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Demonstration of Existence of Superlight Speeds

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Abstract:

This paper introduces an idea of experimental demonstration of electrons superluminal speed existence or non-existence in vacuum of near-Earth space of Universe. As according to Einstein's special relativity theory superlight speeds of both particles having non-zero rest mass and particles with zero rest mass are forbidden, such an experiment will either confirm Einstein's special relativity theory in the part of absence in Nature of superlight speeds of any particles or disprove Einstein's theory clearly, crudely and seeably.

Key words: *new relativistic space-time theory, superlight speeds, dependence of a particle charge upon its speed.*

1. Theory

According to Einstein's special relativity theory (SRT) [1], which is based on two principles-postulates (the relativity principle and a principle of light speed independence on the speed of a light source) between two inertial reference frames (IRF) moving each with respect the other uniformly and rectilinearly there is an asymmetry – while a time measurement unit (TMU) of a "stationary" light clock is equal to a value

$$T_0 = {2L_0}\big/{c_0}, \tag{1}$$

where L_0 is the distance between two parallel mirrors of a light clock, c_0 = 299792458 m/s is the speed of light in vacuum of a stationary IRF, the TMU of another light clock of identical design moving at a speed $\boldsymbol{V}$ with respect to the stationary light clock is equal to a value

$$T = \frac{L_0}{\gamma}\left(\frac{1}{c_0 - V} + \frac{1}{c_0 + V}\right) = T_0 \cdot \gamma\,, \tag{2}$$

where T_0 is the TMU of the stationary light clock, defined by equation (1); V is the speed of light clock motion; $\gamma = 1\Big/\sqrt{1-(V/c_0)^2}$ is the relativistic factor [2].

As the relativity principle with respect to such physical system as the light clock must read: *The laws, by which the indications of light clock undergo change, are not affected, whether these changes of indications be referred to the one or the other of two systems of co-ordinates in uniform translatory motion,* this asymmetry results in a self-contradictoriness of Einstein's SRT. Indeed, from a point of view of the relativity principle any of two light clocks moving each with respect the other uniformly and rectilinearly we can name as a stationary one (and the other as a moving one). This means that time measurement units (TMU) of both light clocks moving each with respect the other uniformly and rectilinearly must have equal time measurement units. But as it is shown in formulas (1) and (2) the TMU of a light clock considered to be a moving one is greater than the TMU of a light clock considered to be a stationary one. Einstein himself (and he was followed by some generations of his adepts) did not consider time dilation effect of the SRT from point of view of comparing time measurement units of "stationary" and "moving" light clocks. Although it is clear that a "moving" light clock can retard with respect the stationary light clock only because of non-equality of their TMU. And namely that clock, which TMU will be greater, will retard with respect with the other one, which TMU will be less.

Now it is clear why either Einstein himself, or his followers did not use the analysis of TMU of clocks moving each with respect the other uniformly and rectilinearly – because it is impossible to have simultaneously greater and lesser time measurement unit than the other light clock. They found how they could explain that both clocks could simultaneously be late with respect the other clock by comparing one clock in one IRF with a pair of clocks in another IRF. But only a stupid person will insist on a statement, that TMU of clocks having identical design moving each with respect the other uniformly and rectilinearly are not equal.

That is why the problem of non-equality of TMU in the so called light clocks now is not even defined. Although the so-called “mirror concerns” dealing with reflections from moving mirrors are sometimes discussed among scientists.

In order to get rid of this self-contradictoriness a new relativistic space-time theory (NRSTT) was offered [3], which was based upon the only relativity principle. In this NRSTT the Einstein’s second postulate is discarded as erroneous and such law of light speed propagation dependence upon speed u of light source motion is derived from the principle of relativity [2]

$$c_u = \sqrt{c_0^2 + u^2}\ . \tag{3}$$

Because equality of TMUs of identical light clocks moving uniformly and rectilinearly each with respect the other is a consequence from the relativity principle. Using this law instead of Einstein’s second postulate, we have the equality of TMU of a moving light clock to the TMU of a stationary light clock. Indeed, in this case instead of (2) we have

$$T = \frac{L_0}{\gamma}\left(\frac{1}{c_u - u} + \frac{1}{c_u + u}\right) = \frac{L_0}{\gamma}\frac{c_u + u + c_u - u}{c_u^2 - u^2} = \frac{L_0}{\gamma}\frac{2\gamma c_0}{c_0^2 + u^2 - u^2} = \frac{2L_0}{c_0} = T_0\,. \tag{4}$$

According to equation (4) in the NRSTT time dilation and retardation of a moving clock with respect to a stationary clock are absent.

2. Experiment

In accordance with the NRSTT the kinetic energy of a particle with a mass of an electron m_e is determined by means of physically measured speed u of electron motion using the formula [4], [5]

$$W = E_0\left(\sqrt{1 + u^2 / c_0^2} - 1\right), \tag{5}$$

where $E_0 = m_e c_0^2$=0.511 MeV is the rest energy of an electron; u is the physically measured speed connected with Lorentzian speed V from Lorentz transformation of Einstein’s SRT according to the formula

$$u = V \Big/ \sqrt{1-(V/c_0)^2}\,; \tag{6}$$

c_0 = 299 792 458m/s is the speed of light in vacuum of a stationary inertial reference frame (IRF). Having solved the formula (5) with respect to the physically measured speed u of an electron motion, we shall have

$$u = c_0\sqrt{\left(\frac{W}{E_0}+1\right)^2 - 1}\ . \tag{7}$$

In accordance with the formula (7) the physically measured speed u of an electron becomes greater than the speed of light in vacuum c_0 under condition that

$$\sqrt{\left(\frac{W}{E_0}+1\right)^2 - 1} > 1. \tag{8}$$

Then, solving the inequation (8) with respect the kinetic energy *W*, we obtain the provision for movement with a speed greater than the speed of light in vacuum

$$W > E_0\left(\sqrt{2}-1\right) \approx 0.414 \cdot \mathrm{E}_0\,. \tag{9}$$

From inequation (9) it follows, that according to NRSTT any particle, having kinetic energy greater than 41.4% from the rest energy of this particle, moves at a speed greater than the speed of light in vacuum.

From (7) it follows that at $W = 2 \cdot E_0$ the speed of an electron with such kinetic energy is equal to $u = c_0\sqrt{3^2-1} = \sqrt{8}\cdot c_0 \approx 2.83 \cdot c_0 \approx 3 \cdot c_0$. For an electron $E_0 = 0.511\,\mathrm{MeV}$ and therefore it follows that if $W_e \approx$ 1.0 MeV, then $u_e \approx 2.83 \cdot c_0 \approx 3 \cdot c_0$.

According to the NRSST a bunch of electrons, having kinetic energy near 1.0 MeV, moving in vacuum at the speed, approximately 3 times greater than the speed of light in vacuum of a stationary IRF, will cover a distance of any length during a time interval approximately 3 times less than any ray of light.

In the experiment it is supposed to measure the speed of electrons having the kinetic energy of approximately equal to the value of W = 1.0 MeV along the 9 meter measuring base. Gamma quanta of any laser will fly over the measuring base of L = 9 meter length, moving at the speed of light in vacuum of $c_0 \approx 3 \cdot 10^8$ m/s during a time span of $\Delta t = L / c \approx$ 9 m/($3 \cdot 10^8$m/s) $\approx$ 30 ns.

Having organized such competition between a laser pulse, moving at the speed of light, and a bunch of electrons, moving at the speed approximately 3 times greater than the speed of light in vacuum, we must obtain a time interval, during which a bunch of electrons will cover the measuring base of 9 meter length, during a time interval equal to 3 times less than the laser pulse, this means that the flyover time for superlight electron bunch will be equal approximately to (30 ns)/3 $\approx$ 10 ns.

The competition itself between a laser pulse and an electron bunch can be performed on the international space station (ISS). For this experiment we can take any light-weight line accelerator of electrons as a source of electrons with kinetic energy of each particle equal to 1.0 MeV, specially developed and manufactured for this purpose.

Such a demonstration of superlight motion of electrons of comparatively small kinetic energy (something about 1.0 MeV) will prove clearly, crudely and seeably the reality of superlight speeds. Of course, if superlight speeds really will be detected.

After delivery to the International Space Station of the laser and the line accelerator, as well as other necessary measuring means, and after performing the very experiments on measuring flyover time for laser pulse or electron bunch with necessary energy across the specified distance of 9 meters we could make a conclusion about confirmation (or about absence of such confirmation) of superlight speeds of electrons.

The same experiment can be made in ground-based vacuum chambers (without usage of international space station). Of course, the kinetic energy of electrons should be measured (not calculated according to formulas of Einstein's Special Relativity Theory).

3. Conclusion

In addition to existence of superlight speeds of particles motion the NRSTT predicts also the dependence (3) of light speed propagation upon the speed of light source motion and a more fundamental dependence of the particle electrical charge upon speed of the particle motion having the form

$$q_u = q_0 / \gamma , \tag{10}$$

where

$$\gamma = \sqrt{1 + \left(u / c_0 \right)^2} . \tag{11}$$

For a superrelativistic particle (for which $u >> c_0$) instead of (11) we have $\gamma \approx u / c_0$ and instead of (10) we have $q_u \approx \frac{q_0 c_0}{u}$.

Study of dependence (3) influence on the behavior of such astronomical formations as double stars and multiple stars shows (see my paper [6]) that almost all astronomical phenomena can be explained by dependence (3) of light speed propagation in space upon speeds of light sources (stars). Among such phenomena we see the following: novae, supernovae, pulsars, red shift of far stars, increasing with increase of distance to a star, microwave background radiation, burst of X-rays and gamma-rays, Olbers's paradox, etc.

Study of dependence (10) of the value of a particle electrical charge upon the speed of particle motion (see my papers [3], [4]) shows, that now we can "close" such "famous discoveries" of the past history as particle with rest mass intermediate between masses of a proton and electron.

Of course, there are many other less important consequences of the NRSTT upon the state of modern physics. But, it seems to me, that more detailed studies in these two directions (dependences (3) and (10)) deserve to be given the highest priority.

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