

A Classical Replacement for Special Relativity

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"Nothing astounds us more than common sense" – Ralph Waldo Emerson.

Abstract:

The following analysis of the theory of special relativity proves conclusively that all formulas and physical effects devolve to those of classical mechanics and electrodynamics. Specifically, they identify relativistic effects as due to the Doppler modifications of wavelengths, frequencies and energies naturally occurring because of the finite velocity of light in the observer's frame of reference.

Introduction:

This paper is based on the findings covered in previous papers, which are **selectively** displayed herein. The findings resolve a conflict that has been raging for over 100 years. On the one hand, we have numerous authors that have identified the obvious logical anomalies in relativity theory. On the other, the corroborative results for many aspects of the theory found in experiments such as those in the Compton effect. To this point, the efforts have been divisive, rather than towards an attempt at resolution.

The answer to this problem has been documented in a series of papers, which have been publicly available for about 8 years. It is one thing to identify the problems in relativity theory, and quite another to **recognize the solution when it is provided**. No doubt its simplicity is a negative factor to the generations of physicists (both supporters and detractors of relativity theory) who have been led to believe that truth is to be found only in complexity. So, at the risk of being repetitive...

Basic Arguments:

The Michelson-Morley experiment confirms that light travels *in vacuo* independently at a constant, c , in each inertial frame of reference. The attempt was made by A. Lorentz and A. Einstein to **retain a universal aether** (despite Einstein's claim to the contrary) and establish **universality** for the speed of light. This was accomplished through the assumption that space, time and mass were modified in the direction of travel for an object in uniform linear motion. This assumption was adopted by the physics community, despite the obvious logical absurdities which ensued. The following shows precisely, that all of the so-called relativistic effects are simply explained through classical means.

Two postulates are adopted.

1. The laws of physics are the same in all inertial frames of reference (Galilean relativity).
2. The speed of light [c] is constant in equivalent inertial frames of reference but will vary according to the characteristics of the medium in which it propagates.

The first postulate was identified by C. A. Zapffe as **the First Principle of Physics**¹. This is entirely in keeping with its importance, since it is difficult to understand how any meaningful physical law could exist without it. By definition, it **rules out the possibility of universal absolutes with respect to physical space, time and mass.**

The second postulate is seen to be a **specific application of the first principle**². In contrast to Einstein's relativity theory, no limitation or universality with respect to the speed of light is implied.

The logical results derived from the second "postulate" have been detailed in a previous paper³ and listed here in the interest of completeness,

- Light propagates independently in all inertial frames of reference (Michelson-Morley experiment).
- It exhibits compound velocities as measured (not seen) by observers in relative motion.
- The existence of a medium specific to each reference frame is required.
- The speed is a characteristic of the medium only (and is also independent of frequency⁴)
- Its constancy defines the common attributes of the medium through which it moves.
- It is a disturbance of the medium. A localized "object" cannot simultaneously occupy multiple locations.
- The observed energy varies directly with relative motion between frames.
- There is no contiguity between frames of reference.

Regardless of any presumed underlying metric, the first principle guarantees the equivalence of space and time⁵ within each reference frame. It therefore logically follows that the speed of light in a moving system will be compounded by its motion ($c+v$ or $c-v$) as calculated (not seen) by a "fixed" observer.

Kinematics:

We begin with the assumption of isotropic space and uniform time for equivalent frames of reference.

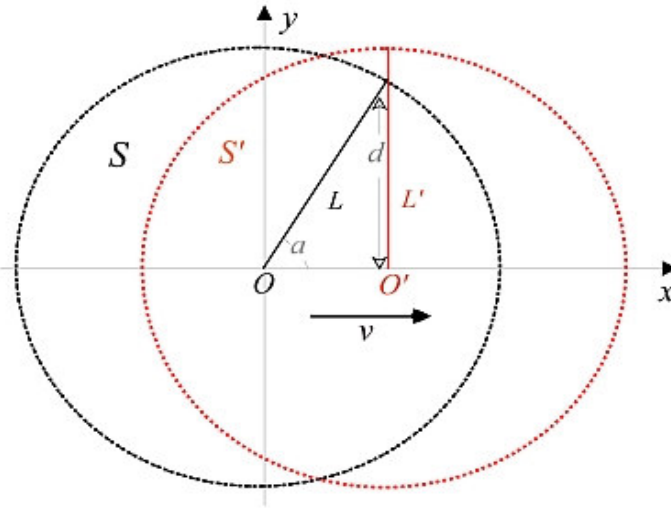


Figure 1

Assume an object travelling at v on the x axis emits a light beam in the y direction at $t = t' = 0$, at origin O in system S' , which is also observable in the fixed system S (Fig. 1). In time t_1 , it has traveled a perpendicular distance, $ct_1 = L'$ in the moving system, which has reached point $t_1v = O'$. Light has also travelled the distance, $L = L'$ in the fixed system, but at an angle of, $a = \arccos(v/c)$ to the x axis⁶. Explicitly, there is no difference in the length travelled by the ray in either system, only in its direction. This is guaranteed by the constancy of light. However, the perpendicular distance d subtending angle a is shorter in the fixed system -

$$d = L \sin(a) \equiv L(1-v^2/c^2)^{1/2} \equiv L[c^2(c^2-v^2)]^{1/2} \quad (1)$$

Thus, the “relativistic space contraction”, (since it is a second-order equation) can only be along the y axis rather than in the direction of travel (Pythagorean theorem). If we assumed a spherical distribution of light emitted at origin O (see dotted lines) at the same time as the light ray, the radius L would be the speed of light c and the distance d would represent the chord drawn perpendicular to the x axis from the moving object to the edge of the wave front in S . Obviously, the ray cannot exceed the distance of the wave front in the fixed system S as they both propagate at c .

Indeed, if **radiation** were emitted by the moving object, the ratio d/L would simply be the normal variation in wavelength and frequency calculated for a 90° Doppler effect measured in the fixed system of reference⁷. No modification in space, mass or time is required. It is merely the displacement of reference frames due to the constancy of light.

In the observer's "fixed" frame of reference, light has traveled a **simultaneous** distance of $c-v$ and $c+v$ relative to the moving object. **This can only apply to radiation**. In fact, as a previous paper⁸ clearly shows, the inverted Lorentz time transformation equations along with those of space, result in the standard equations for frequency and wavelength. The relativistic beta factor, $\beta = (1-v^2/c^2)^{1/2}$ is removed as it has been proven to be redundant⁹.

$$x = x' + vt' \quad x' = x - vt$$

$$t = t' + vx'/c^2 \quad t' = t - vx/c^2 \quad (2)$$

Since $x = ct$, and $x' = ct'$, the equations for time become:

$$t' = t(c-v)/c \quad t = t'(c+v)/c \quad (3)$$

The ratios of (3) indicate that **compound times have been substituted for compound velocities**. This cannot be justified by the dilation of time or asynchronous clocks as it should be evident from the equations that time and space must necessarily contract or expand in one-way motion, depending on the direction of travel. By inverting the equations in (3), the Lorentz time transformations become light frequencies and the space transformations of (2) become wavelengths.

$$f' = f / (1 [+ \text{ or } -] v/c)$$

$$\lambda' = \lambda (1 [+ \text{ or } -] v/c) \quad (4)$$

It is obvious that (Fig. 1) provides the basis for **stellar aberration**¹⁰ and its angular dependence on v/c . The only additional requirement is a discontinuous wavefront. The photon concept proposed by Einstein fills this requirement. Photons have a parallel in Huygens wavelets⁴ used to explain the sharp demarcation of light waves at surface boundaries.

Also the **Sagnac effect** is a direct consequence of compound velocities¹¹. Whether linear or uniform circular motion is involved, the distance (d) (or $d = 2\pi R$) gives the time taken as,

$$t_1 = d/(c-v) \quad t_2 = d/(c+v) .$$

$$t_1 - t_2 = 2dv/(c^2 - v^2) \quad (5)$$

Notice that the distance represented by $2\pi d$, when applied to a sub-atomic particle in motion gives precisely the magnitude required by **de Broglie's matter wave**, $\lambda = h/mv$ (relativistic) that would be effective, for example, when passing through a diffraction grating according to Bragg's law. Obviously, there is no mysterious "matter wave", but only a displacement that varies with velocity due to the finite speed of light. As the velocity increases, the intensity of radiation emitted in the forward direction results in the so-called headlight effect¹². The observed effect through the medium of electromagnetic radiation would **imply** an increase in mechanical energy when in fact it is merely a Doppler (field) effect.

It should now be patently obvious, that the required kinematics of relativity theory have been duplicated without deviating from classical physics. In addition, an explanation for many well-documented effects is given that were inexplicable in relativity, but follow quite naturally from the above. Nothing new has been introduced. If the independent propagation of light in each frame of reference appears counter-intuitive, it is only

because of the authoritative imposition of Maxwell's and Einstein's "absolutes" for over a century.¹³

References:

¹ The phrase and meaning originate in C. A. Zapffe's classic paper, A Reminder on $E=mc^2$, $m=m_0(1-v^2/c^2)^{-1/2}$, & $N=N_0e^{-t/yt}$, <http://wbabin.net/science/rickerzap.pdf>.

² This is based on the results of the Michelson-Morley experiment. Nevertheless, it must be considered conditional in view of the conflicting experimental evidence of constancy on the one hand, and the preferred directions discovered by Dayton Miller² (subsequently confirmed by Michelson and Kennedy-Thorndike). However, there is a strong possibility that the Dayton experiment measures a **difference in frequency**, Ibid 4.

³ The Synthesis of Quantum Electrodynamics, Special Relativity and Classical Mechanics, Walter Babin, <http://wbabin.net/babin/wd6.htm>

⁴ The Speed of Light is Independent of Frequency: B. Schaefer, Physical Review Letters, June 21, 1999

⁵ Note: We are dealing with the **measurement** of space and time, not their meaning.

⁶ Triangle of Velocities, A. Vukelja, <http://wbabin.net/physics/vukelja2.pdf>

⁷ Ibid, 5

⁸ Sub-Atomic Particle Interactions, Walter Babin, <http://wbabin.net/babin/dyna2.htm>. Also, Relativistic Transformation Equations, Walter Babin, <http://wbabin.net/babin/transform.pdf>

⁹ Ibid, 7

¹⁰ See section on aberration, Walter Babin, <http://wbabin.net/fizeau1.pdf>.

¹¹ The Sagnac Effect, Walter Babin, <http://wbabin.net/babin/sagnac.htm>. See also, the logical conclusions derived from the second postulate at <http://wbabin.net/babin/wd6.htm>.

¹² Physics in the Twentieth Century, MIT Press, Selected Essays, V. Weisskopf, p 245.

¹³ An analogous situation for light exists with sound propagating in air. If air travels with a moving system, then sound travels **in that system** at normal speed, but would be calculated (not heard) as moving at $c+v$ or $c-v$ relative to a fixed system. If the same sound were audible in the fixed system at origin, it would travel at normal speed, but with greater compression and higher frequency.