HOW THE SPECIAL RELATIVITY EQUATIONS ARE FUDGED!

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ABSTRACT:

This work presents an indisputable mathematical demonstration revealing that the Special Relativity equations are fudged. It also shows that the actual equations resulting from Einstein’s assumptions are inconsistent, and lead to mathematical inconsistency, falsifying the special relativity predictions.

CONTENTS:

1. Special Relativity Development Motivation

Michelson-Morley Experiment

- The Michelson-Morley experiment [1] was designed in the late 19th century, following Maxwell's EM wave theory of light, to detect the ether (a conjectured light wave propagation medium) 'wind' created by the earth motion through the ether-filled space.
- The results of the experiment were puzzling, as the Earth motion through the ether couldn't be detected—on the basis that the speed of light should vary depending on whether light is moving in the same or opposite direction of the Earth motion relative to the ether.
- Einstein did not reference the experiment in his original paper (1905) on relativity, but admitted years later that he had been aware of it at the time of writing his paper.

2. Special Relativity Development Basis

- The Special Relativity evolved from Einstein's assumption that the speed of light in the empty space is constant in all inertial reference frames [2, 3]. It always propagates at the constant speed c relative to any "inertial" observer.
- This assumption implies that the speed of light, c, in empty space is not referred to any preferred frame of reference (e.g., the ether). Thus the ether becomes unnecessary, and light can propagate without any medium. (When light encounters a medium, it may be slowed down, reflected, or absorbed.)
- With the constancy of the speed of light assumption, and the elimination of the ether, the Michelson-Morley experiment results can be justified from the Earth's rest frame perspective, since the speed of light is no longer varying with the light direction of travel relative to the previously assumed ether "wind" direction.

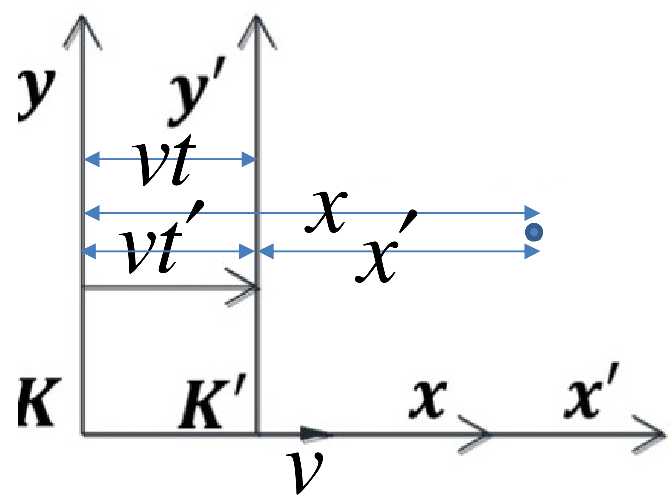
Special Relativity Development Basis (Contd.)

- In addition to the constancy of the speed of light assumption, Einstein also relied, in his formulation of the Special Relativity, on the principle that all inertial frames are equivalent in so far as the applicability of the laws of physics are concerned [2, 3].
- In other words, the formulas governing the laws of physics expressed in a frame of reference coordinate system will take the same form with respect to the coordinate system of another inertial frame in relative motion with respect to the former.
- Another unjustified assumption made by Einstein was considering time to be a fourth dimension. This is indirectly implied in his expression of the time transformation as a function of time and space coordinates [2, 3]; thus imposing a space coordinate dependence on the transformed time.

3. Special Relativity Straight Forward Formulation from Einstein's Assumptions

- Consider two inertial reference frames, $K(x, y, z, t)$ and $K'(x', y', z', t')$, in relative uniform motion along the overlapped x- and x'-axes, at a speed v.
- The transformation relating the space and time coordinates of the two frames is to be determined.
- The Galilean transformation doesn't work under the constancy of the speed of light:

$$\left| \begin{matrix} x' = x - vt \\ x = x' + vt' \end{matrix} \right\rangle t = t'$$



Applying the consequence $x = ct \Leftrightarrow x' = ct'$ of the constancy of the speed of light on the Galilean transformation, we get $t' = t - vt/c$, yielding $v = 0$ for $t \neq 0$, since $t = t'$.

Special Relativity Straight Forward Formulation from Einstein's Assumptions (contd.)

- Therefore a different linear transformation is needed under the constancy of the speed of light assumption (CSL) :

  Relative to K $\boxed{x' = \gamma x + \beta t \;\; ; \;\; y' = y \;\; ; \;\; z' = z}$

- For $x' = 0;\ x = vt \Rightarrow 0 = \gamma vt + \beta t \Rightarrow \beta = -\gamma v\ \ (t \neq 0)$

  Leading to
$$x' = \gamma\left(x - vt\right)$$

- And for $x = ct;\ x' = ct' \Rightarrow ct' = \gamma\left(ct - vt\right) \Rightarrow$

$$t' = \gamma\left(t - \frac{vt}{c}\right) \;\Rightarrow\; t' = \gamma t\left(1 - \frac{v}{c}\right)$$ (direct result of the CSL)

which can be forced to take the form of a function of t and x,
if we arbitrarily substitute $x = ct\ \ (x \neq 0)$ in its second term, yielding

$$t' = \gamma\left(t - \frac{vx}{c^2}\right)$$

Special Relativity Straight Forward Formulation from Einstein's Assumptions (contd.)

- Since K is traveling at a speed of $-v$ with respect to K'
- And owing to the relativity principle implying a transformation symmetry, we can write, relative to K'

$$x = \gamma\left(x' + vt'\right)$$

$$t = \gamma\left(t' + \frac{vx'}{c^2}\right)$$

With $t' \neq 0,\ x' \neq 0,$ and $x' = ct',$ by symmetry.

- Substituting $x' = \gamma\left(x - vt\right)$ and $t' = \gamma\left(t - \frac{vx}{c^2}\right)$ in $t = \gamma\left(t' + \frac{vx'}{c^2}\right)$, leads after simplification to

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

Hence, the Lorentz transformation. However, the time equation is shown to be based on the hidden restriction $x = ct$.

4. Special Relativity Misleading Equations

- In a simple conclusion, the assumed transformation equation

$$x' = \gamma x + \beta t$$

along with the conversions:

For $x' = 0;\ x = vt$

$x = ct \Leftrightarrow x' = ct'$ (consequence of CSL)

and the principle of relativity implication on the transformation symmetry, lead to

$$\left. \begin{cases} x' = \gamma\left(x - vt\right) \\ t' = \gamma\left(t - \dfrac{vt}{c}\right) = \gamma t\left(1 - \dfrac{v}{c}\right) \end{cases} \right\} \quad \gamma = \frac{1}{\sqrt{1 - \dfrac{v^2}{c^2}}}$$

and to the misleading equation $t' = \gamma\left(t - \dfrac{vx}{c^2}\right)$

obtained falsely by substituting $x = ct$ $(t = x/c)$ in the term vt/c.

Special Relativity Misleading Equations (contd.)

- The simply derived Lorentz transformation

$$x' = \gamma(x - vt)$$

$$t' = \gamma\left(t - \frac{vx}{c^2}\right)$$

is therefore misleading, since the condition that $x = ct$ is embedded in the time transformation equation. The same applies to the inverse transformation (i.e. $x' = ct'$ is embedded in the inverse time transformation)

$$t = \gamma\left(t' + \frac{vx'}{c^2}\right)$$

This fact leads to a basic mathematical contradiction:

5. Special Relativity Contradictory Equations

- Indeed, substitute

$$t' = \gamma\left(t - \frac{vx}{c^2}\right) \quad \text{into} \quad t = \gamma\left(t' + \frac{vx'}{c^2}\right) \Rightarrow$$

$$t = \gamma\left(\gamma\left(t - \frac{vx}{c^2}\right) + \frac{vx'}{c^2}\right) \Rightarrow$$

$$t\left(\gamma^2 - 1\right) = \frac{vx}{c^2}\left(\gamma^2 - \frac{\gamma x'}{x}\right)$$

- Since, as shown earlier the time transformation equation and its inverse are restricted to the conditions $x = ct$ and $x' = ct'$, then the above equation can be written as:

.../...

Special Relativity Contradictory Equations (contd.)

$$t\left(\gamma^2 - 1\right) = \frac{vx}{c^2}\left(\gamma^2 - \frac{\gamma t'}{t}\right)$$

- Now, according to the time transformation equation $t' = \gamma\left(t - \frac{vx}{c^2}\right)$,

for $t' = 0,$ we have $t = vx / c^2 \quad (t \neq 0).$ Therefore, the above combined equation, derived from the Lorentz transformation, leads to the contradiction

$$t\left(\gamma^2 - 1\right) = t\gamma^2 \;\Rightarrow\; 0 = 1.$$

- The above contradiction is a solid evidence of the invalidity of the Special Relativity equations.

6. Unveiling Special Relativity Formulation Error

- We have seen through a straightforward formulation of the Special Relativity transformation equations that the constancy of the speed of light assumption (expressed as $x = ct \Leftrightarrow x' = ct'$), along with the transformation symmetry implied by the relativity principle lead to the transformation equations

$$\begin{Bmatrix} x' = \gamma(x - vt) \\ t' = \gamma t\left(1 - \dfrac{v}{c}\right) \end{Bmatrix} \quad \gamma = \frac{1}{\sqrt{1 - \dfrac{v^2}{c^2}}}$$

and the time transformation can misleadingly be expressed as

$t' = \gamma\left(t - \dfrac{vx}{c^2}\right)$ by fudging the equation term vt/c by substituting

t with $x/c \quad (x = ct)$, which actually leads to $0 = 1$, as shown earlier!

Unveiling Special Relativity Formulation Error (contd.)

Now the self-imposed question is: why there appears to be no fudged equation in the main stream derivation of the special relativity equations (the Lorentz transformation equations)?

- The answer is by making formulation assumptions that will force the solution to take the form of misleading equations, when ignoring their being restricted to these assumptions.
- In fact, a consequence of the constancy of the speed of light assumption is that for $x = ct \Leftrightarrow x' = ct'$, which as we have shown earlier not compatible with the Galilean transformation $(x' = x - vt)$. Then, it would be prudent to assume a linear transformation of the form $x' = ax + bt$, which was shown to lead to, under the constancy of the speed of light and relativity principle, the transformation equations

$$\begin{Bmatrix} x' = \gamma\left(x - vt\right) \\ t' = \gamma t\left(1 - \dfrac{v}{c}\right) \end{Bmatrix} \qquad \gamma = \frac{1}{\sqrt{1 - \dfrac{v^2}{c^2}}}$$

Unveiling Special Relativity Formulation Error (contd.)

- However, the assumption made by Einstein on the transformation equations is that the time transformation should be a linear function of x and t [2]:

$$x' = ax + bt$$
$$t' = gx + ht$$
$$y = y';\ z = z'$$

- Thus imposing the dependency of the time transformation on the x-coordinate (in other words making time another dimension coordinate).
- In the main stream derivation of the Lorentz transformation equations, the above equation parameters, *a, b, g,* and *h,* are to be determined under the constancy of the speed of light assumption expressed as

$$x^2 - x'^2 = c^2t^2 - c^2t'^2$$

which implies the basic constancy of the speed of light consequence $x = ct \Leftrightarrow x' = ct'$ used in our earlier simple derivation. .../...

Unveiling Special Relativity Formulation Error (contd.)

- However, it also implies $x = ct$ and $x' = ct'$, since this leads to

$$x^2 = c^2t^2 \text{ and } x'^2 = c^2t'^2 \Rightarrow$$

$$x^2 - x'^2 = c^2t^2 - c^2t'^2$$

$x = ct$ and $x' = ct'$ obviously satisfy the above Einstein's CSL equation.

- So basically, the constancy of the speed of light as expressed by Einstein, implies both:

$$x = ct \Leftrightarrow x' = ct' \text{ AND } x = ct \;\&\; x' = ct'.$$

$$x = ct \Leftrightarrow x' = ct' \text{ results in } t' = \gamma t\left(1 - \frac{v}{c}\right) \text{ and } t = \gamma t'\left(1 + \frac{v}{c}\right),$$

while $x = ct$ & $x' = ct'$ provide the x and x' terms in the former time transformation equations, in line with the sought equation $t' = ht + gx$, yielding the Lorentz transformation misleading equations.

Unveiling Special Relativity Formulation Error (contd.)

- Hence, solving for the parameters in the assumed linear transformation equations

$$x' = ax + bt$$
$$t' = gx + ht$$
$$y = y';\ z = z'$$

under Einstein's constancy of the speed of light equation

$$x^2 - x'^2 = c^2t^2 - c^2t'^2$$

will inevitably lead to the misleading Lorentz time transformation equations,

$$t' = \gamma\left(t - \frac{vx}{c^2}\right) \text{ and } t = \gamma\left(t' + \frac{vx'}{c^2}\right)$$

unnoticeably fudged with the restrictions $x = ct$ and $x' = ct'$ on the space coordinates. In other words, the x and x' in the above equations are indirectly replacing ct and ct', respectively, which will result in the contradiction: $0 = 1$, as shown earlier.

Unveiling Special Relativity Formulation Error (contd.)

- A different formulation approach was used by Einstein in his original 1905 paper [3] on Special Relativity to derive the Lorentz transformation equations. Yet the same fudging of the equations can be revealed.
- In fact, Einstein started his derivation by forcing a space dependence on the time transformation, by assuming the transformed time τ in the traveling system $k(\xi,\eta,\zeta,\tau)$ to be a function of the coordinates $x, y, z,$ and t of the stationary system K. He defined $x' = x - vt$ in K.
- He then derived the equation $\tau = a\left(t - \frac{v}{c^2 - v^2}x'\right)$, and by setting

$$t = \frac{x'}{c-v} \text{ for } \tau = \frac{\xi}{c}, \text{ he got } \xi = ac\left(\frac{x'}{c-v} - \frac{v}{c^2 - v^2}x'\right); \ \xi = a\frac{c^2}{c^2 - v^2}x'$$

- However, this is an invalid partial substitution of t with $\frac{x'}{c-v}$,

since the x' term is embedding t in it. Here lies the trick!

Unveiling Special Relativity Formulation Error (contd.)

- This trick can be exposed by replacing x' with its value $x - vt$ in Einstein's equation

$$\tau = a\left(t - \frac{v}{c^2 - v^2}x'\right), \text{ to get } \tau = \frac{a}{c^2 - v^2}\left(c^2 t - vx\right).$$

Now, for $\tau = \dfrac{\xi}{c}$; $t = \dfrac{x'}{c - v} = \dfrac{x - vt}{c - v}$ or $t = \dfrac{x}{c}$. Hence the above equation yields $\dfrac{\xi}{c} = \dfrac{a}{c^2 - v^2}\left(\dfrac{c^2 x}{c} - vx\right) \Rightarrow \xi = \dfrac{ac^2}{c^2 - v^2}\left(x - \dfrac{vx}{c}\right)$;

which will yield Einstein's equation $\xi = a\dfrac{c^2}{c^2 - v^2}x'$ if and only if the term $\dfrac{x}{c}$ is arbitrarily replaced with t, i.e. by randomly using $x = ct$ in the second term, which results in $0 = 1$, as shown earlier!

Unveiling Special Relativity Formulation Error (contd.)

- Furthermore, τ expression can be written as $\tau = a\left(t - \frac{x'}{(c-v)}\frac{v}{(c+v)}\right)$.

  And for $\tau = \xi / c$ ($\xi = c\tau$) we have $\frac{x'}{c-v} = t \Rightarrow \xi = ac\left(t - \frac{tv}{(c+v)}\right)$,
  instead of $\xi = a\frac{c^2}{c^2 - v^2}x'$. $\left(a = 1/\gamma = \sqrt{1 - v^2/c^2}\ \text{as turned out to be.}\right)$
  Which leads to $\xi = \gamma ct\left(1 - \frac{v}{c}\right)$ and $\tau = \gamma t\left(1 - \frac{v}{c}\right)$,
  that can yield the Lorentz transformation, if and only if

  $x = ct$ and $\xi = c\tau$, which results in $0 = 1$ as shown earlier!

- Another flaw: Einstein noted that $x' = x - vt$ is independent of time. Yet he got $\xi = a\,c^2 x' / (c^2 - v^2)$ that must accordingly be independent of time, contradicting the final equation $\xi = \gamma(x - vt)$, which, for instance yields $\xi = -\gamma vt$ for $x = 0$ (a time-dependent ξ)!

7. Unviability of the Constancy of the Speed of Light

- Now, are the straight forward transformation equations

$$\begin{Bmatrix} x' = \gamma(x - vt) \\ t' = \gamma t\left(1 - \frac{v}{c}\right) \end{Bmatrix} \quad \gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$$

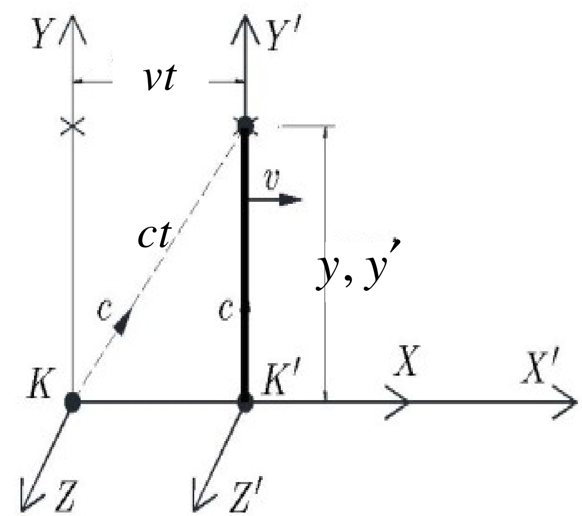
obtained from the constancy of the speed of light consequence $(x = ct \Leftrightarrow x' = ct')$, and the relativity principle viable?

- To answer this question, lets consider another consequence of the constancy of the speed of light:

For $y' = ct'$, or $y'^2 = c^2 t'^2$;

we have

$y^2 = c^2 t^2 - v^2 t^2$, and vice versa.



Unviability of the Constancy of the Speed of Light (contd.)

- Applying the above consequence $(y'^2 = c^2t'^2 \Leftrightarrow y^2 = c^2t^2 - v^2t^2)$ to the transformation $y' = y, \text{ or } y'^2 = y^2$ we get

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

which when compared the above equation of t':

$$t' = \gamma t\left(1 - \frac{v}{c}\right),$$

leads to

$$v = 0 \ (\gamma = 1) \text{ and } t = t'.$$

Therefore, the constancy of the speed of light assumption is deemed unviable.

REFERENCES

[1] A.A. Michelson, E.H. Morley, On the Relative Motion of the Earth and the Luminiferous Ether, Am. J. Sci. , 34 (1887) 333-345.

[2] A. Einstein, Einstein's comprehensive 1907 essay on relativity, part I, English translations in Am. Jour. Phys. 45 (1977), Jahrbuch der Radioaktivitat und Elektronik 4 (1907).

[3] A. Einstein, Zur elektrodynamik bewegter Körper, Annalen der Physik 322 (1905) 891–921.