Open Access Journal of Physics
Volume 3, Issue 1, 2019, PP 1-6
ISSN 2637-5826

An Alternate Theory of Special Relativity and Relativistic Mass

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ABSTRACT

This is the third of five related works on electromagnetic theory, special relativity, relativistic mass, inflationary universe theory, and general relativity. In this work an alternate theory of special relativity is proposed and analyzed. This theory covers the velocity of light, length, time, relativistic mass, and a different interpretation of Newton's laws.

MECHANICS

Introduction

A theory is proposed to replace the mechanics of the special theory of relativity (**STR**). It is required that this theory must closely resemble Newtonian mechanics at low velocities and yet have relativistic properties at high velocities, which at a minimum are that $p\text{->}\infty$ and $E\text{->}\infty$ as $v\text{->}c$. It has already been shown In Aucamp [1] and Aucamp [2] that **STR** is not a feasible theory and likewise for Einstein's [3] equation for mass. In Aucamp [2] it was suggested that the solution to the mass problem is to assume it is a constant, independent of velocity. If this point of view is accepted, there is a problem explaining relativistic properties at high velocities. This problem is resolved in **Part 2** concerning **EM** theory, radiation, and mass.

Four Mechanics Postulates

In this section four **STR** postulates (**P_1,P_2,P_3,P_4**) concerning mechanics are proposed which are seemingly in conflict with relativistic physics. These postulates do not refer to any electromagnetic effects which may be associated with charges, a topic which is covered later.

Postulate P_1

Consider an object which is stationary in the inertial frame of reference, **IFR_0**, and increase its scalar velocity to v. This move has no effect on mass, energy (kinetic or otherwise), measured length and clock time. Kinetic energy K and momentum p are potential quantities evaluated with respect to **IFR_0**. They are only meaningful if the current velocity of the object is changed back to zero. If **IFR_0** is unknown, there is no experiment which can determine any of these quantities.

Postulate P_2

Mass $m(\mathbf{v})$ of an object moving at $\mathbf{v}$in **IFR_0**is given as:

$$m(\mathbf{v})= m_0 \qquad \textbf{(1.2.1)}$$

The above two postulates assume there is nothing magical about the velocity of an object moving through space (aside from the electromagnetic effects discussed later). Changing the **IFR** (and thereby changing the velocity) does not in any way alter the physical properties of an electrically neutral body. These postulates can be explained by the following example: Suppose a bullet of mass m_0 is fired from a gun and is now moving along at scalar velocity v. According to the postulates, the mass remains unchanged at m_0, and there is no kinetic energy K or momentum p. The bullet is simply at rest in a different **IFR**. Otherwise, nothing concerning the physical properties of the bullet has been changed. The kinetic energy needed to increase the velocity from 0 to v is $K=m_0v^2/2$. This energy is not a property of the moving bullet. Rather, it is viewed here as a kind of potential energy which can be recovered if the velocity of the bullet can be brought back to zero (say, by hitting a wall) in the original **IFR**. The same holds true for the momentum, which is also viewed as a potential quantity. Otherwise, the current properties of the bullet have no connection with its original state, and it is impossible to ascertain anything about its original state from its current state.

Postulate P_3

Mass energy, *E*, of a body with rest mass m_0 and rest energy E_0 and moving at velocity *v* is given as follows:

$$E = E_0 = m_0 c^2 \qquad \textbf{(3.3.2)}$$

While **(3.3.2)** is not Einstein's $E=m_0\gamma c^2$, it does satisfy the major aspect of his theory concerning the equivalence of mass and energy. For example, it indicates that the amount of mass energy that can be recovered from nuclear fuel aboard a spacecraft is independent of its speed. Note that the above three postulates avoid the logical inconsistencies cited in Aucamp [2]. The following postulate will appear to be at odds with relativistic experimental findings. This problem is treated in **Part 2**.

Postulate P_4

When total mass is properly evaluated, taking into account any electromagnetic effects, Newton's laws are valid at all velocities.

THE SPEED OF LIGHT

An Alternate Theory on the Velocity of Light

It was shown in the **EM** theory of Aucamp [1] that the velocity of light is *c*, as measured in the **IFR** of the source. This point of view was further strengthened in Aucamp [2], where it was shown that Einstein's second postulate is mathematically invalid.

The questions addressed here are:

- The effect of electromagnetic reflections
- Experiments that purportedly prove **STR**

It is argued here that there are three obvious elementary hypotheses concerning the speed of light: **STR**, **RET**, and **ALT.** These are all well-known and deserve some consideration. They are:

STR (Special Theory of Relativity)

The measured velocity of light is independent of the velocities of the source and observer.

RET (Re-radiation Emission Theory)

The initial velocity of light is *c* with respect to the **IFR** of the source. Perfect reflectors become new sources.

ALT (Alternate Theory)

The velocity of light is *c* and remains at *c* with respect to the initial **IFR** of the source. Perfect reflectors do not become new sources.

Though Ritz [4] originally proposed that the velocity of light is *c* with respect to the source, he apparently did not differentiate between **RET** and **ALT**. This turns out to be crucial because experimental evidence strongly shows **RET** is not valid (see later). Thus, **RET** will not be considered any further in this work. Since **RET** and **ALT** state the initial velocity of light is *c* as measured with respect to the source, they are often referred to as emissions theories, and they are currently discredited. As **STR** is mathematically non-feasible and logically questionable, it would then appear none of the three elementary hypotheses are possible. In spite of the current disrepute of emissions theories, the following postulate is proposed:

Postulate on the Velocity of Light: ALT is valid.

In partial support of **ALT**, the next section provides evidence that experiments confirming **STR** which are based on a moving source in the lab are extremely difficult to carry out. Then in a subsequent section several well-known experiments which purport to support it are questioned.

A Thought Experiment Showing Measurement Difficulties

Note that two different sources of starlight will almost always have different measured speeds if **ALT** is true, and they should have the same speed if **STR** is true. As these speeds are unknown and hard to directly measure, it would appear they are currently not of great use in settling which theory is valid, if either. Thus, a lab test may be needed which involves the emission of photons from controlled moving sources. From the following thought experiment, it is argued that differentiating between **STR** and **ALT** in such a direct test is an extremely difficult undertaking.

Consider an experiment in which two pulses are emitted from the ends of a double bladed propeller having a radius of *r* and spinning counter-clockwise in the *xy* plane. At the precise instant when the propeller is exactly lined up with the *x* axis, with one tip at $x=r$ and the other at $x=-r$, two pulses are emitted which travel to a detector on the positive *y* axis at $y=Y$. Assume the propeller tips move at a precisely known speed of *v*. If **STR** is true, the two pulses arrive at *Y* at the same time *t*, as given by $t=D/c$, where *D* is the distance travelled and $D^2=r^2+Y^2$. On the other hand, if **ALT** is true, the velocities of the pulses are different, as measured with respect to the two inertial frames of reference of the individual propeller tips. If **ALT** is valid, consider the case of the pulse emitted from the right tip. Let t_1 and D_1 be the transit time and distance, respectively, to the detector. If the right tip becomes the **IFR** for this source, then the relative motion of the detector at D is toward the axis (x=y=0) at speed v. Thus, the pulse hits the y axis at a relative distance Y_1 (with respect to the tip) at time t_1, rather than at Y and t, respectively. The equations are:

$$D_1 = c\, t_1 \qquad \textbf{(2.2.1)}$$

$$D_1^2 = Y_1^2 + r^2 \qquad \textbf{(2.2.2)}$$

$$Y_1 = Y - v\, t_1 \qquad \textbf{(2.2.3)}$$

Equations **(2.2.1)**, **(2.2.2)** and **(2.2.3)** have three unknowns: D_1, Y_1 and t_1.

After a little algebra, solving for t_1 yields:

$$t_1 = \{ -Yv + \sqrt{[Y^2c^2 + r^2c^2 - r^2v^2]}\} / [c^2 - v^2] \qquad \textbf{(2.2.4)}$$

Similarly, for the left tip, the equations are:

$$D_2 = ct_2 \qquad \textbf{(2.2.5)}$$

$$D_2^2 = Y_2^2 + r^2 \qquad \textbf{(2.2.6)}$$

$$Y_2 = Y + v\, t_2 \qquad \textbf{(2.2.7)}$$

Solving for t_2 from **(2.2.5)**, **(2.2.6)** and **(2.2.7)** yields:

$$t_2 = \{Yv + \sqrt{[Y^2c^2 + r^2c^2 - r^2v^2]}\} / [c^2 - v^2] \qquad \textbf{(2.2.8)}$$

The arrival time difference, Δt , of the two pulses is therefore given from **(2.2.4)** and **(2.2.8)** as:

$$\Delta t = t_2 - t_1 = 2Yv / (c^2 - v^2) \qquad \textbf{(2.2.9)}$$

Now consider the values of Δt one might achieve in a lab under what is argued as optimistic conditions. Assume, for example, the propeller has a radius of r=2 meters, and the length of the lab is Y=10 meters. It is difficult to make Y very large because the two light paths must travel in an evacuated chamber. If the propeller frequency is, say, f=120 rps, then v=2πrf=1508 m/s. Assuming this value of v, and on setting c=3x10^8 m/s, (2.4.9) yields Δt=3.35x10^{-13} seconds. When the experimental difficulties are also considered, such as (a) timing the 2 pulse releases exactly when the propeller lies on the x axis, (b) measuring v, r and Y precisely, (c) creating pulses that are virtually spikes, (d) using a propeller that doesn't bend, etc., it would appear that any attempt to distinguish between **STR** and **ALT** by an experiment of this type would be an extremely difficult task.

Conclusions Concerning the Velocity of Light

STR was shown in Aucamp [1] and Aucamp [2] to be mathematically non-feasible. In **Part 2**an alternate theory (**ALT**) is proposed which assumes the velocity of light is c in the **IFR** of the source, and it stays at c in this **IFR** after perfect reflections. This theory was originally conjectured by Ritz [4], though apparently no distinction was made concerning what happens with reflections. It is argued here that this is crucial because the well-known experiments which purport to support **STR** do not use moving sources. They only use moving reflectors.

Relativistic Mass Theory

Introduction

The objective of this work is to offer an alternative **STR**. As it was postulated in **Part 1** that the mass $m(v)$ of an object is $m(v)=m_0$, this contradicts all three of Einstein's formulas, but experimental data dealing with high velocities. In the theory developed here it will be shown that the total mass of an object is not just its stationary value, m_0, but also in some cases an extra amount that is carried along with it. The situation is akin to adding a weight to an empty wheelbarrow. The weight of the wheelbarrow is unchanged in this case, but it becomes heavier because of the load.

Background

The **EM** theory in Aucamp [1], which is crucial to this presentation, can briefly be summarized as follows: Consider a "ray" emitted by a moving charge q_1 at time t, and define **IFR**(t) as the inertial frame of reference at this instant. This ray is the field emitted over an infinitesimal period of time, dt. Suppose the ray arrives at a moving charge q_2 at time $t+\Delta t$, where the position of q_2 has moved from $\mathbf{r}(t)$ at the emission to $\mathbf{r}(t+\Delta t)$ at the arrival, all as measured in **IFR**(t). Define $\boldsymbol{f_0}$as the Coulomb force exerted by stationary q_1 on $q_2$at $\mathbf{r}(t+\Delta t)$ in the case when q_2 is stationary in **IFR**(t) at the instant of arrival. Further define V as the component of the q_2 velocity in **IFR**(t) moving in the direction of $\mathbf{r}(t+\Delta t)$when the ray arrives. Then the force $\boldsymbol{f}$ exerted on q_2 is:

$$\boldsymbol{f} = \boldsymbol{f_0}\, [1 - (3/2)\, V/c + (1/2)\, V^2/c^2] \qquad \textbf{(3.2.1)}$$

This law is based on the idea that the electric field force, which travels at c in **IFR**(t), loses pushing power when it acts on a moving charge. In effect, this postulate is a dynamic version of

Coulomb's law. The force reduction when $V>0$ is somewhat similar to what happens when rushing water hits a raft moving in the direction of the flow. Alternatively, it is akin to the idea of an "electric flux" which moves at c in the direction of v, where the net force on a moving charge depends on the relative flow by the charge. In Aucamp[1] several of the conclusions which are drawn are as follows:

- Magnetic forces do not exist
- All **EM** forces are due to electric fields
- Light travels at c with respect to the source
- The measured velocity of light at the observer is $c–V$
- The force this ray exerts on $q_2$is given by **(3.2.1)**

Note from **(3.2.1)** it is seen that:

$$f \to 0 \text{ as } V/c \to 1 \qquad \textbf{(3.2.2)}$$

It is clear from these findings, especially (4) and (5), thatthis theory is in complete disagreement with**STR**. Also, from **(3.2.2)** it is seen that devices such as linear accelerators which operate by using **EM** forces cannot push charges to the value of c. However, **(3.2.1)** does not explain why the momentum at impact when V is close to $c$can be significantly greater than m_0c. This problem is resolved with relativistic mass theory as given below.

Relativistic Mass Theory

It is noted that non-**EM** forces which push against objects do not create an extra load on the objects being pushed. The "wheelbarrow" in this case stays empty, and from **(1.2.1)**the mass of the object remains at m_0. However, this is not what happens when **EM** forces push against charged particles. While the extra loading is imperceptible when v/c is small, this is not the case when dealing with relativistic velocities.

It is noted from **(3.2.1)** that the coulomb force, f, exerted by one moving charge q_1 on another moving charge q_2 suffers a scalar force reduction, $R=f-f_0$, as follows:

$$R=f_0[\,(3/2)\, V/c – (1/2)\, V^2/c^2] \qquad \textbf{(3.3.1)}$$

As a practical matter, high V/c values are attained in particle accelerators where an electric field exerts a force on a charge q_2 which is moving in the same direction as the field (or where a series of q_1's are used). It is therefore convenient to assume that $\boldsymbol{v}$ and $\boldsymbol{f}$ obey the following assumption:

ASSUMPTION A: *v* and *f* are in the x direction, so that V=*v*

Under this assumption all movements are in the positive x direction. Since $R>0$when $V>0$ in **(3.3.1)**, and since the available coulomb field energy loss over a differential move dx is f_0dx, then this available energy is not all converted into kinetic energy. From **(3.3.1)** the unconverted energy is Rdx, and it must appear somewhere. As the charge is moving at a virtually constant velocity close to c (in the interesting case), there is little or no radiation. Thus, the key question concerns what happens to the unused energy? In this regard, it is conjectured that the arriving field does not pass through the moving charge. If this is true, then the following postulate is made concerning what happens over a differential move dx:

Postulate P_1

Absent any loss in energy from leakage, the unused field energy, Rdx, remains in the vicinity ofq_2. The mass dM of this field energy is

$$dM= Rdx/c^2. \qquad \textbf{(3.3.2)}$$

It is assumed in **(3.3.2)** that that $dE=c^2dM$. Based on the above theory, the following equation obtains:

$$dE = f_0(x)dx =dK + c^2dM \qquad \textbf{(3.3.3)}$$

In **(3.3.3)**dE is the energy transferred to q_2 and its immediate vicinity when the impinging field travels a distance dx and f_0 is the force it would exert if q_2 were stationary in **IFR**(t). This energy is used to increase the kinetic energy K, as well as to increase the field mass M which is carried along. As $K=m_0v^2/2=m_0V^2/2$, then:

$$dK =m_0VdV \qquad \textbf{(3.3.4)}$$

Based on **(3.3.1)** the unused force is R, so that the unused energy is Rdx. Then from **(3.3.3)**:

$$c^2dM = Rdx = f_0[\,(3/2)\, V/c – (1/2)\, V^2/c^2]\, dx \qquad \textbf{(3.3.5)}$$

Thus, from **(3.3.3)-(3.3.5)**, and allowing f_0 to depend on x:

$$f_0(x) = m_0VdV/dx+f_0(x)[\,(3/2)\, V/c – (1/2)\, V^2/c^2] \qquad \textbf{(3.3.6)}$$

It is noted that in general $f_0(x)$ is known. Thus, **(3.3.6)** is a differential equation in $V(x)$. Unfortunately, a closed-form solution might be virtually impossible to find except in certain special cases. A computer program using numerical methods might be necessary. As it turns out the example problem given below a closed-form solution is obtained.

It is important to note in **(3.2.6)** that it is assumed there is no energy leakage. This could happen, for example, if a collision were to occur or for some other reason. Obviously, the kinetic and field mass energies are lost when q_2 hits an ending barrier. This accumulated energy is presumably turned into heat and radiation.

Linear Accelerators

The problem studied here concerns a linear accelerator where a constant force f_0 is created to move q_2 over a straight line distance L to a relativistic velocity$V$. To do this it might require many segments which curve around a very long loop. It this case L is the sum of the individual segment distances. In any case it will be assumed that each segment involves a linear path. It is assumed that any magnetic forces which may be used to move the charges on a curved path do not affect velocities. Thus, the entire apparatus studied here will involve a single force along a straight line.

Only the situation at the end of the run of length L will be studied. The total energy E at position L is given as:

$$E = f_0L = m_0V^2/2 + Mc^2 \qquad \textbf{(3.4.1)}$$

In **(3.4.1)**V is the final velocity and M is the mas of the attached final field. It is assumed here that there is virtually no leakage. If it is further assumed that V is very close to c, then the following obtains:

$$f_0\, L = m_0c^2/\, 2 + Mc^2 \qquad \textbf{(3.4.2)}$$

Solving for M in **(3.4.2)** yields the following:

$$M = f_0L/c^2 – m_0/\, 2 \qquad \textbf{(3.4.3)}$$

From (3.4.3) the mass m that hits the ending wall is given as:

$$m = m_0 + M = f_0L/c^2 + m_0\,/2 \qquad \textbf{(3.4.5)}$$

It is seen from **(3.4.5)** that all the field energy during the last stages of the process goes into the creation of mass, and that it is possible to end up with large values of m if L is long enough.It is noted the actual $m(L)$ curve starts out at $m(L)=m_0$ for small values of L and then asymptotically approaches the value given by **(3.4.5)**. It is also seen that theterminal value for the momentum, p, in linear accelerators with large L is approximated as:

$$p = mc = f_0L/c+ m_0c/2 \qquad \textbf{(3.4.6)}$$

Radiation

This paper is concerned primarily with **STR** and not with radiation. The ideas given here are intended to serve as a start on this topic. Suppose a force $\boldsymbol{f}$ is exerted at time $t$on a charge q having a mass m which consists of m_0 and possibly some extra field mass. If the velocity $\boldsymbol{v}$ of m is along the x axis, and if$\boldsymbol{f}_x$ is the component of the force in this direction, then the amount of energy, dE, exerted on m over a distance dx is:

$$dE = f_x\, dx \qquad \textbf{(4.1)}$$

In general, there could be various ways that this energy might be consumed, and radiation is one of them. Later on, some of this energy might be consumed in various other ways. In the case of the linear accelerator previously discussed, it is conjectured that virtually all the incident force on q_2 is consumed in increasing the kinetic energy and the field mass energy.In any case radiation can be a complex problem. When currents are involved and all the energy is transformed into radiation, Maxwell's equations appear to be a most satisfactory way to evaluate radiation.

Alternate Theory of Relativity (ATR) - Summary

- **STR** is untenable
- Newton's laws are valid. K.E. and $\boldsymbol{p}$ depend on **IFR**.
- $m=m_0$ and $E=m_0c^2$
- Speed of light=$c$wrt source, before and after perfect reflections
- Length and clock times do not undergo velocity transformations
- Charges accelerated in electric fields accumulate unused field mass

Final Conclusions

In **Part 1** it is shown by two separate methods that **STR** is theoretically non-feasible. One of these methods looks at several thought experiments along the lines similar to Einstein's paper, except the light rays are allowed to move at an angle α with respect to the velocity and one-way passage times are also considered. The other method examines the logical difficulty with m in Einstein's $E=mc^2$.In **Part 2**one of the two possible versions of the Ritz conjecture is resurrected, which assumes the velocity of light is c with respect to the source **IFR**, and stays at *c* with respect to this **IFR** after perfect reflections. Also, the direct experimental evidence supporting **STR** is brought into question because these experiments are not based on moving sources (at best, only reflectors are moving). Moreover, certain other inconsistencies are cited. The proposed theory is then used to show that astronomical calculations tend to underestimate stellar approach velocities, so that this might explain the findings that the universe is inflationary.

In **Part 3** an alternative to **STR** mechanics is postulated and more **STR** inconsistencies are cited. One of the primary conjectures of the proposed theory is that there is nothing special about any given **IFR**. Thus, mass is constant, length and time do not undergo transformations, and kinetic energy and momentum are merely potentials evaluated with respect to an initial **IFR** where v=0. They only attain meaning if the moving body can be brought back to rest in that particular **IFR**.As there does not appear to be any direct experimental evidence that attaches relativistic properties to contact and gravitational forces, which are weak and create low velocities, and since **STR** is rejected, Newton’s laws are assumed.

In addition, a theory is proposed concerning a dynamic version of Coulomb electric field forces and energies which is used to explain relativistic effects at high velocities. Finally this work is used to postulate a theory of neutrinos.

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Citation: *Donald Aucamp, "An Alternate Theory of Special Relativity and Relativistic Mass", Open Access Journal of Physics, vol. 3, no. 1, pp. 1-6, 2019.*