More Insights into Pion Analogies:
Lord Kelvin's Ether Density; and 'SRT' Limitations

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To hopefully add more insight into topics previously addressed by the author and others, he now presents the following: "One more way of constructing the 'pion-to-electron' mass ratio"; "Lord Kelvin's old ether density estimate and why it is still relevant"; and "Questioning Einstein's inference -- that one coordinate system can NOT be deemed closer to 'absolute rest' than another, when one passes by the other at high speed."

1. An Alternate Way of Constructing the Pion-to-Electron Mass Ratio, 270.10 / 1

Largest Sphere (2702/1) that when averaged with 'Kaon sphere' (shown in previous papers: ref. 970/1) yields a Proton-to-electron mass ratio estimate of 1836.00/1

First method of Pion construction; uses an electron Outside the Pion

(Ref. same size electron used in all sphere constructions)

PION

PION

Alternate method of Pion construction; uses electrons all Inside of the Pion substructure.

hexagonal pattern substructure

modified SIDE VIEW of sub-structure:

Optional '3-electron triangular pattern' is shown at top and bottom of hexagonal pattern which is compatible with a spherical covering
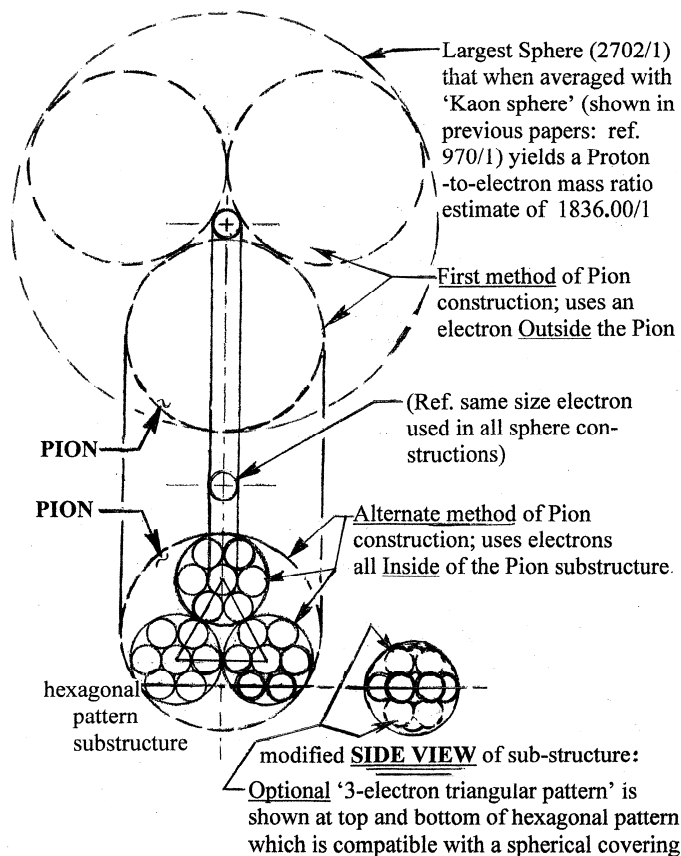
Fig. 1. Two ways to create avg. Pion/electron mass ratio 270.10/1

The lower half of Fig. 1 shows an alternative way of constructing the average 'Pion-to-electron' mass ratio, (i.e., as contrasted with the author's previous method shown in the upper half of the Fig. 1) [1]. The new way uses electrons entirely *inside* of the 1 pion constructed. (By contrast, the previous method created 3 pions, by requiring that they be equal, touch each other, and also touch one centered electron lying entirely *outside* of each of those 3 pions).

Reminder: we first examined *volumetric* ratios existing in sphere patterns consisting of some different sized spheres. And when we compared those *volume* ratios with the average pion-to-electron *mass* ratio, we found near equality of those ratios.

The new pion construction utilizes three small spherical *substructures*, with each substructure having (within its own interior) 6 electrons surrounding a single electron. And thus also manifesting a 'hexagonal pattern'.

As shown in the *optional* 'modified' side view (to the right of the lower sketch); we can also imagine 3 more electrons sitting on top of that 'hexagonal electron pattern' and 3 more electrons sitting below it. Those optional electrons would also touch the same single electron that serves as the center for the hexagonal pattern. And those 3 optional upper and lower electrons would also help define and support the *spherical* housing for the 'hexagonal pattern', and help stabilize the position of that hexagonal structure.

Important: In our lower sketch, we note that the 3 *triangularly-positioned* spherical *sub*structures served as the foundation for our medium-size sphere – our pion (our 'pion analogy'). And, in our upper sketch, we note that 3 *triangularly-positioned* spherical pions (each equal to the previously mentioned medium-size sphere) serve as the foundation for our largest sphere. That exemplifies a tendency toward **'***fractal***'** structuring, a 'hierarchical structuring'; and such structuring likely plays a very important role in our universe.

Incidentally, the largest sphere in Fig. 1 serves as one of two important spheres used in our 'proton analogy', as described in previous papers [2]. As proposed there, *ether*, itself, may have structure. So let us next address one aspect of ether – its density.

2. Lord Kelvin' Estimate of Minimum Ether Density and its Possible Relevance Today

In 1854, Lord Kelvin (William Thomson) presented his method for estimating a minimum density for ether (in earth's vicinity) and made such estimate [3]. That was considered a notable accomplishment; and later both Maxwell and Tait made respectful references to it [4-5].

Lord Kelvin's actual wording was, "We may conclude that probably a cubic foot of the luminiferous medium in space traversed by the earth contains not less than $1/1560 \times 10^{17}$ of a pound of matter"… etc. (A lowest limit estimate)

Converting his old 'foot & pound' units to universally used kilogram (kg) and meter (m), his 'minimum *Ether Density* estimate' comes out to 1.027×10^{-19} kg/cu. m.
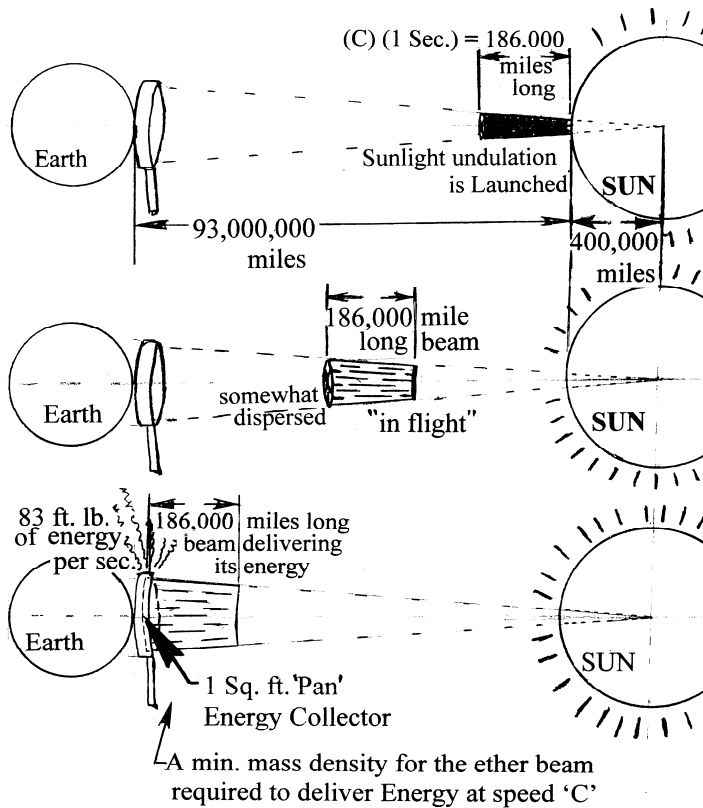
Fig. 2. One of several Ether concept in the 19th Century: the propagation of an ethereal undulation through space

If we used improved values for light's speed, etc., that estimate would still *roughly* result, using his 1854 methodology and assumptions.

Important: It is interesting, today, to compare the ratios of the following density extremes: The 'minimum *ether* density' (the *lowest* density classically supposed to occupy most of the universe) -- with modern estimates for '*nuclear* density' (the *highest* often-occurring density in our universe that is rather easily estimated) [6]. Lord Kelvin's *ether* density was 1.027x10^{-19} kg/cu. m, and today's accepted *nuclear* density is 2.3x10^{17} kg/cu. m, roughly. So the resulting ratio is 4.5x10^{-37}.

We compare that 'ratio of *densities*' to the 'ratio of **forces**' in the universe: (the weak gravitational forces to the strong nuclear forces, as found in textbooks [7].) *The forces ratio*: 10^{-38} results.

It is noteworthy that the *density ratio*, (ether/nuclear), differs by only a few magnitudes or less from the *force ratio*, (weak/strong) in our universe; not a great error, I think, considering the nearly 40 orders of magnitude contrasted!

Possible Causal Relationships: In my 1996 NPA paper [8], I proposed that some fundamental forces in the universe might be related to Bernoulli's equation for flows, and resulting pressures. And, thus, that the great *contrast* in *densities* might relate to some great *contrasts in weak vs. strong forces* in our universe. (Some NPAers have stressed the relevance of great contrasts in Bernoulli-related velocities, and for *some* cases, I would agree.)

In my paper [8], I estimated ether's density, which I realized came out only a few magnitudes greater than N. Tesla's. But I was then unaware that my estimate was close to Lord Kelvin's (although his was a minimum estimate). In view of the ratio of nature's strong-to-weak force and its closeness to the ratio of

high nuclear densities-to-low ether density (using Lord Kelvin's minimum ether density), let us further review his work.

Concepts in Lord Kelvin's day: Try to imagine a narrow slug of ether, produced by the Sun in a second -- about 186,000 mile long, heading toward earth and spreading out as it travels. (Or a wave equivalent.) And all of it hitting and heating, exactly, a one square foot surface of an energy measuring detector on earth. We can calculate that that exact amount of heat could not be delivered to the earth detector, unless that long narrow slug had a minimum ether density after fully launched. That gives the reader a very rough idea of one creative aspect of Lord Kelvin's approach. (I will later criticize some aspects of his model.)

Related Remarks about our Sun, etc. [9]: Our Sun emits 4.3x10^9 kg/sec worth of equivalent mass in the form of *radiated* energy (total 'luminosity'). Our eyes see about 40% of that spectrum, and our eyes miss about 50% that is 'infrared', and miss another 10% that is 'ultraviolet'. (Lord Kelvin knew that.) But the Sun also throws out another 1.7 x 10^9 kg/sec of *particles* (gross mass) as a '*solar wind*', beyond its gravitational 'retrieval' (*as if* protesting a too great of 'radiation' demand). That is almost half as much as the 'mass equivalent' it throws off by radiation. The Sun's surface temperature is about 5,800 Deg. K.

That Sun surface (5,800 Deg. K.) is much higher than enough to melt a tungsten filament (3,643 Deg. K.), the element with the highest melting point. And to melt tantalum (3270 Deg. K); molybdenum (2893 Deg. K); quartz (1873 Deg. K) and iron (1808 Deg. K). And to break-up a hydrogen molecule into its hydrogen atoms (about 2000 Deg. K), or to soften fused silica (1938 Deg. K).

My criticisms of Lord Kelvin's methods despite his 'good' results: I find it very difficult to decipher the thinking of some scientists who lived in a 'different age'; so I might not do him full justice. So readers are encouraged to study his original works and times. My own model of ether allows just *one* kind of ether, very uniform over almost all of our universe. But my ether has structure and different aspects, and thus causes different actions. Contrasting my ether with Lord Kelvin's, his seems much thicker near the Sun than near the earth. And he seems to assume that a certain fraction of ether is 'luminous' and the remainder '*non-luminous*' or non-energy transferring.

Optional: He seems to regard only a 'transverse' action (velocity) of light, which he considers only 1/50 th (or less) of its real travel velocity, to contribute to heating its earthly absorbing target. Thus, he seems to err, first by requiring his ether, near earth, to have 50x50 times more mass than I think wise (at that step in his calculating). He does, commendably, calculate that his (luminous) ether near the Sun's surface has 46,400 times greater energy density than near earth. So I think that his greater energy density, *near the Sun*, without applying his 50x50 'fudge factor', would be helpful for calculating a fairly accurate ether density that should be *applied to almost everywhere* in our universe.
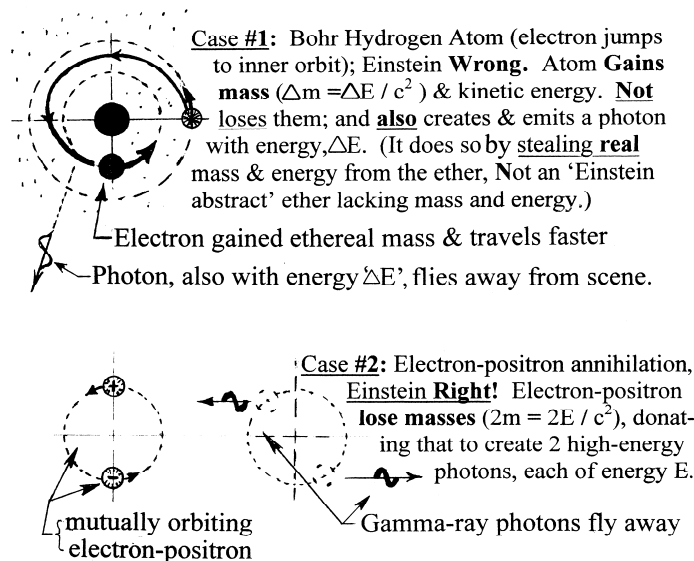
I think Lord Kelvin, by seeming to apply his famous density results (as actually estimated *close to the earth*) as rather typical of our solar system and maybe beyond -- gets a somewhat 'luckier-than-deserved' outcome! I think his emphasis on '*near-the-earth*', (instead of near the Sun) unwisely decreased his ether density estimate by 1/46,400. But his 50x50 = 2500 'fudge factor' (see previous paragraph) unwisely increased his density estimate. I think his errors somewhat cancel out and that he came out slight-

ly better (using his methods, his concept, and his emphasis) -- than I did (by my *generally using his* commendable, creative approach). My approach is based on being next to our Sun and with a few other modest, 'wise' modifications injected.

My suggestions for fixing Lord Kelvin's misconceptions: Modern photon theory helps explain light and some *pressures* and other things; but I don't think photons explain the following: *The attraction-like actions between two strong bar magnets very near each other, the attractions of gravity and of opposite charges, or even the strong tensile strength of some metals. Those 'realms' rightfully belongs to ether* and to ether flow! [10]

I think that a tungsten strip, heated to just <u>below</u> tungsten's melting point, (or a star cooler than our Sun, i.e., a 'red giant') is conceptually better for estimating ether's density (a subtle and likely <u>in</u>exact science). Here is an outline of some reasons why:

Sadly for Lord Kelvin, in 1905 Einstein drew a conclusion, [11], valid for many cases, see 'Case 2', Fig. 3, below. But, very importantly, it is *invalid* for some other cases, 'Case 1', below (some comfort for Lord Kelvin). Einstein basically concluded, "*When a body radiates energy E, its mass diminishes by E/c^2 .*"

Case #1: Bohr Hydrogen Atom (electron jumps to inner orbit); Einstein **Wrong.** Atom **Gains mass** ($\triangle m = \triangle E / c^2$) & kinetic energy. **Not** loses them; and **also** creates & emits a photon with energy, $\triangle E$. (It does so by <u>stealing</u> **real** mass & energy from the ether, **Not** an 'Einstein abstract' ether lacking mass and energy.)

Electron gained ethereal mass & travels faster

Photon, also with energy '$\triangle E$', flies away from scene.

Case #2: Electron-positron annihilation, Einstein **Right!** Electron-positron **lose masses** ($2m = 2E / c^2$), donating that to create 2 high-energy photons, each of energy E.

mutually orbiting electron-positron

Gamma-ray photons fly away

Note: In case #2, **no** mass or energy donated **by the ether**; (also generally true for fissions, most fusions, A-& H-bombs)

Fig. 3. Lord Kelvin's (improved) ether density estimating method is still *useless* for cases as in lower sketch! But generally *useful* for cases in the upper sketch (within a few orders of magnitude)

Consider a high-energy photon flux -- one gamma-ray fired after another (but allowing, for each ray, an 'unencroached-upon' imaginary box with length of each side equal to the gamma-ray's wavelength). Some nuclear reactions inside stars give off such gamma-rays. But let us just consider one of two gamma-rays emitted from the annihilation of a mutually orbiting electron–positron pair. That gamma ray's density (equivalent mass per 'boxed' volume) is a very high density, comparable to the air around us and thus dwarfing any reasonable space-ether concept, including Newton's! But to create that gamma-ray, that electron contributed *its own mass* (all of it in that example). Thus, that is a 'self-*parasitic*' contribution, since that gamma-ray's equivalent mass was *not* condensed out of ether around it! Much to his credit, Einstein treats that class of actions correctly!

But contrast that to what happens when a photon is emitted from a hydrogen atom when its electron jumps from an outer to an inner orbit! There, Einstein *errs* by missing *this*: Such *electron's mass increases* slightly, *and the newly emitted photon is also* sent away with its own equivalent mass. (A net increase for the hydrogen atom's mass, and its inertia characteristic.)

So the increased mass of the atom and emitted photon were both '*pulled out of the ether*' (or field) to do that! *NOT a 'self parasitic'* stealing of mass from its electron or proton. So that offers us a more appropriate way to estimate ether density; and it likely requires some time for scooping mass out of the thin ether. And that yields a lower 'photon density', i.e., a 'photon mass' per (previously described) box volume – since that photon's wavelength is much longer than a short gamma-ray's.

But conceptually, a tungsten strip, at close to its melting point, with its smoother surface and with its electron orbits extending only to its *attached*, neighbor atoms – offers a better model. Tungsten's extremely *high tensile strength* seems to arise from some sort of internal high-efficiency *transducer*-like system which, itself, fundamentally arises from interaction between (low-density) ether and tungsten's 'gross matter'.

My attempt to accurately picture and describe an exact mechanism will likely err with respect to details. Perhaps the greater my oversimplification, the greater my errors and distortions, but as we slowly bring tungsten up to its melting point, picture this: Nearby, crowded balls of ether, about 1-angstrom in size, spin at super-luminal velocity. Tungsten's ether cycle ("*inhale, 'then a transducer-action-with-electron-help' and exhale*") tries to maintain tensile strength. But it is slowly *diverted* by a 'vibrate, make photon, and send it' cycle, as a roughly equal amount of ether is subverted for photon production. (Or perhaps the added photon flux causes congestion, turbulence, or chokes-off normal ether flow). Thus tungsten loses tensile strength and melts!

So I wish Lord Kelvin could have used a cooler star than our Sun, a more stable red giant (*too cool to quite melt tungsten* on its surface, and so *not* throwing as much mass into a solar wind).

Consider the 'interface' between a typical star's hot surface and 'space'. That is a basic factor in the balance of our universe: 'Gross bodies' vs. small (hard-to-detect) particles or 'field stuff'. Stars (large bodies) that are so hot that their radiation (equivalent mass per volume) exceeds ether's density -- slowly die and lose mass. But the cool debris they throw-off (and maybe their own cooler corpse) becomes 'fodder' for 'gravity' to use to form new (replacement) stars. A *universe recycling principle*!

(Incidentally, a hydrogen atom's emitted 'Balmer' series photon contains enough energy to heave an electron beyond the Sun's gravitational retrieval – faster than the escape velocity.)

Lord Kelvin's method of estimating ether density has some merit, but is *not* the only method, nor my favorite. He believed 'ether *is* light' - today's photon. But he now seems wrong, since nuclear fission & fusion can make gamma-rays by *self-parasitic* means. So we need Einstein's gamma-ray (photon bullet concept) to, at least, help Lord Kelvin's ether do the whole job.

Important: Before moving on, here are some speculative thoughts about further utilizing Bohr's hydrogen atomic model even further than science has so far. (See Case 1, Fig. 3). Instead of the Bohr proton, electron, attractive 'electrostatic' forces, and electron jumping; let us apply analogous reasoning to a large

cool old star or body and a very distant smaller cool body (very slowly moving) like Pluto, and gravity. I think that by examining various events and possible outcomes; we can quickly motivate and focus on the major themes of Einstein's relativity theories. And maybe get a simpler insight into them and suggest how to extend them, or even improve parts of them.

Science should compare the following numbered realities, and try to give us their conclusions:

1. The *total 'mass'* (inertia characteristic) of the small and large bodies when very distantly separated.

2. The *total mass* of the small and large bodies, after the small one has been gravitationally attracted to, plowed into, and been absorbed by the larger one -- with important frictional increase of heat and temperature resulting.

3. The *total (merged) mass*, as in [2] above, *but after* it has cooled back to its original low temperatures.

4. The *total mass*, as in [2], except that, instead of the frictional heat resulting, a rare 'mass gaining' nucleosynthesis occurred due to a gravitation-caused collision, and thus, say, only *negligible* temperature and heat increases resulted.

5. The *total mass*, as in [2], except that if part of the heat (energy) and mass in [2] created a close orbiting moon – but we are still talking about the total mass (large body *plus* its moon.)

6. Important: if, in [3], the total merged very large mass is now equal to the total original (distantly) separated masses; are their mc^2 also equal?

Or, if the merged body attempted to explode itself by nuclear internal explosion; would its own added gravity hindrance, such as the added escape velocity required of its parts, lead to an 'unequal playing field'. (I.e., prevent its mc^2 from equaling the original separated ones' mc^2, as far as its measurable effect on the distant universe around it, assuming the original bodies also attempted an mc^2 explosion – for comparison purposes?)

In other words, *does* $E = mc^2$ *need a gravitational-related correction term inserted to correctly correspond to its presumed reduced capacity to explosively manifest its mc^2 on the distant universe around it, due to its own increased gravity*? (Or might a compensating increase of mass arise, like a slowed-up satellite timer, to 'go with the territory'?) Many of these questions were prompted by considering Larmor's and Bohr's work, alone. (Incidentally, would neutrinos, or any other strange rogue actions, reheat the large body's interior, in [3], back up to appreciable temperatures, even after cooled, and left alone?

3. Revisiting Einstein: Is One Coordinate System Closer to 'Absolute Rest' than Another?

Let us now question another aspect of Einstein's 'Special Theory of Relativity' (SRT). I start by presenting another challengeable quote from Einstein's work; and I have *emphasized* the especially challengeable part, as follows:

"Take, for example, the reciprocal electrodynamic action of a magnet and a conductor... *Examples of this sort*, together with the unsuccessful attempts to discover any motion of the earth relatively to the 'light medium,' *suggest that the phenom-*

ena of electrodynamics as well as *of mechanics possess no properties corresponding to the idea of absolute rest.*" [12]

I think that others have previously addressed the above issue well, but perhaps in a more complicated and lengthy way than in the simpler way that I will now attempt. Admittedly, Heisenberg's uncertainty principle, etc., may prevent me from finding '*absolute rest*' without a slight error. Yet, I will try to show how to distinguish some slowly moving mechanical things (i.e., closer to absolute rest) from some faster moving ones. (Even if both move along the same straight line!)

Also, admittedly, SRT type 'thought experiments' can easily fool their creator, due to subtleties. I will not give all details here, nor try to guess all possible objections or rebuttals. But I just invite those interested to consider my circumspect, commonsense approach; and research it further if they wish, and judge it.

Let us consider, first, the vast amount of small atoms, molecules, and even loose nuclei or similar small debris at significant distances from large hard bodies [13]. Some of that small debris may be orbiting around 'this or that body' quite fast; but even the great majority of that has velocities *far less than the velocity of light*, '*c*'. (Ultimately, I believe that this is because the *average* velocity of ether is zero or nearly zero. And I think the *averaging* actions of hundreds of nearby galaxies severely limit the relative number of translational events by the small debris at super-high speeds, relative to light's. To avoid excessive speculation, let us limit ourselves, here, to relatively nearby galaxies instead of those at super-great distances from earth.)

Let us see if we can use the above and below (alleged) facts [14] to distinguish between an instrument *absolutely* moving *at great velocities (say '0.20c' or more)* compared to 0.010c or much less. Let us remember that even the vast amount of solar wind has velocity far less than 0.01c. Even great amounts of small debris orbiting common galaxies, orbits at 0.01c maximum or far less, and changes direction greatly as one crosses the galaxy. Similarly for the highest velocities of 'approaching and receding' stars in our Milky Way galaxy and other nearby galaxies.

Thus, I think the 'dust-measuring' or 'dust-gathering' means that I will propose to detect *absolute* super-high velocity (vs. more mundane velocities) *is central* to questioning Einstein's phrase: "*mechanics possess NO properties corresponding to the idea of absolute rest*".

Before proceeding with details, I wish to express my view that even a small instrument's 'mechanical' life will likely be shortened, statistically, by its super-fast translational travel.

Here is my *first* of two 'thought-experiments' challenging 'SRT': Consider three separate circular rings (as circular as thought possible). And, say, let one be (seemingly) 'stationary', but send one other toward the North Star (but a few degrees off-course to avoid collision with it or a like body). And also send one ring Southward, ('S'), oppositely from the other's Northward ('N') direction. Send each of the apparently high speed traveling loops with enough fuel to likely reach, say, 0.30c, and the other -0.30c. (Let each just use up a *similar high number of molecules* of rocket fuel. One or both need not even reach exactly 0.30c absolute velocity. Let each carry an exactly similar 'molecular timer', and travel perpendicular to ring's plane.)

Imagine good observers sitting along the perimeter of the circular loops, counting how many loose molecules, atoms, or nuclei (space debris) pass through each loop, (N to S vs. S to N), a partially 'eclipsing event'. Perhaps count 'cosmic rays', too. (The idea, of course, is to *note great asymmetries*!) Even adjust the orientation of the loop to pick up the greatest number of particles passing one way through it compared to the opposite.

I predict that *if* each loop is absolutely traveling super-fast, *each will count many more particles (small debris) passing one way 'through the loop' than the other*. And, after missing the North Star; if the loop continues traveling through the Milky Way and into intergalactic space and gathers more data for a while – all the better. The *timing* of the fast-traveling timer will be slowed, increasing its 'sensitivity', i.e., more particles passing through it per its clock time, than using a stationary clock. (And, likely the fast-traveling instrument would be destroyed sooner!)

(Instead of the above convenient 'wire loop' concept, one could likely use a long, narrow, hollow 'straw', with a diaphragm barrier near the middle – and imagine counting the molecules, etc., accumulated on its 'sticky' interior walls. A convex or concave flexing of the diaphragm, separating north and south chambers and accumulations, would not affect the conceptual outcome. Note also -- if the loop or straw speed was, say, only 0.10c; even a downstream solar wind of particles or fast orbiting ones would be easily scooped-up! And if the 0.30c 'N' traveling loop also launches a stored-up 'baby' loop at about 0.30c faster northward, and another 'baby' loop at about 0.30c southward – to recheck the phenomenon – 'all the better'!)

My *second* thought experiment involves how stars would appear from space vehicles with instruments, in spectroscopic studies (red vs. blue *shifts*), if they were traveling 'super-fast'! Say, northward at 0.30c, vs. southward at -0.30c, vs. one at rest?

Observers on the northbound space station would likely note a 'Doppler shift' toward the ultra violet if looking toward the northern hemisphere, and infrared if looking toward the south hemisphere. (An opposite effect would be noted by observers in the southbound space station.) And from the viewpoint of a rather stationary space station, (*if*, in fact, it was so stationary), no such great asymmetry would be noticed in the universe!

Moreover, if the northbound space station, itself, launched, say, one baby space satellite northward and one southward; the latter would notice a more normal spectrum. That would constitute a double check of what is closer to 'absolute rest'.

In summary, in 1905 Einstein commendably presented mathematical treatments, for many cases (or classes), that turned out empirically consistent with his implication. (That is that no preferred coordinate system is truly 'deemable' as closer to absolute rest than another). *But* yet, and *importantly*, there is a *different class* of observed realities that would contradict the Einstein implication. Einstein's implication would *not* be appropriate, useful, or correct – for that class! (To borrow some old pre-Torricelli wording, 'that nature *abhors* a vacuum'**;** I think that "in some cases, Nature *abhors* Relativity"!)

Hopefully various classes of phenomena will be further studied in years to come. (Some to be classified as 'consistent with SRT', some 'inconsistent with SRT', and some 'undecided'.) Some NPA members have already discussed some of that, giving their conclusions, reasons and *interpretations*. (Maybe even our solar system's ecliptic tilt of 60 Deg. out of the plane of the Milky Way -- may indicate a slight preference by the former for the 'vertical arm' position in Michelson-Morley-type experiments.)

References

[1]   C. R. Littmann, "Sphere Volume Ratios in Tetrahedral & Triangular Patterns, and Some Implications", *Proceedings of the NPA* **8**: 351-353 (2011).

[2]   Ibid., which also contains references to related papers.

[3]   W. Thomson (Baron Kelvin), "On the Possible Density of the Luminiferous Medium ... etc.', *Philosophical Mag.* IX (LVI): 36-40 (1855). Local library provided researcher a 'Google eBook' copy. (Thomson's first presentation found in 'Edin. Royal Soc. Trans.', 1854; and reprinted in Phil. Mag. a year later)

[4]   J. Maxwell, **A Dynamical Theory of the Electromagnetic Field**, Part I, Introduction, sect. ('5'), presented to Royal Soc. London, 1864, pub. Vol. CLV in their Phil. Trans., 1865; and also found in T. F. Torrance's edited version, pg. 35, (Wipf and Stock Publishers, Eugene OR, 1996).

[5]   B. Stewart, P. G. Tait, **The Unseen Universe,** Chap. IV, Matter and Ether, Art. 146, pp. 150-151, (Macmillan and Co., Ltd., New York, 1901), Reproduction (Adamant Media Corp, Elibron Classics Series, 2005).

[6]   H. Semat, **Introduction to Atomic and Nuclear Physics**, 4th Ed., Prob. 4-4 and ans., both at end of chap. 4, pg. 112, (Holt, Rinehart and Winston, New York, 1962)

[7]   Ibid. , 15-22, pp. 535-536.

[8]   C. R. Littmann, "Force Strengths in our Universe, Material Densities and Bernoulli's Equation", *Proceedings of the NPA* **3** (1): 131-134 (2006)

[9]   Based on my rough calculations using www.wikipedia.com**,** data under their topics: Sun and Solar Wind. But readers are also encouraged to consult other sources and do their own calculations.

[10] C. R. Littmann, "A Simplified Approach to Metal Tensile Strength Using Concepts of Guericke and Venturi", a 2001 article at author's website, www.causeeffect.org

[11] A. Einstein, "Does the Inertia of a Body Depend Upon Its Energy Content?", *Ann. der Physik* **18**: 639ff (1905).

[12] A. Einstein, "On the Electrodynamics of Moving Bodies", *Ann. der Physik* **17**: 891ff (1905).

[13] W. K. Hartmann, "Gas Densities in Different Environments", in **Astronomy: the Cosmic Journey**, 4th Ed., Table 20-2, p. 436 (Wadsworth Publishing Co., Belmont, CA, 1989).

[14] Wikipedia, www.wikipedia.com, topics: Doppler Effect, Milky Way, Solar Wind, Sun, Luminosity, List of nearest galaxies, Galaxy Rotation, and Red Shift.