Production Superluminal Particles

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My paper [1] about a way of production of superluminal particles has elicited some interest. Essence of the method is that the one object is accelerated by the second object in their joint relative motion. For example, a bunch of protons moves with a velocity v nearly equal to the speed of light c, ahead of a bunch of electrons, which move with the same velocity c, and accelerates them in relative movement. When bunch of electrons comes nearer to bunch of protons, it will have velocity 0.3 c relative to the protons and 1.3 c relative to the laboratory. By using relative movement it is possible to accelerate bunches of particles of equal sign, only accelerating bunch should push bunch, which is accelerated.

This approach has raised some questions. For example, Robert J.Hannon (4473 Staghorn Lane, Saratoga, Fl 34238 USA) sets following questions.

"The fundamental question that must be resolved before your method of achieving superluminal velocities can be applied is: Can electromagnetic force propagate in empty space at a velocity greater than c? Does the field of charged particle moving at v nearly equal to c propagate space at v + c? Perhaps superluminal velocity might be achieved by transfer of momentum between particles of different masses. A collision between a proton moving at 0.1 c with a positron "at rest" should accelerate the positron to a velocity much greater than c, assuming such a "collision" is possible ".

Other kind of questions are asked by relativist phisicists who represent which present modern establishment physics. Referring to the law of velocity addition in the Theory of Relativity, they believe, that increments of velocity in relative movement and velocity of relative movement can not be added. Therefore the total velocity of accelerated bunch will not exceed the speed of light.

As it is known the relativistic law of velocity addition is stipulated by a length contraction and a time dilation in relative movement, accepted in the Theory of Relativity. Thus superluminal motion and the Theory of Relativity are not compatible. Therefore to answer all above mentioned questions, first of all we must solve the latter problem.

The problem is a follows. Man is surrounded by the world, which he studies and describes. In this world one body acts on an other. The action of one body on an other is perceived when the latter is accelerated. For the description of this action man has invented force. This kind of description of action gave us as Newton’s three laws, which form the basis of mechanics. Except for the description of interactions with the help of forces in the second half 19th century the description of interaction with the help of energy is just beginning. Therefore the force representation of interactions has begun to fall out of use and we have begun to study the interaction of moving charged and magnetized bodies. This tendency has led to the result, since the works on electromagnetic phenomena by J.K.Maxwell, G.A.Lorentz, A. Einstein and others, a description of interactions has developed, in which it is supposed, that the forces do not depend on relative motion of interacting objects.

In reality all electromagnetic experiments testify, that the bodies moving relative to each other interact with one another differently from when they are motion less. For example, when two charges are in relative motion the force between them is not defined by Coulomb’s law . To agree a rule about independence of interactions from relative movement with experimentally dependence on motion, we have invented dependence of a length, time and mass on velocity of motion in the Theory of Relativity. Thus the relativistic way of description of electromagnetic interactions has been invented, in which the interaction of relatively moving objects is described as interaction of immovable one, but the distances, time and mass should to change in according to the G.A.Lorentz's transformation.

The relativistic way of describing electromagnetic interactions has become dominant in 20th century science. However, are many scientists, who continued to develop a classical method of describing interactions, among them I mention several: Oliver Heaviside [2], G.F.Lomakin [3], T.G.Barnes with colleagues [4], C.W.Lucas, Jr. and J.W.Lucas [5], V.I.Suhorukov with colleagues[6], Xu Shaozhi and Xu Xiangqun [7], O.D.Jefimenko [8], T.E.Phipps, Jr. [9] and many others. In my works, for example [1], I have received expression for force of interaction between relatively moving charges, which is based on the experimental laws of electromagnetism, in the following form:

$$\vec{F} = \frac{q_1 q_2 \left(1-\beta^2\right)\vec{r}}{\varepsilon\left\{r^2 - \left[\vec{\beta}\times\vec{r}\right]^2\right\}^{3/2}}, \tag{1}$$

where $\vec{\beta} = \vec{v}/c_1$ is standardised velocity, $\vec{v}$ is the velocity of one object relative to the other; is a distance between the objects; $c_1 = c/\sqrt{\mu\varepsilon}$ is a velocity of propagation of action in the medium; c is velocity of light in the *vacuo*; ε and μ are dielectric and magnetic permeabilities of the media. In the *vacuo* $\varepsilon = \mu = 1$ and $c_1 = c$.

The expression for the force the other scientists [4], [5], [8] have close suited. The law of interaction (1) allows us to solve all problems of electromagnetic interactions of relatively moving bodies. In this case the relativistic transformations for length, time and mass are not used, and relativistic formula for velocity addition is not used. In other words, this method of describing interactions completely replaces the Theory of Relativity.

Now we shall pass to the answers on the R.J.Hannon's questions.

From many experiments we know, that electromagnetic action (light, radiowaves and etc.) are propagate in space with the speed c_1. Thus in rarefied medium, the vacuum, $\varepsilon = \mu = 1$ and $c_1 = c$. But here it is necessary to pay attention for one feature. The propagation velocity was always measured from one object to other. Therefore irrespective from the receiver and source of electromagnetic action it is impossible to speak about propagation velocity of electromagnetic action in the space. The experiments only testify that if the receiver and the source are stationary relative to one another, the propagation velocity of action between them will be equal to c_1. For example, the speed of light between the Earth and Jupiter at their parallel orbital velocities or the velocity of light between two opposite mirrors in the A.A.Michelson's experiments will be equal to c_1. If a receiver and source from move away from one another with velocity v or approach one another with the some velocity, the electromagnetic action will be propagated between them with the velocity $c + v$ (+ in case of approaching). For example, as was installed by O.Roemer in 1676, between a Jupiter and Earth, when the latter approaches or recedes from it with orbital velocity v_E, the speed of light is equalled $c + v_E$, and this was proven by B.G.Wallece [10], in the case of motion of a Venus relative to the Earth with velocity v_V, the speed of radiowaves between them is equal $c + v_V$.

Thus, the action between objects propagate by the speed $c + v$, where v is velocity of their relative movement. The interaction between two objects should be determined only by relative velocity of motion. From experiment we know that interaction of two bodies depend on their relative velocity and not on velocity of each body relative to any space. For example, the electric voltage on the coil ends, inside which the magnet moves, only depend on their relative velocity and this voltage does not depend on their velocity relative Earth's surface. Therefore if one charged particle acts on other charged particle, their interaction will only depend on their relative velocity, but not on the particle velocity relative to other bodies, empty space, ether etc. The experiment states so.

In addition, it is necessary to consider the electromagnetic interaction and its propagation not in abstract space and not in reference systems, but to between interacting objects. The electromagnetic (EM) interaction is not waves in some media, as now it is present in the physics. The EM-action is changing on time and that is all. There is not media, there is not vibration of particles of this media, and there is not waves which are like waves on the water.

Therefore if two particle, for example proton and positron, will move at identical direction with velocity c, they will interact between themselves and positron will receive additional velocity and its absolute velocity will be greater velocity of light. We shall calculate the conditions under which the acceleration of particles to superluminal velocity is possible by in this way. We shall consider the interaction of two charged particles, the proton and positron, with the help of the law (1). At this interaction, as it was shown in our works, for example [11], their relative velocity on distance R will be

$$v_{rel} = c_1 \sqrt{1-(1-v_0^2/c_1^2)\exp\frac{2\mu_1}{c_1^2}(\frac{1}{R}-\frac{1}{R_0})}\,, \tag{2}$$

if in the beginning of the interaction they were on distance R_0 and had relative radial velocity $v_{rel} = v_0$ and where

$$\mu_1 = \frac{q_1 q_2 (m_1 + m_2)}{\varepsilon m_1 m_2}\,, \tag{3}$$

q_1 and q_2 are charges and m_1 and m_2 are the masses of interacting particles.

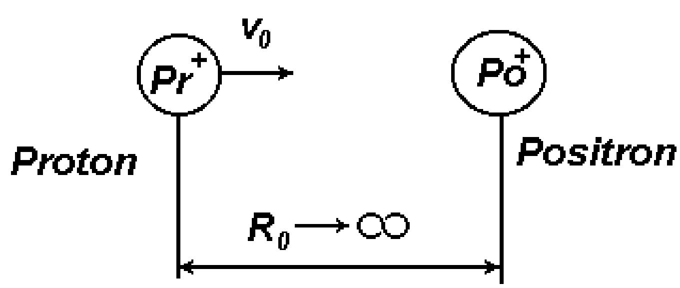

Fig.1. The Beginning of Acceleration.

If a proton (Fig.1) moves from infinity with velocity v_0 and acts on immovable positron the equation (2) become

$$v_{rel} = c_1 \sqrt{1-(1-v_0^2/c_1^2)\exp\frac{2\mu_1}{c_1^2 R}}\,. \tag{4}$$

In a further interaction of proton and positron the distance between them is

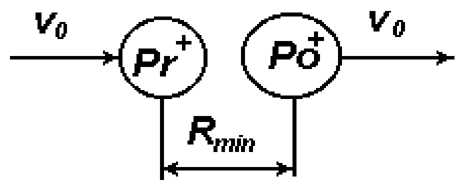

Fig.2. The Middle of Acceleration.

diminished to $R_{\min}$ at velocity $v_{rel} = 0$ (see Fig.2). Then substituting $v_{rel} = 0$ into (4) we can define the minimal distance between interacting particles

$$R_{\min} = -\frac{2\mu_1}{c_1^2 \ln(1 - v_0^2 / c_1^2)} . \tag{5}$$

As the proton mass is greater than a positron mass, the proton velocity will be the same, i. e. $v_{pr} = v_0$, and the positron will have the same velocity $v_{pr} = v_o$.

The interaction continues and the positron will move away from proton. The relative positron velocity can be calculated from (2) if we set $v_0 = 0$ and $R_0 = R_{\min}$ .The acceleration of positron will be completed, when the distance between particles R is equal to infinity; and from (2) we obtain the relative velocity of the positron

$$v_{rel} = c_1 \sqrt{1 - \exp \frac{2\mu_1 c_1^2 \ln(1 - v_0^2 / c_1^2)}{2\mu_1 c_1^2}} = c_1 \sqrt{1 - 1 + v_0^2 / c_1^2} = v_0 . \tag{6}$$

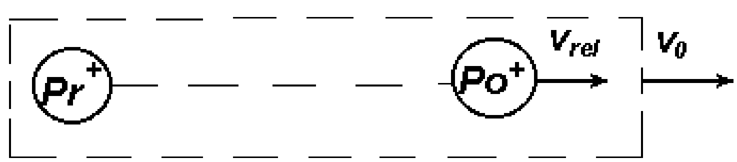

Fig.3. The End of Acceleration.

Therefore the full velocity of positron will be

$$v_{po} = v_0 + v_{rel} = 2v_0 . \tag{7}$$

We shall consider that interaction law (1) is kept and this equations is correct, if $R_{\min}$ is greater than sum of radii of the proton R_{pr} and positron R_{po}. Let us calculate the initial proton velocity v_0 which allows to bring the particles together at the distance

$$R_{\min} = R_{pr} + R_{po}. \tag{8}$$

Substituting (8) in (5) we receive

$$\beta_0 = v_0 / c_1 = \sqrt{1 - \exp \frac{-2\mu_1}{c_1^2 (R_{pr} + R_{po})}} . \tag{9}$$

We can write the coefficient

$$k = \frac{-2\mu_1}{c_1^2 (R_{pr} + R_{po})} = -\frac{2q_1 q_2 (m_1 + m_2)}{\varepsilon c_1^2 R_{pr} m_1 m_2 (1 + R_{po} / R_{pr})} \quad . \tag{10}$$

Now we can take such parameters of particles:
$m_1 = m_{pr} = 1.672*10^{-24} g$; $m_2 = m_{po} = 9.1095*10^{-28} g$;
$q_1 = q_2 = e = 4.8*10^{-10}\ cm^{1.5} g^{0.5}/s$; $\varepsilon=1$; $\mu=1$;
$c = 3*10^{-10}\ cm/s$; $R_{po}=1.4*10^{-13} cm$; $R_{pr}=2.817*10^{-13} cm$.
As $m_1 >> m_2$, equation (10) we can write as

$$k = -\frac{2e^2}{c^2 R_{pr} m_{po} (1 + R_{po} / R_{pr})} . \tag{11}$$

Substituting parameters in (11) we receive k =-1.34. Then according (9) the initial proton velocity we can take

$$\beta_0 = \sqrt{1 - \exp k} = 0.859, \tag{12}$$

i.e. $v_0 = \beta_0 c =$ 0.859c. Thus in according with Eq. (7) the positron can be accelerated to velocity $v_{po} = 2v_0$ = 1.72c, i.e. we obtain superluminal positrons.

Above we have considered interaction of protons with positrons. Up to such superluminal velocity the electrons can be accelerated with the help of antiprotons. As we see, the conditions of acceleration are quite feasible.

Such acceleration can be realized, if the bunch of heavy particles will strike motionless cloud of resting particles. The probability of direct collision of particles will depend on density ensembles of these particles. Then the further problem will arise how to diagnose superluminal accelerated particles or to separate them from heavy particles. Some variants of the problem decision is here seen. It is possible to use Cerenkov's counters of superluminal particles. It is possible to reject the heavy particles using cross electromagnetic action. After rejecting devices only the bunch of superluminal particles will move along an axis of apparatus. It is also possible on the analysis of results of collision to define the density of angular distribution probability of particles, which will characterize the availability of superluminal particles. Knowledge of the trajectories of interacting particles will be required in this case. They are calculated in our works and are submitted in a form of the tables in my book [12].

This is how to obtain superluminal particles. Their diagnostics is real as. All that is required is an unprejudiced attitude and attention to this problem of the physicist-experimenters, having by necessary technical devices.

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