the aether-space medium. Absolute (or intrinsic) rest means an object is experiencing comoving-freefall. The laws of physics are the same for all observers in all inertial frames.

(2) **The time relativity postulate.** Clocks run fastest when intrinsic motion is zero. Time slows in relation to speed through aether.

(3) **The speed of light postulate.** The speed of light is constant through aether-space; and is independent of the motion of the source. Aether serves as the conductor of electromagnetic waves.

Needless to say, the measured speed of light will always be constant no matter what the relative velocity of the source and the observer may be. In agreement with Einstein's hypothesis, all observers regardless of motion will always measure the same speed of light. But as we have seen, the path length of a light beam may vary among different inertial observers. Everyone agrees on the speed of light.

The speed of light  $c$  in a vacuum —that is, through aether-space— is an ultimate speed that cannot be exceeded by any entity carrying either energy or information. The explicit understanding is that aether serves as the medium for the propagation of electromagnetic waves. And it is a property of aether that determines their speed limit. Furthermore this explains why the motion of the light source does not change the wave speed (but does change the wave length).

The several deviations from Einstein's relativity —such as absolute inertial motion, preferred frame, light-propagation medium— are the direct consequences of introducing aether and defining space as an aether quantization. Space is now a sea of discrete entities.

The *time postulate* seems like an almost negligible change (or addition) yet it leads to some truly startling consequences; it embodies the most profound difference when compared to conventional relativity. One of the gems of DSSU time relativity is that *gravitational time dilation* is automatically included! Time-rate calculations do not, in precise terms, depend on acceleration —neither the actual acceleration of the observer nor the equivalent acceleration experienced on the surface of a planet— but

### ∞ DSSU RELATIVITY ∞

- (1) **The motion relativity postulate.** Relative to aether-space, intrinsic motion can be measured. There exists a preferred frame of reference —the comoving-freefall frame of reference.
- (2) **The time relativity postulate.** Clocks run fastest when intrinsic motion is zero. Time slows in relation to speed through aether.
- (3) **The speed of light postulate.** The speed of light is constant through aether-space; and is independent of the motion of the source. Aether serves as the conductor of electromagnetic waves.

### EINSTEIN 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 unresolved paradox.
- (3) The speed of light is constant. Light is always propagated in a vacuum with a velocity independent of the motion of the source.

### THE DSSU FUNDAMENTAL DIFFERENCE

*Space is a quantized composition of fundamental entities. This 'aether-space' defines a preferred, detectable, frame of reference; and serves as the conducting medium for light.*

rather depend solely on the *speed with which aether flows past the observer or clock* (or stated more briefly, *speed through aether*). Furthermore, this pillar postulate has been used to resolve a major paradox in *Einstein's special relativity*.

**I**n conclusion, the fundamental difference between DSSU and ESR relativity is that the one recognizes the fact of absolute motion while the other denies it. The practical difference is that the former includes the difference between intrinsic motions (speeds with respect to local aether-space) while the latter uses only the relative difference in motion. ESR presents us with only a partial depiction; DSSU relativity encompasses a complete picture of the relativity of time. □

**NOTES AND REFERENCES**

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- <sup>2</sup> Ranzan, C. 2008. *Theoretical Foundation and Pillars of the Dynamic Steady State Universe*, Published on Cellular Universe Website ([www.CellularUniverse.org/Th4Postulates.PDF](http://www.CellularUniverse.org/Th4Postulates.PDF))
- <sup>3</sup> Ranzan, C. 2008. *The History of the Aether Theory*, Published on Cellular Universe Website ([www.CellularUniverse.org/AA3AetherHistory.htm](http://www.CellularUniverse.org/AA3AetherHistory.htm)) Section 4 *Chronology of the Development of the Aether Theory*
- <sup>4</sup> Newton, as in Genz, H. 1994, *Nothingness, The Science of Empty Space* (1999 Perseus Books) p158
- <sup>5</sup> Genz, H. *Nothingness, The Science of Empty Space* p177
- <sup>6</sup> The physical *space* of the DSSU is dynamic by flowing, expanding, and contracting. The non-physical *space* of general relativity is dynamic through its curvature —by become distorted.
- <sup>7</sup> Michelson, Albert A. and Morley, Edward W. 1887. *On the Relative Motion of the Earth and the Lumniferous Ether* (The American Journal of Science, Vol 34 No. 203)
- <sup>8</sup> Cahill, Reginald T. *The Michelson and Morley 1887 Experiment and the Discovery of Absolute Motion* (Progress in Physics, October, 2005 Vol. 3)
- <sup>9</sup> Genz, H. *Nothingness, The Science of Empty Space* p148
- <sup>10</sup> Absolute motion can be determined by means of a Michelson-Morley interferometer operating in gas-mode as described by Professor Reginald Cahill in the 2002 paper *Absolute Motion and Quantum Gravity*. [[www.scieng.flinders.edu.au/cpes/people/cahill\\_r/processphysics.html](http://www.scieng.flinders.edu.au/cpes/people/cahill_r/processphysics.html)]
- <sup>11</sup> Einstein, A. 1952, *Relativity, The Special and the General Theory* (1961 Random House, NY) also Bronowski, J. *The Clock Paradox*, Scientific American Feb 1963 p134.
- <sup>12</sup> Chris Hillman and John Baez, 2001 Jan, Website: <http://math.ucr.edu/home/baez/RelWWW/wrong.html>
- <sup>13</sup> Ranzan, C. 2008. *Space Flow Equations and Expansion-Contraction Rates* Published on Cellular Universe Website ([www.CellularUniverse.org/Th5AetherEqns.PDF](http://www.CellularUniverse.org/Th5AetherEqns.PDF))
- <sup>14</sup> Ibid.
- <sup>15</sup> **Time difference between any two clocks 1 and 2**, having velocities  $v_1$  and  $v_2$  with respect to aether:
- Using eq. (5) we state  $\Delta t_1 = (1 - (v_1/c)^2)^{1/2} \times \Delta t_{\text{ABS.REST}}$  and  $\Delta t_2 = (1 - (v_2/c)^2)^{1/2} \times \Delta t_{\text{ABS.REST}}$ .  
Let  $t_1$  be the faster clock (i.e., experiencing slower  $v$ ); and  $t_2$  the slower clock (i.e., experiencing faster  $v$ ). Then:
- $$\Delta t_1 - \Delta t_2 = [(1 - (v_1/c)^2)^{1/2} - (1 - (v_2/c)^2)^{1/2}] \times \Delta t_{\text{ABS.REST}}$$
- For speeds  $\ll c$  use the approximation given by the binomial theorem,  $(1 - (v/c)^2)^{1/2} \approx 1 - \frac{1}{2}(v/c)^2$ . Thus:
- $$\begin{aligned} \Delta t_1 - \Delta t_2 &\approx [(1 - \frac{1}{2}(v_1/c)^2) - (1 - \frac{1}{2}(v_2/c)^2)] \times \Delta t_{\text{ABS.REST}} \\ &\approx \frac{v_2^2 - v_1^2}{2c^2} \Delta t_{\text{ABS.REST}} \end{aligned} \quad (11)$$
- <sup>16</sup> Ashby, N. as found on Website: <http://math.ucr.edu/home/baez/RelWWW/wrong.html>
- <sup>17</sup> Hillman, C. 2001 Jan, Website: Ibid.
- <sup>18</sup> Ibid.
- <sup>19</sup> We can go one step further in improving the accuracy of the predicted difference between the Earth versus orbital clocks. In DSSU theory we know that the effect of ‘frame dragging’ diminishes the velocity of the aether-flow that is actually impacting the Earth’s surface. The *frame dragging* effect is maximum at the equator, decreases inversely with latitude, and is nonexistent at the poles (of rotation). This means that at the geographical latitude of Bethesda, Maryland, the actual aether flow which the ‘ground clock’ experiences is slightly less than the nominal speed of 11.184 km/s. It is easy enough to calculate that the ground clock’s proper speed through the gravitational aether is 11.1782 km/s.  
And so, taking frame dragging into account, the predicted time difference (using eq. (7a) or (11)) will be **446.18 parts per trillion**.
- <sup>20</sup> Pagels, H. 1988, *The Dreams of Reason* (Bantam Books) p171
- <sup>21</sup> Einstein, A. 1952, *Relativity, The Special and the General Theory* p62, 104, 170
- <sup>22</sup> Smolin, L. 2001, *Three Roads to Quantum Gravity* (Basic Books) p169
- <sup>23</sup> Ibid., p217