the general science journal

A Final Fix to an Ancient Topic

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Abstract:

All experiments carried out during the last century, by various methods, trying to detect an ether wind resulted null or inconsistent. The best explanation found at the time to cope with the null results was given by physicists George Fitzgerald and Hendrik Lorentz who have attributed the result to a hypothetical contraction of all material bodies in the direction of their movement. And that has been the view point up to now. People need to understand that not always the word of authority is the best counselor. If the opinion issued seems weird, we should accept it with reserve but continue looking for a better explanation more appropriate for the context. Richard Feynman once said "***Science is the organized skepticism in the reliability of expert's opinion***". Often, when an opinion is issued, there still does not exist an ample knowledge about the subject in question and the opinion emitted is just the best possible given the knowledge base at the time. Academics often feel inhibited and discouraged to challenge the opinions of respected authorities and miss-interpretations keep propagating from generations to generations and end up being accepted as the final truth. Nobody argues about it anymore and any further knowledge that, in some way, derives from the flawed one will, necessarily, be flawed too.

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The above mentioned experiments have been extensively described in innumerous papers and can be readily obtained from various sources elsewhere and I see no necessity to describe any of them here again. It suffices to show that, in those experiments, it was expected that

$$\frac{d}{c+v} + \frac{d}{c-v} \neq \frac{2\cdot d}{c} \qquad (1)$$

where **d** represents the length of the interferometer arm and **d/c-v** = time it takes for light to travel distance **d** when going parallel and in the same direction as the measuring instrument; **d/c+v** = time it takes the light to travel distance **d** when going parallel and opposite to the direction of the measuring instrument; **2d/c** indicate the time it would take for light to travel the two way distance **2d** if the speed **v** had been zero.
The transverse measurements, being senseless, will not be taken into account since there is no transverse light aberration for a co-moving source and detector. In simple terms, the unexpected result came out to be

$$\frac{d}{c+v} + \frac{d}{c-v} = \frac{2\cdot d}{c} \qquad (2)$$

where it should have been

$$\frac{d}{c+v} + \frac{d}{c-v} = 2\cdot d\cdot\frac{c}{c^2 - v^2} \qquad (2a)$$

That implies that some mysterious correction factor δ had to be applied to validate Eq. (2) so as to make

$$\frac{d}{c+v}\cdot\delta + \frac{d}{c-v}\cdot\delta = \frac{2\cdot d}{c} \qquad (3)$$

solving Eq.3 for δ we obtain

$$\delta = 1 - \frac{v^2}{c^2} \qquad (4)$$

But, applying δ directly to Eq. 3 is obviously a mathematical tautology unless we find a good physical justification for it. Let's look for it!

It's a well known and proven fact that moving clocks and clocks immersed in a gravitational field slow down. The noticeable effect extends to an amazing great distance from the center of mass as has been experientially verified by Irwin Shappiro in 1964. The well known equation linking time to gravitation

$$t = t_0\cdot\sqrt{1 - \frac{Ss_r}{R}}$$ can also be written as $$t = t_0\cdot\sqrt{1 - \frac{2\cdot G\cdot M}{R\cdot c^2}} \qquad (5)$$

Where

Ss_r = Schwartzschild radius

G = Universal gravitational constant

M = Mass of gravitating object

R = Distance from gravitating mass

c = velocity of light

t_0 = time in the absence of a gravitational field

It must be stressed that this is a consequence of the principle of equivalence and conservation of energy and need not, necessarily, be explained as an effect of special or general relativity nor any curvature of space-time.

So, let's plug actual physical values into the the factor of $\mathbf{t_0}$ in Eq.(5) and compare it to $\boldsymbol{\delta}$ in Eq.(4):

$$G = 6.67390\cdot 10^{-11}\cdot\frac{m^3}{kg\cdot s^2}$$ $$M_s = 1.987864\cdot 10^{30}\cdot kg$$ <= Mass of the Sun (gravitating mass)

$$R_{orb} = 1.49595\cdot 10^{11}\cdot m$$ <= Earth mean orbital radius (distance from gravitating mass)

$$v_e = \sqrt{\frac{G\cdot M_s}{R_{orb}}}$$ <= Earth mean orbital speed $$v_e = 2.978\times 10^4\,\frac{m}{s}$$

Comparing the factor of $\mathbf{t_0}$ in Eq.(5) with δ in Eq. (4) it becomes obvious where the missing factor in Eq.(3) is to be found

$$\frac{\sqrt{1 - \frac{2 \cdot G \cdot M_s}{R_{orb} \cdot c^2}}}{1 - \frac{v_e^2}{c^2}} = 1.00000000000000$$

the mysterious factor in (3) came out to be

$$\delta = \sqrt{1 - \frac{2 \cdot G \cdot M_s}{R_{orb} \cdot c^2}} \qquad (6)$$

It can be seen that the arm length **d** of the the interferometer has no relation with the outcome of the experiment since only time delay is at stake, and it casts serious doubt upon the concept of length contraction. As it becomes apparent, you may attribute any value to **d** in the equations below.
Here, just to maintain dimensional coherence, We make d = 1 meter

$$d = 1 \cdot m$$

and

$$\left(\frac{d}{c + v_e} \cdot \delta + \frac{d}{c - v_e} \cdot \delta \right) - \frac{2 \cdot d}{c} = 0\,s \qquad (7)$$

or

$$\delta \cdot \left(\frac{d}{c + v_e} + \frac{d}{c - v_e} \right) = \frac{2 \cdot d}{c} \qquad (3\ \text{bis})$$

Quod **E**rat **D**emonstrandum

If you like, it can also be interpreted as a light velocity reduction due to an increase of space refraction index near to a gravitating mass.

$c - \delta \cdot c = 2.958 \frac{m}{s}$ in this case, just about 3 m/s slower than in gravitation free space!