the general science journal

Restricted Relativity:

A Detailed Account of the Main Objections

A. A. Faraj
a_a_faraj@hotmail.com

Abstract:

In the present investigation, the conceptual framework of Einstein's special theory of relativity, as well as the primary objections raised, over the years, by various authors, in the published literature, against some of its chief components, have been reviewed and, carefully examined. In addition, a number of new objections and potential vulnerabilities, pertaining to certain aspects of the physical theory, under discussion, has been explored, analyzed, and expounded, in detail.

Keywords:

Relativity postulate; constancy postulate; Lorentz transformation; aberration of light; Doppler effect; Dingle's clock paradox; Lorentz aether theory; addition of velocities; ballistic theories; uniform motion.

Introduction:

Even though, it does appear, on the surface, as an independent and stand-alone theory, restricted relativity — Einstein's special theory of relativity — is, as a matter of fact, just a helper hypothesis, freely selected — so to speak — during the early years of the ***20**th* century, by broad agreement, in the physics community, from a list of several similar hypotheses, such as the Lorentz helper hypothesis, the Larmor helper hypothesis, and the aether-dragging helper hypothesis, which have been designed, specifically, to help Maxwell's electromagnetic theory, overcome the experimental failure of its most striking perdition, regarding the orbital speed of Earth, around the barycenter of the solar system, in particular, and the absolute speed of Earth, relative to the luminiferous aether, in general.

Outwardly, the theory under discussion, is, widely, assumed to have done away with the luminiferous aether, for good. Nevertheless, it's quite clear that since it has been grafted onto, and constructed, from the very beginning, upon the framework of Maxwell's electromagnetic theory, the special theory of A. Einstein, in reality, has almost nothing substantial that might help it, theoretically or otherwise, to somehow rid itself of the luminiferous aether.

And that is, obviously, because Maxwell's electromagnetic theory, necessarily, requires a carrying medium, such as the luminiferous aether, without which the wave concept of light, in that theory, would be, totally, inadmissible, wholly, incomprehensible, and, completely, baseless.

The dynamical properties of the luminiferous aether are well-known and considered by many authors, including, of course, A. Einstein, himself, to be ad hoc and superfluous.

However, within the current context, only the kinematic aspects of the luminiferous aether are relevant. And these aethereal features are, certainly, more transparent and internally consistent. But, at the same time, a few points need to be clarified further and pointed out, explicitly, in this regard:

1. Nothing, in Maxwell's electromagnetic theory, excludes, directly, or indirectly, the possibility of the motion of the observable part of the universe, along with its luminiferous aether, with some constant speed, in some direction. Motions relative to the luminiferous aether, therefore, are not equivalent, in the strictest sense, to motions relative to immobile space.

2. In Maxwell's electromagnetic theory, the motion of every physical object has to be reckoned relative to the luminiferous aether, indirectly, as a matter of course, by means of the speed of light. That is, clearly, because a symmetrical assignment of motions in this case, renders long-range measurements of motions by optical means, practically, useless. Also, the motion of the luminiferous aether, relative to physical objects, necessarily, leads to illusory motions of stationary bodies, easily, noticeable in short-range measurements. And so, as long as no such illusory motion is observed, the above generalization shall remain valid and, theoretically, admissible.

3. The notion of stationary luminiferous aether, with respect to moving bodies, does not exclude however, the possibility of independently contracting or expanding luminiferous aether, at a cosmic scale. In fact, phenomena explainable by the conventional model of expanding universe are equally explainable by the hypothesis of expanding luminiferous aether.

4. Within the framework of Maxwell's electromagnetic theory, the speed of light, relative to the luminiferous aether, is, always, assumed to be equal to ***c***, in accordance with the following formula:

$$c = \frac{1}{\sqrt{\mu_0 \varepsilon_0}}$$

where μ_0 is the magnetic permeability of the luminiferous aether; and ε_0 is the electric permittivity of the luminiferous aether.

And as a consequence, if it's taken for granted that the measurement of the numerical values of the magnetic permeability of the luminiferous aether, μ_0, and the electric permittivity of the luminiferous aether, ε_0, do not depend, in any way, upon the speed of the measuring observer, relative to the same luminiferous, then, on the basis of Maxwell's electromagnetic theory, it should be possible, in principle, at least, for the numerical value of the actual speed of any moving system, isolated or otherwise, relative to the luminiferous aether, to be determined and measured, directly, by observers, who are located inside that moving system, and at rest, relative to it.

The above theoretical prediction, as calculated, in compliance with the rules of Maxwell's electromagnetic theory, is straightforward, clear, and pretty simple.

Let's take the motion of the earth as an example; since its orbital speed, $\boldsymbol{v}$, around the gravitational center of the solar system, has been, accurately, measured, by multiple methods, and well-established from kinematic perspective as well as from dynamical perspective.

Subsequently, the prediction of the classical electromagnetic theory goes something like this:

The time of flight, $\boldsymbol{T_1}$, by a light beam, over a distance equal to $\boldsymbol{L}$, in the forward direction of the velocity vector, $\boldsymbol{v}$, is, readily, obtained, by using the following equation:

$$T_1 = \frac{L}{c - v}$$

And likewise, the time of flight, $\boldsymbol{T_2}$, by a light beam, over a distance equal to $\boldsymbol{L}$, in the backward direction of the velocity vector, $\boldsymbol{v}$, is, also, readily, obtained, by using this equation:

$$T_2 = \frac{L}{c + v}$$

Correspondingly, the total time of flight, $\boldsymbol{T}$, by a light beam, over a distance equal to $\boldsymbol{L}$, in both directions, is equal to the sum of $\boldsymbol{T_1}$ and $\boldsymbol{T_2}$:

$$T = \frac{2L}{c\left(1 - \frac{v^2}{c^2}\right)}$$

And similarity, the total time of flight, ***T'***, by a light beam, in the transversal direction, over the two sides of an isosceles triangle whose height is equal to ***L*** ***[Ref. #14]***, and at right angles to the velocity, ***v***, is obtained, through the use of the following equation:

$$T' = \frac{2\sqrt{L^2 + \left(\frac{vT'}{2}\right)^2}}{c} = \frac{2L}{c\sqrt{1-\frac{v^2}{c^2}}}$$

And it follows, therefore, that the time difference, ***Δt***:

$$\Delta t = t - t' = \frac{2L\left(1-\sqrt{1-\frac{v^2}{c^2}}\right)}{c\left(1-\frac{v^2}{c^2}\right)}$$

should lead to a displacement equal to about ***0.04*** of the distance between the interference fringes, which can be, easily, measured, in the lab,by means of the Michelson interferometer ***[Ref. #15]***.

However, E. Morley, and A. Michelson, himself, were, practically, unable to obtain a displacement of about ***0.04*** of the distance between the interference fringes, by making use of the aforementioned Michelson interferometer.

And since the theoretical prediction, under discussion, is simple, fundamental, and inextricably linked to its framework core, Maxwell's electromagnetic theory has to be modified, and its kinematic rules must be tweaked, somehow, in order for it to survive an experimental failure of this magnitude.

And so, after a relatively short period of developing and trying out various tweaks, the physics community, since the early years of the previous century and up to the present time, has settled upon Einstein's special relativity, as the best available tweak for the kinematic rules of Maxwell's electromagnetic theory, which appears to settle the above anomaly, somewhat, better than other proposed tweaks, as well as to explain away, in a seemingly satisfactory manner, the reported null result of the Michelson-Morley experiment, along with making a few specific predictions of its own.

It's the principal objective of the current investigation to review the basic tenets of this Einstein's tweak to Maxwell's electromagnetic theory, and to analyze, in detail, its weaknesses,, as well as to evaluate, as precisely as possible, the forcefulness, weight, and relative strength of the various objections to it.

From the outset, Einstein had chosen to present his special theory of relativity, in a deductive form, and to base it on just two postulates, namely, the postulate of restricted relativity, and the postulate of constancy of light speed in vacuum, from both of which everything else, within its theoretical framework, should come out, in a formal deductive way, naturally.

1. The Postulate of Restricted Relativity:

In all likelihood, independently inspired, by Galileo's ship thought experiment ***[Ref. #20]***, both A. Einstein and H. Poincaré defined the postulate of restricted relativity, in a similar fashion, as follows:

- A. Einstein defined the postulate of restricted relativity, within the framework of his own special theory, as the principle, in accordance with which: *"The laws by which the states of physical systems undergo change are not affected, whether these changes of state be referred to the one or the other of two systems of co-ordinates in uniform translatory motion"* ***[Ref. #7.1]***.

- H. Poincaré defined the same postulate of restricted relativity, within the framework of the Lorentz aether theory, as: *"The principle of relativity, according to which the laws of physical phenomena must be the same for a stationary observer as for an observer carried along in a uniform motion of translation; so that we have not and can not have any means of discerning whether or not we are carried along in such a motion"* ***[Ref. #19]***.

However, in Galileo's ship thought experiment, there is only one frame of reference; i.e., just the hull of a windowless ship, in which observers are, virtually, unable to look outside. And so, although it's by no means impossible, it would be, extremely, difficult, for such observers, to find out, for sure, whether the ship is in uniform linear motion, or it's at rest in a calm harbor.

While, by contrast, in the generalized scenario of H. Poincaré and A. Einstein, the observers have, at their disposal, two systems in uniform linear motion, relative to each other, along with a light ray to serve as a trustworthy and pretty reliable go-between. And as a result, the principle of relativity, as defined, within the context of Einstein's special relativity, and the context of Lorentz aether theory, is, clearly, vulnerable to criticism, and fairly easy to dispose of several of its essential aspects, theoretically, as well as experimentally, at once:

I. Laws of nature are the same with respect to reference frames in uniform motion. This feature of the postulate of restricted relativity is a special case of the basic assumption, which is at the foundations of natural philosophy, in accordance with which laws of nature are the same everywhere in the universe. Evidently, such an assumption, by its own very metaphysical nature, can neither be proved nor disproved. In addition, whenever an exception to the rule is found, it is, automatically, utilized in developing even more general laws of the natural world. That is after all, the essence of progress in science. Consequently, if any violation of the aforementioned assumption is discovered, it won't have to be, necessarily, fatal to Einstein's special theory, Lorentz aether theory, or any other physical theory, for that matter.

II. No experiment, performed inside an isolated physical system, can reveal its uniform linear motion. This second aspect of the postulate of restricted relativity, is, in fact, a statistical conclusion, based on a fairly large, but by no means encompassing, sample of physical situations. It was, widely, popularized, during the Galilean campaign, against the Ptolemaic geocentric theory. And it has been used ever since, by various competing factions, against the classical aether theory, according to which it is, possible, in principle, for observers, inside an isolated physical system, to make use of the speed of light rays, relative to the luminiferous aether, and determine, precisely, the uniform linear speed of that physical system. However, as a fundamental principle, this particular feature of the postulate of relativity is, quite weak, and having little or no logical force of its own, to speak of; since, by definition, the number of natural and artificial phenomena, inside an isolated physical system, which may, well, reveal its uniform linear motion, is, potentially, infinite, and can never be, totally, made known, and, completely, exhausted, in any conceivable way, at all.

III. The relative speed, between two co-ordinate systems, in uniform linear motion, is indivisible, and has, exactly, the same numerical value, as measured by observers at rest, in both co-ordinate systems. This is by far, the weakest and most vulnerable ingredient of the postulate of restricted relativity to criticism. Since it's possible, in principle, to turn the apparent indivisible relative speed into divisible, and to obtain, precisely, the actual instantaneous speed, for each co-ordinate system, from inside either one of two co-ordinate systems, in uniform linear motion, relative to each other, through the employment of Bradley's law of light aberration.

IV. Two co-ordinate systems, in relative and uniform linear motion, are equivalent, in every respect, to each other. And as a consequence, observers, inside either one of those two co-ordinate systems, can equally assert, all the time, that their own co-ordinate system is stationary, while the other co-ordinate system is moving, on its own, and doing the whole uniform linear motion, all by itself. This other feature of the postulate of restricted relativity too is, quite weak and, extremely, vulnerable to criticism. And that is, definitely, because it's, always, possible to determine the actual instantaneous speed, for each co-ordinate system, from inside either one of two co-ordinate systems, in uniform linear motion, relative to each other, by, simply, making use of the phenomenon of Bradley's light aberration.

V. Temporal and spatial variations, introduced by the Lorentz transformation, have the same numerical values, as computed in either one of two co-ordinate systems in uniform linear motion, relative to each other. Like the two previous features of the postulates of restricted relativity, this one too is pretty weak and quite vulnerable to criticism, as well. Since the assumption of indivisible speed, between two co-ordinate systems, in uniform linear motion, relative to each other, upon which has been based, is, entirely, inconsistent with Bradley's law of light aberration, by the use of which the instantaneous speed, for each one of the two co-ordinate systems, can be determined, exactly, on demand, anytime.

2. The Postulate of Constancy:

The postulate of constancy of speed of light, in vacuum, as defined, within the framework of Einstein's special theory, has two distinct versions, namely, the weak version, and the strong version:

- The weak version of the postulate of constancy of speed of light, in vacuum, has been defined, explicitly, by A. Einstein, himself, in the first part of his ***1905*** article entitled: **"On the Electrodynamics of Moving Bodies"**, as follows: *"Any ray of light moves in the "stationary" system of co-ordinates with the determined velocity c, whether the ray be emitted by a stationary or by a moving body"*. And so, this weak version of the postulate of constancy of speed of light, in vacuum, is very similar to the constancy of speed of light, as defined, within the framework of Maxwell's electromagnetic theory, in accordance with which any ray of light moves, always, with the constant speed ***c***, relative to the luminiferous aether, regardless of whether is being emitted, by a stationary light source, or by a moving light source, during the time of emission.

- The strong version of the postulate of constancy of speed of light, in vacuum, has been defined, implicitly, by Einstein's equation, for the addition of velocity, and, explicitly, in the vast majority of physics textbooks, this way: *"Any ray of light moves, in vacuum, with the constant speed c, relative to all observers, regardless of their motion, relative to the light source"*.

- No other speeds, in the entire universe, beside the speed of the light ray, itself, are allowed, under any circumstances, to have numerical values equal to, or greater than the determined speed ***c***. This supplementary condition has been, arbitrarily, imposed, within the framework of Einstein's special theory, upon the weak version as well as the strong version of the postulate of constancy of speed of light, in vacuum, for the sole purpose of avoiding the mathematical singularity, in the case of of speed values equal, exactly, to ***c***, as well as the imaginary numerical values of the relatively ubiquitous factor gamma — $1/[1-v^2/c^2]^{0.5}$ — in all cases of speed values greater than the determined speed of light, ***c***, in vacuum.

According to the weak version of the postulate of constancy of speed of light, in vacuum, as defined above, within the context of both Einstein's special theory and Maxwell's electromagnetic theory, the speed of light rays is independent of the speed of the light source, at the time of emission; but, at the same time, the speed of light rays is dependent upon the speed of the light receiver, at the time of reception. In other words, the speed of light rays is half ballistic, or half Galilean – so to speak – on the basis of this weak version of the postulate of constancy of speed of light, which allows, only, the speed of light rays and the speed of the light receiver, at the time of reception, to add up to each other, in accordance with the basic rules of the Galilean transformation.

It should be quite obvious, therefore, that A. Einstein needed to use, extensively, throughout the first part of the aforementioned ***1905*** article of his, the weak version of the postulate of constancy of speed of light, in vacuum; otherwise, it would have been all but impossible, for him, to take advantage of classical relative speeds of light, such as $(c + v)$, $(c - v)$, $1/(c + v)$, and $1/(c - v)$, directly or indirectly, or to claim, publicly, to have derived, independently, his own version of the Lorentz transformation, the Doppler formula, the light aberration formula, or any other related formula, in any shape or form, at all.

Unlike the familiar weak version, however, the strong version of the postulate of constancy of speed of light, in vacuum, as defined above, has no precedent, in the published literature, on this particular topic, prior to the publication of the forenamed ***1905*** article. And thus, it should be, abundantly clear this strong version of Einstein's second postulate has to be of his own making and invention.

Although, at first glance, it might, well, appear that A. Einstein could have been guided, straight away, to conjecturing it, by the previously published interpretation of the reported Michelson-Morley experimental result, within the framework of Lorentz aether theory, in reality, one of the most serious weaknesses of the strong version of the postulate of constancy of speed of light, in vacuum, is, as a matter of fact, its clear, unmistakable, and outright inconsistency with the Lorentz transformation, itself, ***[Ref. #3]*** & ***[Ref. #9]***.

And even, on the basis of the weak version of the postulate of constancy of speed of light, in vacuum, which is, seemingly, in line with it, the Lorentz transformation, as H. Lorentz, himself, demonstrated, can, only, be derived and arrived at, tentatively, through inductive reasoning. To put it, simply, the idea that the Lorentz transformation can be derived, deductively, from a given number of postulates, is, from any logical standpoint, an utterly impossible undertaking and non-starter, from the its very beginning.

3. The Lorentz's Transformation:

As calculated earlier, on the basis of Maxwell's electromagnetic theory, in the Michelson-Morley experiment, the total travel time of the light beam, along the longitudinal arm of the interferometer, is equal to, ***T***, in accordance with the following equation:

$$T = \frac{2L}{c\left(1 - \frac{v^2}{c^2}\right)}$$

And likewise, the total time of the light beam, along the transversal arm of the same interferometer, is equal to ***T′***, as computed through the use of this equation:

$$T' = \frac{2L}{c\sqrt{1 - \frac{v^2}{c^2}}}$$

where ***L*** is the length of the arm of the interferometer; ***v*** is the orbital speed of Earth, around the gravitational center of the solar system; and ***c*** is the speed of light, relative to the luminiferous aether.

Nonetheless, the actual experimental result, as reported by A. Michelson and E. Morley, indicates, very clearly, that the total travel time of the light beam, along the longitudinal arm of the interferometer, ***T***, as well as the total travel time of the light beam, along the transversal arm of the same interferometer, ***T′***, are both consistent with the following formula:

$$T = T' = \frac{2L}{c}$$

as if Earth was at rest, relative to the luminiferous aether.

And so, it's either the speed of light beam depends upon the speed of the light source, at the time of emission, in accordance with ballistic theories of light; or Maxwell's electromagnetic theory has to be tweaked, anyhow, in order to explain away the above experimental result. Historically, as it happened, H. Lorentz, H. Poincaré, and A. Einstein, along with, at least, a simple majority of the physics community, at that time, opted for the latter option; i.e., tweaking the electromagnetic theory, by scaling down the length of every measuring rod, in the longitudinal direction of the moving system, (e.g. length contraction); and, simultaneously, slowing down the ticking rate of every clock, throughout the same moving system, (e.g. time dilation), by the appropriate mathematical factors, respectively, through the employment of one of these two methods:

A. The Inductive Method of H. Lorentz and H. Poincaré:

The primary objective of the application of this method, by H. Lorentz and H. Poincaré, is to transform the two equations, above, for calculating ***T*** and ***T'***, into this one single equation:

$$T = T' = \frac{2L}{c}$$

for calculating the travel times, during round trips, made by the light beam, in every direction, throughout the moving co-ordinate system.

And subsequently, by simply dividing ***T'*** by ***T***, both H. Lorentz and H. Poincaré were able to obtain, at once, the following mathematical factor, for length contraction, in the longitudinal direction of the moving system, ***Factor*** $_1$:

$$Factor_1 = \frac{T'}{T} = \sqrt{1 - \frac{v^2}{c^2}}$$

And also, by merely dividing the aforementioned result of the Michelson-Morley experiment by ***T'***, they were able to obtain the following mathematical factor, for time dilation, throughout the moving system, ***Factor*** $_2$:

$$Factor_2 = \frac{2L/c}{T'} = \sqrt{1 - \frac{v^2}{c^2}}$$

where ***2L/c*** is the reported result of the Michelson-Morley experiment.

And it follows, therefore, that, according to the above tweak of Maxwell's electromagnetic theory, ***Factor*** $_1$, for length contraction, and ***Factor*** $_2$, for time dilation, together, effectively, reduce the two equations, for ***T*** and ***T'***, to ***2L/c***, in both direction, within the moving system. And at the same time, both factors can be utilized, in the construction of the following equations of the Lorentz transformation, for converting length and time measurements, from the stationary co-ordinate system, to the moving co-ordinate system; and vice versa:

$$x' = \frac{x - vt}{\sqrt{1 - \frac{v^2}{c^2}}}$$

$$y' = y$$

$$z' = z$$

$$t' = \frac{t - \frac{vx}{c^2}}{\sqrt{1 - \frac{v^2}{c^2}}}$$

where x, y, z, & t belong to the stationary co-ordinate system; and x', y', z', & t' belong to the moving co-ordinate system.

However, in spite of its conciseness and clarity, on the whole, the inductive method of H. Lorentz and H. Poincaré has a number of deficiencies, the most troubling of which is, undoubtedly, its basic assumption that, only, the longitudinal physical dimensions of rigid bodies, in motion, undergo length contraction. That is because if this theoretical assumption holds true, then the above tweak of Maxwell's electromagnetic theory, by H. Lorentz and H. Poincaré, must lead, measuring observers, in the moving co-ordinate system, to overestimate all spatial distances, parallel to the velocity vector of that same co-ordinate system, by a factor of $1/[1 - v^2/c^2]^{0.5}$, due to the contraction of their measuring rods, by a factor of $[1 - v^2/c^2]^{0.5}$; and to overestimate, at the same time, all kinds of space velocities, including the space velocity of their own co-ordinate system, itself, by a factor of $1/[1 - v^2/c^2]$, due to the contraction of the measuring rods, by a factor of $[1 - v^2/c^2]^{0.5}$, and the slowdown of the ticking rate of every clock of theirs,by a factor of $[1 - v^2/c^2]^{0.5}$, as well.

B. The Deductive Method of A. Einstein:

The main objective of the employment of this method, by A. Einstein, is to turn the inductive method of H. Lorentz and H. Poincaré on its head, and to obtain, deductively, from his two postulates, the mathematical factors, for length contraction and time dilation, along with the related equations of the Lorentz transformation, for converting length and time measurements, from the stationary co-ordinate system, to the moving co-ordinate system; and vice versa.

By, merely, assuming that the strong version of the postulate of constancy of speed of light, in vacuum, holds good, throughout the moving co-ordinate system, A. Einstein was able to obtain total times of flight, for round trips, in every direction, equal to $2L/c$, as measured by observers, in the moving co-ordinate system, without having to resort to the reported result of the Michelson-Morley experiment.

Apparently, however, things get much tougher and more complicated, for A. Einstein, in the stationary co-ordinate system:

Firstly, he had to assume that the weak version of the postulate of constancy of speed of light, in vacuum, holds good, throughout the stationary co-ordinate system; so that he would be able to make use of the following two classical equations, for computing the travel times light beam, in the forward as well as in the backward direction, as measured in the stationary co- system, respectively.:

$$t_B - t_A = \frac{rAB}{c-v} \quad \& \quad t'_A - t_B = \frac{rAB}{c+v}$$

where $(t_B - t_A)$ is the time of flight of the emitted light ray, in the forward direction, over the moving rod, from *A* to *B*; $(t'_A - t_B)$ is the time of flight of the reflected light ray, in the backward direction, over the moving rod, from *B* to *A*; and ***rAB*** is the length of the moving rod.

Secondly, A. Einstein had to assume that the length contraction of the moving rod is visible, in the stationary co-ordinate system, to such an extent that if it's measured, in accordance with the operational procedures. described by him, the relation, below, must be found to hold good:

$$rAB = L\sqrt{1-\frac{v^2}{c^2}}$$

where ***L*** is the length of the stationary rod.

Thirdly, he had to assume that the clocks, in the co-ordinate system of the moving rod, cannot be synchronized with the clocks, in the stationary co-ordinate system. And that is just about the same assumption, made by H. Lorentz and H. Poincaré, according to which time dilation is, decidedly, local, practically, concealed, and, directly, measurable, neither from the inside, nor from the outside of the moving co-ordinate system.

And so, in the end, A. Einstein had been forced to let observers, at rest, relative to each co-ordinate system, do their own local measurements; while he, himself, would play the role of the know-it-all super observer, connect the two sets of hypothetical measurements, and deduce, mathematically, from both sets, $\boldsymbol{Factor_1}$, for length contraction, $\boldsymbol{Factor_2}$, for time dilation, and the related equations of the Lorentz transformation, far less deductively, much more inductively, and in, almost, the same tentative manner, H. Lorentz and H. Poincaré had done it, before him.

All in all, the above deductive method, by A. Einstein, has two fatal weaknesses:

- The invisibility of the length contraction of the moving rod, in the stationary frame of reference, due to the Terrell effect, as worked out on the basis of none other than Einstein's special theory, itself ***[Ref. #17]***, for all intents and purposes, does away with his entire scheme of rods and clocks, in uniform linear motion, relative to each other, for good, and effectively, renders these two equations of his own special theory of relativity:

$$t_B - t_A = \frac{rAB}{c-v} \quad \& \quad t'_A - t_B = \frac{rAB}{c+v}$$

identical to and, exactly, the same as these two equations of Maxwell's electromagnetic theory:

$$T_1 = \frac{L}{c-v} \;\; \& \;\; T_2 = \frac{L}{c+v}$$

- The Lorentz transformation implies, necessarily, that, as measured in the moving co-ordinate system, the speed of light, in the forward direction, c'_1, in the backward direction, c'_2, and in the transversal direction, c'_3, are, always, in accordance with the three equations, below, respectively:

$$c_1' = \frac{c}{1+\frac{v}{c}} \;\; \& \;\; c_2' = \frac{c}{1-\frac{v}{c}} \;\; \& \;\; \mathrm{c}_3' = c$$

in blatant contradiction to the strong version of the postulate of constancy of the speed of light, in vacuum, according to which c'_1, c'_2, and c'_3 must be equal to c.

In brief, therefore, Einstein's ***1905*** derivation of the Lorentz transformation does not work, as intended, in any event. And moreover, none of his subsequent attempts at deriving it, deductively, on the basis of his two postulates, works, in any way, either ***[Ref. #12 & Ref. #16]***.

4. Einstein's Formula for Adding Velocities:

In the ***1905*** article entitled: **"On the Electrodynamics of Moving Bodies"**, A. Einstein presented the following general formula, for the composition of velocities, within the context of his special theory:

$$V = \frac{\sqrt{v^2 + w^2 + 2vw\cos(\alpha) - \left(\frac{vw\sin(\alpha)}{c}\right)^2}}{1+\frac{vw\cos(\alpha)}{c^2}}$$

where V is the velocity resultant; v is the velocity of the moving co-ordinate system, relative to the stationary co-ordinate system; w is the velocity of a material point, a ray of light, a projectile, a ponderable body, or a third co-ordinate system, relative to the moving co-ordinate system; and α is the angle between the velocity vector v, and the velocity vector w.

In the special case of direct approach, in which the angle, α, is equal to 0^o, as well as in the special case of direct recession, in which the angle, α, is equal to 180^o, the above general formula takes the following form:

$$V = \frac{v \pm w}{1 \pm \frac{vw}{c^2}}$$

While, in the special case, in which ***v*** and ***w*** are at right angles, the same general equation takes this form:

$$V = \sqrt{v^2 + w^2 - \left(\frac{vw}{c}\right)^2}$$

Probably, Einstein's formula, for the addition of velocities, is the only equation, in the entire theory of his special relativity, which is, evidently, consistent with the strong version of the postulate of the constancy of speed of light, in vacuum, in accordance with which: *"Any ray of light moves, in vacuum, with the constant speed c, relative to all observers, regardless of their motion, relative to the light source",* in all cases, in which the numerical value of ***v*** and the numerical value ***w*** are equal to, or less than the numerical value of ***c***.

However, as ingenious as it is, Einstein's formula, for the composition of velocities, has, at a minimum, two major flaws:

- Einstein's formula, for the composition of velocities, produces different numerical results, for the one the same vector sum of the velocity vector, ***v***, and the velocity vector, ***w***. For instance, the following formula, for calculating velocity resultants, in the special case of direct approach,

$$V = \frac{v + w}{1 + \frac{vw}{c^2}}$$

  gives, for the given numerical values of the velocity vector, ***v***, and the velocity vector, ***w***, different numerical results, for the velocity resultant ***V***, as summarized in Table #***1***, below:

Velocity Vector v	***Velocity Vector w***	***Velocity Resultant V***
0.1c	***0.9c***	***0.91743119c***
0.2c	***0.8c***	***0.86206897c***
0.3c	***0.7c***	***0.82644628c***
0.4c	***0.6c***	***0.80645161c***
0.5c	***0.5c***	***0.80000000c***

Table #1: Resultants of Equal Vector Sums of v & w

And it follows, therefore, that Einstein's formula, for the composition of velocities is, plainly, inconsistent with the basic kinematic feature of the relativity principle, in accordance with which equal velocity sums must have equal velocity resultants.

- Einstein's general formula, for the composition of velocities, in the special case of three velocity vectors, ***v***, ***w***, and ***u***, yields the expected numerical results, if and, only, if the three velocity vectors, ***v***, ***w***, and ***u***, are along the same straight line. In each and every other case, however, the aforementioned formula leads to, significantly, different numerical results, depending on the order, in which the calculations are performed. For example, in the simple case, in which the first and the second velocity vectors, ***v***, and ***w***, are, on a straight line; while, at the same time, the third velocity vector, ***u***, is, at right angles to the second velocity vector ***w***, the following two equally valid calculation procedures bring about two different numerical values of the final velocity resultant, relative to the stationary co-ordinate system:

1. The velocity resultant, ***V***, of the velocity vector, ***w***, and the velocity, ***u***, is computed, relative to the moving co-ordinate system, first, by using this equation:

$$V = \sqrt{w^2 + u^2 - \left(\frac{wu}{c}\right)^2}$$

And then the velocity resultant, $\boldsymbol{V_1}$, of the velocity vector, ***v***, and the computed velocity resultant, ***V***, is calculated, relative to the stationary co-ordinate system, by using this equation:

$$V_1 = \sqrt{v^2 + V^2 - \left(\frac{vV}{c}\right)^2}$$

2. The velocity resultant, ***V***, of the velocity vector, ***v***, and the velocity, ***w***, is computed, relative to the stationary co-ordinate system, first, by using this equation:

$$V = \frac{v+w}{1+\frac{vw}{c^2}}$$

And then the velocity resultant, V_2, of the velocity vector, ***u***, and the computed velocity resultant, ***V***, is calculated, relative to the stationary co-ordinate system, as well, by using the following equation:

$$V_2 = \sqrt{V^2 + u^2 - \left(\frac{Vu}{c}\right)^2}$$

And it follows, therefore, that the general formula, for the addition of velocities, within the framework of Einstein's special relativity, in the case of three velocity vectors, and, by inference, in all cases of more than two velocity vectors, produces mismatched results whose numerical values depend upon the ordering of steps, in which the calculations of the final velocity resultant, relative to the stationary co-ordinate system, are carried out. And this should indicate, very clearly, that, at the very least, one of the assumptions, upon which the formula, under discussion, has been constructed, is unwarranted, or, outright, baseless and false.

The two velocity resultants, V_1, and V_2, for the given values of the velocity vectors, ***v***, ***w***, and ***u***, have calculated, through the use of the two calculation methods, above, and the numerical results are summarized, in Table #*2*, below:

Vector v	***Vector w***	***Vector u***	***Resultant*** V_1	***Resultant*** V_2
0.1c	***0.2c***	***0.3c***	***0.367608487388c***	***0.410755064708c***
0.4c	***0.5c***	***0.6c***	***0.710211236183c***	***0.720000000000c***
0.7c	***0.8c***	***0.9c***	***0.932618065600c***	***0.993070495690c***

Table #2: The two Velocity Resultants of v, w, & u

5. Einstein's Doppler Formula:

According to Einstein's ***1905*** article entitled: **"On the Electrodynamics of Moving Bodies"**, *"if an observer is moving with velocity **v** relatively to an infinitely distant source of light of frequency ν, in such a way that the connecting line "source-observer" makes the angle ϕ with the velocity of the observer referred to a system of co-ordinates which is at rest relatively to the source of light, the frequency ν' of the light perceived by the observer is given by the equation"*:

$$\nu' = \nu\left(\frac{1-\frac{v}{c}\cos(\phi)}{\sqrt{1-\frac{v^2}{c^2}}}\right)$$

And so, in the special case, in which the angle ***ϕ***, between the connecting line "source-observer" and the velocity vector of the observer, is equal to ***0º***, the above equation assumes this form:

$$\nu' = \nu\sqrt{\frac{1-v/c}{1+v/c}}$$

in accordance with which when ***v*** is equal to ***-c***, ***ν'*** is equal to infinity.

By comparison, on the basis of the wave theory, and the two ballistic theories as well, *"if an observer is moving with velocity **v** relatively to an infinitely distant source of light of frequency ν, in such a way that the connecting line "source-observer" makes the angle ϕ with the velocity of the observer referred to a system of co-ordinates which is at rest relatively to the source of light, the frequency ν' of the light perceived by the observer"* is given by the following equation:

$$\nu' = \nu\left(1-\frac{v\cos(\phi)}{c}\right)$$

which, in the special case of direct approach, takes this form:

$$\nu' = \nu\left(1+\frac{v}{c}\right)$$

as well as, in the special case of direct recession, it takes the following form:

$$\nu' = \nu\left(1-\frac{v}{c}\right)$$

where ***ν'*** is the observed frequency, in the reference frame of the moving observer; ***ν*** is the emitted frequency, in the reference frame of the stationary light source; and $\boldsymbol{v}$ is the velocity of the observer, relative to the stationary light source.

And it follows, therefore, that A. Einstein arrived at the above general Doppler formula of his special theory, by dividing the general Doppler formula of the wave and the two ballistic theories, in the case of a moving observer and stationary light source, by the Lorentz factor, ***LF***:

$$LF = \sqrt{1 - \frac{v^2}{c^2}}$$

And as a result, the Doppler blue shift is increased; while, at the same time, the Doppler red shit is decreased, as calculated by using the aforementioned Einstein's formula, by the Gamma Factor, GF:

$$GF = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$$

However, the indivisibility of the relative velocity $\boldsymbol{v}$, based on his own postulate of restricted relativity, seemingly, forced A. Einstein, in the above article of his, to ignore, entirely, the Doppler effect, in the case, in which the light source is moving "*with velocity* $\boldsymbol{v}$ *relatively to an infinitely distant*" observer, at rest; and for which the ballistic new-source theory has this Doppler formula:

$$\nu' = \nu\left(1 - \frac{v\cos(\theta)}{c}\right)$$

and the classical wave theory has the following Doppler formula:

$$\nu' = \frac{\nu}{1 - \frac{v\cos(\theta)}{c}}$$

while, the ballistic elastic-impact theory has the following Doppler formula:

$$\nu' = \nu\left(1 - \frac{v\cos(\theta)}{c\sqrt{1-\left(\frac{v\sin(\theta)}{c}\right)^2}}\right)$$

where, in all of the above three Doppler formulas, $\boldsymbol{\theta}$ is the angle, between the connecting line "source-observer" and the velocity vector of the light source.

Nonetheless, upon examining the three Doppler formulas, above, it should be, quite, clear that the Doppler formula of the ballistic new-source theory of his former classmate — W. Ritz — is much closer to the Doppler formula of Einstein's special relativity than that of the classical wave theory; and hence, by simply, dividing it, by the Lorentz factor, Einstein's missing Doppler formula, in the case of a moving light source and observer at rest, can be obtained, at once:

$$\nu' = \nu\left(\frac{1 - \frac{v}{c}\cos(\theta)}{\sqrt{1-\frac{v^2}{c^2}}}\right)$$

where $\boldsymbol{\theta}$ is the angle, between the connecting line "source-observer" and the velocity vector of the light source, $\boldsymbol{v}$.

In addition, A. Einstein, in the aforementioned ***1905*** article of his, refrained, for some unclear reasons, from showing, explicitly, how his Doppler formula, for an observer *"moving with velocity* ***v*** *relatively to an infinitely distant source of light of frequency ν, in such a way that the connecting line "source-observer" makes the angle φ with the velocity of the observer referred to a system of co-ordinates which is at rest relatively to the source of light, the frequency ν' of the light perceived by the observer"*, as given by his equation, above, should look like, in terms of light wavelength. However, the Doppler formula of the ballistic new-source theory, in terms of wavelength, is as follows:

$$\lambda' = \frac{\lambda}{1 - \frac{v}{c}\cos(\phi)}$$

where $\boldsymbol{\lambda}$ is the light wavelength, at the time of emission; and $\boldsymbol{\lambda'}$ is the observed light wavelength, at the time of reception.

And subsequently, by merely, multiplying the above Doppler formula of the ballistic new-source theory, by the Lorentz factor, the following Doppler formula of Einstein's special relativity, in terms of light wavelength, is, readily, obtained:

$$\lambda' = \lambda\left(\frac{\sqrt{1-\frac{v^2}{c^2}}}{1-\frac{v}{c}\cos(\phi)}\right)$$

All in all, the Doppler formula of Einstein's special relativity, as expressed in terms of light frequency, ***ν***, as well as in terms of light wavelength, ***λ***, has, clearly, to major weaknesses:

I. Unlike the closing speeds, such as ***(c + v)*** and ***(c – v)***, employed earlier by A. Einstein in the construction of the Lorentz transformation, which tend to contradict the strong version of his second postulate, indirectly, the closing speed ***(c – vcos(ϕ))***, in Einstein's Doppler formula, is in direct conflict with both the strong version of Einstein's postulate of constancy of speed of light, in vacuum, and Einstein's formula, for the composition of velocities, as well. And that is because, in the latter case, light is moving with ***(c – vcos(ϕ))***, relative to the measuring observer's co-ordinate system, itself, which is supposed to be the exclusive domain of the strong version of the second postulate and the velocity-addition formula of Einstein's special relativity.

II. Einstein's Doppler formula, as expressed in terms of light wavelength, predicts that, in the special case, in which an observer is moving, at right angles, "*with velocity* ***v*** *relatively to an infinitely distant source of light"* of wavelength ***λ***, the observed wavelength, ***λ'***, is in accordance with the following Doppler equation:

$$\lambda' = \lambda\sqrt{1-\frac{v^2}{c^2}}$$

which conflicts, sharply, with the calculated result, for the Ives-Stilwell experiment, on the basis of the following Doppler equation:

$$\lambda' = \frac{\lambda}{\sqrt{1-\frac{v^2}{c^2}}}$$

in the special case, in which ϕ is equal to ***90º***.

6. Einstein's Aberration of Light:

Einstein stated, in his ***1905*** article entitled: **"On the Electrodynamics of Moving Bodies"**, that the formula, below, "*expresses the law of aberration in its most general form*":

$$\cos(\phi') = \frac{\cos(\phi) - v/c}{1-\frac{v\cos(\phi)}{c}}$$

where ϕ' is the angle between "*the wave-normal (direction of the ray) in the moving system and the connecting line "source-observer"*"; ϕ is the angle between "*the velocity of the observer referred to a system of co-ordinates which is at rest relatively to the source of light*" and the connecting line *"source-observer"*; and v is the relative velocity between the observer's co-ordinate system and the co-ordinate of the light source.

And so, in the case, in which ϕ is equal to 90^o, the above equation becomes, simply:

$$\cos(\phi') = -\frac{v}{c}$$

That is one one hand. On the other hand, according to Bradley's law of light aberration, by contrast, in the special case, in which the observer's co-ordinate system is moving with the velocity v, relative to the stationary co-ordinate system of the light source, the actual position of the light source θ', has to be determined, within the framework of the classical wave theory, as well as within the framework of the ballistic new-source theory, and the framework of the ballistic elastic-impact theory,, through the use of the following equation:

$$\sin(\Delta\theta) = \sin(\theta' - \theta) = \frac{v}{c}\sin(\theta)$$

where θ' is the actual position of the light source; and θ is the apparent position of the shifted image of the same light source, as measured in the moving co-ordinate system of the observer.

However, in the general case, in which both the co-ordinate system of the observer and the co-ordinate system of the light source are moving with the velocity v, and the velocity v_s, respectively, the mathematical formula, for calculating Bradley's light aberration, within the framework of the classical wave theory, remains the same, as in the special case, above. That is on one hand.

On the other hand, the mathematical formula of the ballistic new-source theory, for computing Bradley's aberration of light, in the general case, takes the following form:

$$\sin(\Delta\theta) = \frac{v\sin(\theta)/c}{\sqrt{1 + \frac{v_s^2}{c^2} - 2\frac{v_s}{c}\cos(\beta)}}$$

where β is the angle, between the velocity vector of emitted light c, and the velocity vector of the co-ordinate system of the light source v_s, as measured inside the same co-ordinate system of the light source.

While, by comparison, the mathematical formula of the ballistic elastic-impact theory, for calculating Bradley's aberration of light, in the same general case, takes the following form:

$$\sin(\Delta\theta) = \frac{v\sin(\theta)/c}{\sqrt{1-\left(\frac{v_s}{c}\sin(\alpha)\right)2} - \frac{v_s}{c}\cos(\alpha)}$$

where α is the angle, between the direction of the velocity resultant of emitted light and the velocity vector of the co-ordinate system of the light source, as measured from inside the moving co-ordinate system of the observer.

And therefore, the main difference between the above mathematical formulas of the two ballistic theories, for calculating Bradley's light aberration, is that, in the latter, the measured direction α of. the resultant of c and v_s is utilized, directly; while, in the former, the measured direction has to be processed further, in order to deduce, from it, the initial direction β of emitted light.

Also, it should be noted, within the current context, that the shifted position of the light source, due to the aberration of light, has no effect, at all, on the angle between the direction of emitted light and the velocity vector of the light source, as reckoned from inside the moving co-ordinate system of the measuring observer.

And moreover, for typical astronomical speeds, the differences between the numerical results, as computed by using the above two formulas, in the general case of a moving light source, and the formula, in the spacial case of a light source at rest, is, quite, small. For example, for a directly receding star at a speed of ***300*** km/s, the the amount of stellar aberration, as computed, in the moving reference frame of Earth, by using the two mathematical formulas, above, is about ***0.02*** arc-second greater than the amount of stellar aberration, given by the mathematical formula, in the special case of a light source, at rest; and less by about ***019*** arc-second, in the case of direct approach, with the same speed.

As compared with Bradley's formula, for calculating the aberration of light, in the special case of a moving observer and light source at rest, Einstein's formula, for computing aberration of light, within the theoretical framework of his special relativity, exhibits the following major flaws:

- The indivisibility of the relative velocity, between the observer and the light source, as mandated, within the context of Einstein's special theory, by the postulate of restricted relativity, muddles, necessarily, the notion of actual velocities, and makes it all but impossible to define the observer's velocity vector, in the case under discussion, in a clear and, mathematically, precise manner.

- Computing the angle of the apparent position of the light source ϕ', between "*the wave-normal (direction of the ray) in the moving system and the connecting line "source-observer"*"; in terms of the angle of the actual position of the same light source ϕ, between "*the velocity of the observer referred to a system of co-ordinates which is at rest relatively to the source of light*" and the connecting line *"source-observer"*, is impractical; since, by definition, in the observer's moving co-ordinate system, only the angle of the apparent position of the light source ϕ' can, in point of fact, be observed and measured.

- Because Einstein's formula of aberration of light has been built, upon a displacement triangle, two sides of which equal to ***(ct)*** and ***(vt)***, respectively, the apparent position of the light source, as predicted on the basis of it, is being shifted to the backward direction of the velocity vector of the observer's co-ordinate system; instead of being shifted to the forward direction of the same velocity vector of the same co-ordinate system of the observer, as predicted on the basis of the aforementioned Bradley's mathematical formula, which has been constructed, right from the start, upon a velocity triangle, the two sides of which equal to ***v*** and ***c***, respectively.

- Due to the fact that the above mathematical formula of A. Einstein is based on the displacement triangle of ***(ct)*** and ***(vt)***, his own aberration of light, as calculated in accordance with it, is, actually, a special sort of parallax, caused, necessarily, by the displacement, made by the observer's co-ordinate system, during the travel time of light ***t***, from the light source to the moving co-ordinate system of the observer. And, consequently, Einstein's aberration of light has nothing to do, at all, with actual optical phenomenon of Bradley's light aberration.

7. Einstein's Train Thought Experiment:

Einstein had, presumably, to come up, at a later time, with his train thought experiment, for the sole purpose of sharpening the relatively dull arguments, for relative simultaneity, in his ***1905*** article, and demonstrating further how the notion of relative simultaneity, within the framework of his own special theory of relativity, should be precisely defined, theoretically worked out, and successfully proven, beyond the reasonable doubt, to be, physically, meaningful, and to hold true, in all co-ordinate systems, in uniform linear motion, relative to each other.

At any rate, in the thought experiment, under investigation, as described, in Einstein's book entitled, "***Relativity: The Special and General Theory***", a point O is located midway between the two points, A and B, along a railway station. At the exact moment of time — $t_0 = 0$ — at which the leading end of a train, traveling with the uniform linear speed ***v***, coincides with the point A, its trailing end coincides with the point B, and its middle point coincides with the point O, two flashes of light are assumed to be sent, simultaneously, with respect to the stationary reference frame of the railway station.

And subsequently, in the stationary reference frame of the railway station, the light flash A and the light flash B have to arrive at the point O, as measured by the stationary observer, at the same time; i.e.,

$$t_{AO} = t_{BO} = \frac{AO}{c} = \frac{BO}{c}$$

where t_{AO} is the travel time of the light flash A, from the point A to the point O; and t_{BO} is the travel time of the light flash B, from the point B to the point O. with respect to the stationary reference frame of the railway station.

However, in accordance with the weak version of Einstein's postulate of constancy of speed of light, in vacuum, according to which any *"ray of light moves in the "stationary" system of co-ordinates with the determined velocity c, whether the ray be emitted by a stationary or by a moving body"*, the observer, inside the reference frame of the moving train, has to measure a shorter travel time of the light flash A, from the point A to the point O, than the travel time of the light flash B, from the point B to the point O, in conformity with the following relation:

$$\left(t'_{AO} = \frac{AO}{c+v}\right) < \left(t'_{BO} = \frac{BO}{c-v}\right)$$

where t'_{AO} is the travel time of the light flash A, from the point A to the point O; and t'_{BO} is the travel time of the light flash B, from the point B to the point O, with respect to the reference frame of the moving train.

And, correspondingly, A. Einstein arrived, in the aforementioned book of his, at the exact same conclusion, he had made years earlier, in his ***1905*** article entitled: **"On the Electrodynamics of Moving Bodies"**, which stated, unequivocally, that "*we cannot attach any absolute signification to the concept of simultaneity, but that two events which, viewed from a system of co-ordinates, are simultaneous, can no longer be looked upon as simultaneous events when envisaged from a system which is in motion relatively to that system*".

Nevertheless, the drawn conclusion, above, is, as a matter of fact, fundamentally, flawed, due to the major oversight and the clear failure, on Einstein's part, to take into consideration, in the scenario, under discussion, the Doppler blue and red shifts, which have the following, highly, significant effects, on the travel time of the light flash A, from the point A to the point O, as well as on the travel time of the light flash B, from the point B to the point O, as measured by the observer, in the reference frame of the moving train:

1. The Doppler blue shift decreases, necessarily, the travel time of the light flash A, in the backward direction of the velocity vector ***v***, from the point A to the point O, as measured in the reference frame of the moving train, in accordance with this equation:

$$t'_{AO} = \frac{ct_{AO} - vt'_{AO}}{c} = \frac{t_{AO}}{\left(1+\frac{v}{c}\right)}$$

   where t'_{AO} is the travel time of the light flash A, from the point A to the point O, as measured in the reference frame of the moving train; and t_{AO} is the travel time of the same light flash A, from the point A to the point O, as measured in the stationary reference frame of the railway station.

2. The Doppler red shift increases, necessarily, the travel time of the light flash B, in the forward direction of the velocity vector ***v***, from the point B to the point O, as measured in the reference frame of the moving train, in accordance with the following equation:

$$t'_{BO} = \frac{ct_{BO} + vt'_{BO}}{c} = \frac{t_{BO}}{\left(1-\frac{v}{c}\right)}$$

where t'_{BO} is the travel time of the light flash B, from the point B to the point O, as measured in the reference frame of the moving train; and t_{BO} is the travel time of the light flash B, from the point B to the point O, as measured in the stationary reference frame of the railway station.

And it follows, therefore, that, by factoring out, properly, and removing, in the right manner, the effects of the Doppler blue shifts and the Doppler red shifts, on the time measurements, in question, the observer, in the reference frame of the moving train, should be able to conclude, straight away, that the light flash A and the light flash B have been emitted, simultaneously, at the one and the same moment of time, as A. Einstein had assumed both to be, in his train thought experiment, from the outset.

8. Dingle's Clock Paradox of Relativity:

In his book entitled "***Science at the Crossroads***", H. Dingle stated that, in the form of a concise argument, the clock paradox of relativity is as follows: "*According to the special theory of relativity, two similar docks, A and B, which are in uniform relative motion and in which no other differences exist of which the theory takes any account, work at different rates. The situation is therefore entirely symmetrical, from which it follows that if A works faster than B, B must work faster than A. Since this is impossible, the theory must be false*".

Also, in the above book of his, H. Dingle reformulated his clock paradox of relativity, in the form of a simple question, along these lines: "*According to the special relativity theory, as expounded by Einstein in his original paper, two similar, regularly-running clocks, A and B, in uniform relative motion, must work at different rates. In mathematical terms, the intervals, dt and dt', which they record between the same two events are related by the Lorentz transformation, according to which dt ≠ dt'. Hence one clock must work steadily at a slower rate than the other. The theory, however, provides no indication of which clock that is, and the question inevitably arises: How is the slower-working clock distinguished? The supposition that the theory merely requires each clock to appear to work more slowly from the point of view of the other is ruled out not only by its many applications and by the fact that the theory would then be useless in practice, but also by Einstein's own examples, of which it is sufficient to cite the one best known and most often claimed to have been indirectly established by experiment, viz. 'Thence' [i.e. from the theory he had just expounded, which takes no account of possible effects of acceleration, gravitation, or any difference at all between the clocks except their state of uniform motion] 'we conclude that a balance-clock at the equator must go more slowly, by a very small mount, than a precisely similar clock situated at one of the poles under otherwise identical conditions'. Applied to this example, the question is: what entitled Einstein to conclude from his theory that the equatorial, and not the polar, clock worked more slowly?*" ***[Ref. #10.2]***.

And so, it should be, quite, obvious that Dingle's clock paradox of relativity is based, squarely, upon the fundamental contradiction, within the framework of the special theory of A Einstein, between the relativity principle of H. Poincaré, on one hand, and the time dilation of H. Lorentz, on the other hand.

In particular, it's viable and possible, in theory, for the hypothetical time dilation of H. Lorentz, to be employed, directly, in dismantling, first of all, and, then, discarding, altogether, almost, every facet of the relativity principle of H. Poincaré, except, perhaps, its least consequential feature, according to which laws of nature have the same form, in all in co-ordinate systems, in uniform linear motion, relative to each other.

Although, as demonstrated earlier, time dilation, within the context of Einstein's special relativity, can be measured, directly, neither from inside the stationary co-ordinate system, nor from inside the moving co-ordinate system, its numerical values, in each and every case, can be, easily, computed, through the use of Lorentz transformation. And subsequently, those calculated values of time dilation can be utilized for taking apart the various aspects of the postulate of restricted relativity, step by step, and one aspect, at a time:

I. It's very easy, as H. Dingle pointed out, to dig out the intrinsic asymmetries of time dilation, by, simply, calculating "*the intervals, dt and dt', which they record between the same two events*", on the basis of the Lorentz transformation, "*according to which* $dt \neq dt'$ "; in order to prove, beyond a shadow of a doubt, the underlying incompatibility, between time dilation and the basic feature of Einstein's postulate of restricted relativity, which requires, at the very least, that quantitative spatial and temporal variations — all the way down to the basic spatial and temporal units — implied by the Lorentz transformation, must have, at all times, the same numerical values, as computed in each one of any pair of co-ordinate systems in uniform linear motion, relative to each other.

II. Dingle's clock paradox of relativity becomes even more lethal to Einstein's postulate of restricted relativity, in all cases, in which three co-ordinate systems are assumed, in advance, to be in uniform linear motion, relative to each other. Take, for example, the simple case, in which two co-ordinate systems, A and B, are moving, at uniform linear speeds, ***0.75c*** and ***0.25c***, respectively, relative to a third co-ordinate system, C, at rest. As computed in the stationary co-ordinate system C, the amount of elapsed time, registered by the clock of the co-ordinate system A, is less, by a factor of ***0.6614***, and the amount of elapsed time, registered by the clock of the co-ordinate system B, is less, by a factor of ***0.9682***, than the amount of elapsed time, registered by the clock of the co-ordinate system C; i.e., the amount of elapsed time, registered by the clock of the co-ordinate system A is less by a factor of ***0.6831*** than the amount of elapsed time, registered by the clock of the co-ordinate system B, upon the reunion of the two co-ordinate systems, in the same place. While, at the same time, when the relative speed of ***0.8421c***, between the co-ordinate system, A and B, as calculated by using Einstein's formula, for the composition of velocities, is employed in the calculations, the predicted amounts of elapsed time, as calculated in either one of the two co-ordinate systems, must appear, of course, to be equal and, exactly, the same, in compliance with Einstein's postulate of restricted relativity. But, upon reunion, it's supposed that, only, the clock of one of the two co-ordinate systems would show the predicted amount. For the sake of argument, let the amount of elapsed time, as registered by the clock of the co-ordinate system A, be the one, which happens, by chance, to be less, by a factor of ***0.5393*** than the amount of elapsed time, registered by the clock of the co-ordinate system B. "*Applied to this example, the question*", therefore, is the following: Which of the two equally valid numerical results, within the context of Einstein's special theory of relativity, would have to be displayed by the clock of the co-ordinate system A, upon the reunion with the clock of the co-ordinate system B, in the one and the same place?

III. Dingle's clock paradox of relativity, certainly, becomes much more destructive and fatal to the remaining features of Einstein's postulate of restricted relativity, in all cases, in which four co-ordinate systems are assumed to be in uniform linear motion, relative to each other. Say, for instance, a spacecraft C, moving with a uniform linear velocity of ***0.5c***, relative to Earth, fires a space probe A, in the direction of its velocity vector, at a uniform linear velocity of ***0.7c***, and a space probe B, in the opposite direction of its velocity vector, at a uniform linear velocity of **0.8c**, both relative to itself. And correspondingly, the calculation, performed on the spacecraft, predicts any amount of elapsed time, displayed by the atomic clock of the space probe B, is less than any amount of elapsed time, displayed by the atomic clock of the space probe A, by a factor of about ***0.8402***, upon the reunion in one place. While, by contrast, the calculation, performed on Earth, predicts any amount of elapsed time, displayed by the atomic clock of the space probe B, is greater than any amount of elapsed time, displayed by the atomic clock of the space probe A, by a factor of about ***1.7463***, upon the reunion in one place. "*Applied to this example, the question*", therefore, is this: Which of these two equally valid numerical results, within the framework of Einstein's special theory of relativity, would have to be displayed by the atomic clock of the space probe A, upon the reunion with the atomic clock of the space probe B, in the one and the same place?

In short, therefore, by digging out and exposing its fundamental incompatibility with time dilation, as computed on the basis of the Lorentz transformation, for two, three, or more co-ordinate systems, in uniform linear motion, relative to each other, the Dingle's clock paradox of relativity, for all intents and purposes, does away with Einstein's postulate of restricted relativity, for good and all. And, as a result, it's either time dilation has to be deemed chimeric and illusory; or Einstein's postulate of restricted relativity, along with his formula, for the addition of velocities, both have, in the final analysis, to be discarded, entirely; and, concurrently, the built-in luminiferous aether of the Lorentz transformation has to be imported, and, somehow, implanted into the structure of Einstein's theory of special relativity.

9. Concluding Remarks:

Even though, it has been, widely, presumed, since the early years of its public debut, that everything, in Einstein's special theory of relativity, follows, in a deductive manner, from the postulate of restricted relativity and the postulate of constancy of speed light, in vacuum, upon close examination, nothing, in it, seems to transpire — not even remotely — or to come out, logically, anyhow, in that way:

- Neither Einstein's postulate of restricted relativity, nor his postulate of constancy of speed of light, in vacuum, is self-evident, self-consistent, simple, independent, and complete. The first postulate is composed of loosely related conjectures, inferences, and hypotheses. And the second postulate has two different versions, the stronger of which defies common sense, and breaks, almost, every basic rule, in kinematics, mathematics, and formal logic.

- The long-standing and de-facto distinction, within the framework of Einstein's theory of special relativity, between relative velocities of light, with respect to the moving co-ordinate system, as reckoned from the stationary co-ordinate system, to which the weak version of the postulate of constancy of speed of light, in vacuum, and the Galilean transformation have to apply, and between relative velocities of light, with respect to each co-ordinate system, as reckoned from inside the co-ordinate system, itself, to which the strong version of the postulate of constancy of speed light, in vacuum, and Einstein's formula, for the composition of velocities have to apply, is, in every respect, an artificial, arbitrary, and, theoretically, unjustifiable distinction.

- The supposition, according to which relative uniform motion, between two co-ordinate systems, or two physical objects, can, actually, shorten the abstract dimensions of space, and slow down the passage of time, is, probably, one of the farthest fancies, from deductive reasoning, as well as inductive reasoning, an overactive human imagination could, possibly, come up with. And as such, nothing logical could, feasibly, come out of it. Nevertheless, it's, virtually, impossible, anyway, for the two speculative notions of length contraction and time dilation, to, somehow, be deduced, in a Euclidean way, from any given set of postulates, regardless of whether those postulate are coherent and consistent with each other, or not.

- The whole arrangement of rods and clocks, as described in Einstein's ***1905*** article entitled: **"On the Electrodynamics of Moving Bodies"**, is groundless; since length contraction and time dilation can be observed or measured, directly, neither from inside his co-ordinate system K, nor from inside his co-ordinate system k.

- The Lorentz transformation predicts different speeds of light, in different directions, throughout the moving co-ordinate system, as measured from inside the reference frame of the same moving co-ordinate system. And hence, the Lorentz transformation can neither come out, from Einstein's postulate of constancy of speed of light, in vacuum, nor coexist, in harmony, with it, within the reference frame of the same moving co-ordinate system, in any shape or form, at all.

On the whole, therefore, deep down, the two theoretical notions of length contraction and time dilation, along with the Lorentz transformation, itself, have been, essentially, assumed, in advance, within the framework of Einstein's special theory of relativity, in almost the same way, they have been assumed earlier, within the framework of Lorentz aether theory.

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