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UNITARY QUANTUM THEORY VS RELATIVISTIC THEORIES OF ACCELERATORS, COLLIDERS AND MAGNETIC SPECTROMETERS

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ABSTRACT

Rejecting the outdated principle of Bohr's Complementarity, the Leo Sapogin's Unitary Quantum Theory considers the internal processes in moving particles and the influence of the environment (physical vacuum) on them to be decisive in constructing the theory of accelerators, colliders and magnetic spectrometers. In this regard, the article questions the efficiency of accelerators, colliders, magnetic spectrometers as well as tokomak

KEYWORDS*: physical vacuum, polarization, mass, speed, momentum, energy, accelerator, colliders, magnetic spectrometers, tokomak*

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1. INTRODUCTION

The CMS collaboration in the experiment at the Large Hadron Collider in 2019 demonstrated a decrease in the t-quark mass with increasing energy for the first time [1]. They studied the distribution of reaction products in pp collisions with an energy from 1 [TeV] to 13 [TeV]. It was found the decrease in the mass of elementary particles obtained from data up to an energy of 13 [TeV], as well as a decrease in the magnitude of the interaction constants at a confidence level of 95%, depend on the energy at which measurements are made. This effect, explained by vacuum polarization, was indeed observed in experiments in particular, the decrease in the mass of b and c quarks was measured, as well as the decrease in the strong interaction constant [1]. Today, the requirement of invariance with respect to Lorentz transformations in quantum electrodynamics (QED) and quantum chromodynamics (QCD) is not substantiated in any way and is a tribute to Einstein's relativism. The non-invariance of the equations of electrodynamics is associated with the assumption of the reality of vacuum polarization and with the existence of effects of retarded potentials and deformations of the electric field, moving charges in a polarization medium. Complete invariance of the equations of electrodynamics is admissible only in the absolutely empty space of Einstein's SRT [2].

2. REJECTION OF EINSTEIN'S RELATIVISTIC MECHANICS AND TRADITIONAL THEORY OF ACCELERATORS

In the article "The Conflict between the Unitary Quantum Theory and the Special and General Theories of Relativity", Professor Lev Sapogin subjected to devastating criticism Einstein's relativism [3].

The increase in the mass of a particle with a speed according to Einstein is described by the relativistic formula [4]:

$$m = \frac{m_o}{\sqrt{1-\frac{v^2}{c^2}}} \quad , \tag{1}$$

Where m_o is rest mass, v is the speed of the particle; c is the speed of light

Like classical mechanics, the relativistic theory does not consider internal processes in moving bodies and the influence of the environment (vacuum) on them. It is based on the extrapolation of Galileo's principle of indistinguishability of the state of rest and uniform motion to all natural phenomena. Galileo's relativism comes into conflict with the Special Theory of Relativity. According to SRT, with an increase in the speed of a particle, its mass M also increases. Professor Lev Sapogin, the author of the Unitary Quantum Theory (UQT), discarding the outdated Bohr Complementarity principle, which forbids interest in the internal structure of a particle, suggested that the increase in particle mass with increasing speed is due to internal processes. Thus, between the Schrödinger wave function describing the particle and the de Broglie wave function arising in the medium, when the particle moves at a relativistic speed, a resonance phenomenon arises, in which the growth of the particle mass reaches its limit. He describes elementary particles as clots (wave packets) of the field of the real world, which are identified with the polarization, inhomogeneous cosmic medium of the physical vacuum. Sapogin writes: "Apparently, the mistake of all previous attempts to represent a particle as a wave packet was that the packet was built from de Broglie waves, which rapidly losing structure out in outer space. In UQT, a packet is built from partial waves with a monstrously high frequency, the so-called Schrödinger jitter, and the de Broglie wave appears as a by-product when a particle moves in a physical vacuum" [3]. The physical meaning of this lies in the fact that after an external impact on the quantum vacuum from the side of an accelerated particle, a de Broglie wave $\lambda = h/mv$ or $\lambda = 2\pi c/\omega$ arises in it, whence:

$$\omega_B = \frac{mv^2}{\hbar}, \tag{2}$$

- Where h is Planck's constant and $\hbar = h / (2\pi)$
- Mv is the momentum of the particle

The particle has momentum, and transverse oscillations are formed in the heterogeneous space medium when the particle moves at a speed v, this is the trace of the particle in the medium. The oscillatory motion of particles along a helical sinusoid is the so-called uncertainty of the particle trajectory according to Heisenberg.

When the oscillation frequency of the de Broglie wave ω_B approaches the particle's natural oscillation frequency, resonance occurs. The frequency ω_S of free vibrations of a particle is very high: it is proportional to the rest energy of the particle and is equal:

$$\omega_S = \frac{m_0 c^2}{\hbar\gamma}, \quad \gamma = \sqrt{1 - v^2 / c^2} \tag{3}$$

At low energies $\omega_S >> \omega_B$ and the presence of fast natural vibrations, all quantum phenomena that arise as a result of de Broglie oscillations are not affected. In the case when $v \to c$, frequency $\omega_B \to \omega_S$, $\gamma \to 0$ (resonance frequency ω_r), the phenomenon of energy and resonance growth occurs, which leads to an increase in the oscillating amplitude and an increase in the mass of a quantum object

$$m_r = \hbar\, \omega_r / c^2 \tag{4}$$

The standard graph of the dependence of the particle's mass on its speed is now simply half the amplitude-frequency characteristic of the forced oscillations of a harmonic oscillator with no dissipation, and the mass growth is absolute [3].

Figure 1 shows two nonlinear dependences of the growth of the mass of a proton and an electron with a speed constructed by the method of direct numerical simulation in the relativistic (1) and quantum approaches (4)

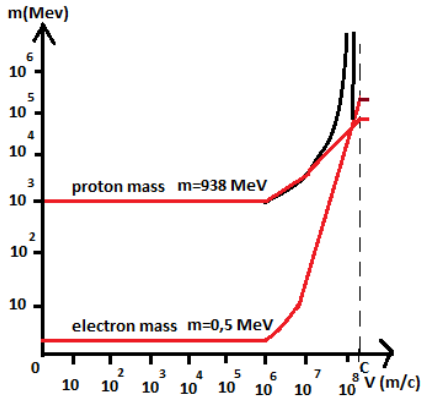

Figure 1: Dependences of the Mass of Electrons and Protons on the Velocity, (Method of Direct Numerical Simulation).

- The red lines show the resonance dependence of the particle mass $m_r = \hbar\, \omega_r / c^2$, as $v \rightarrow s$
- The black lines show the relativistic dependence of the particle mass $m = \frac{m_0}{\sqrt{1-\frac{v^2}{c^2}}}$, as $v \rightarrow s$.

Pay attention to Figure 1, a noticeable increase in the mass of a relativistic particle with a speed starting from v~ 10^6m/s completely coincides for both approaches, up to v~10^8, before the onset of resonance, and then only the relativistic curve rushes to infinity. Therefore, the authors do not urge to reject all the achievements of relativistic theory and practice, but urge to clearly define the framework in which Einstein's theory of relativity can be used, and outside of these limitations it does not reflect reality. In linear accelerators, charged particles are accelerated in vacuum along the axis of the accelerator by a longitudinally directed electric field, flying a path of several meters. The accelerating electric field is created by the difference of constant potentials between the cathode and the anode electrode. At the same time, even small deviations of the initial momenta and coordinates of particles from the calculated values can lead to the fact that in the process of motion the particles go beyond the limits of the working area (for example, the vacuum chamber of the accelerator). This can also be caused by various perturbing factors acting on particles during acceleration (distortions of the leading and focusing fields, scattering by gas molecules in the chamber, an increase in the mass of a relativistic particle). Therefore, it is necessary that in the process of acceleration when the particles deviate from the reference trajectory, they are affected by restoring or, as they say, focusing forces that take into account the increase in the mass of particles during their acceleration. The practice of operating accelerators shows that, up to a certain energy, the focusing forces compensate for the change in the momentum of a particle with an increase in its mass in accordance with the relativistic theory. However, after the mass growth stops, the particles refuse to obey Einstein's laws of relativity and fly out of the working area. The effect of reducing the force interaction of a moving charge with magnetic and electric fields, as well as the

recognition of the limitation of mass growth with speed, require further experimental study. Maxwell erroneously applied the Ostrogradsky-Gauss theorem not only for charges at rest, but also for moving ones. As a result of this arbitrary assumption, the dynamic state of moving electric charges is simply replaced by their static state. Coulomb's law is valid only for fixed charges [3]. The Chinese physicist Fang Liangjao experimentally confirmed the effect of limiting the growth of mass at v→c by performing three experiments at the linear accelerator of the Shanghai Institute of Applied Physics [4]. Fan Liangzhao reported his results at the 2010 Congress "Fundamental Problems of Natural Science and Technology", Part III, pp.5-16 St. Petersburg, 2010 acceleration.

At the Large Hadron Collider in 2019, the CMS collaboration for the first time discovered and explained vacuum polarization, the effect of reducing the mass of elementary particles, and also a decrease in the value of the strong interaction constant in pp-collisions with increasing energy from 1 TeV to 13 TeV, which in no way fits into relativistic concepts [5]. Thus, today the requirement of invariance under Lorentz transformations in quantum electrodynamics (QED) and quantum chromodynamics (QCD) is not substantiated by anything and is a tribute to Einstein's relativism. The non-invariance of the equations of electrodynamics is associated with the assumption of the reality of the existence of a quantum vacuum and with the existence of effects of retarded potentials and deformations of the electric field, moving charges in the polarization environment. Complete invariance of the equations of electrodynamics is admissible only in the absolutely empty space of Einstein's SRT. The interpretation is in question Einstein's famous formula $E=mc^2$. The principle of equivalence of the total energy of a particle E to its rest mass m_0 was obtained by A. Einstein in 1905 by expanding the relativistic mass m_r into a binomial series, depending on the velocity according to the Lorentz transformations [6]:

$$E = m_r c^2 = m_0 c^2 + m_0 \upsilon^2/2 + \quad , (5)$$

с последующим отбрасыванием всех членов разложения, кроме первых двух. В таком случае при $\upsilon = 0$ следует соотношение между энергией и массой покоя $E=m_0c^2$, а при $\upsilon \rightarrow c$:

$$E = \frac{m_0}{\sqrt{1-\frac{v^2}{c^2}}} c^2 \quad (6)$$

This provision was interpreted by A. Einstein as the principle of equivalence of energy and rest mass of any substance, and as the possibility of mutual transformation of mass m_0 and energy E of rest. However, Einstein's interpretation of the formula $E=m_0c^2$ does not take into account the fact that the mass of the body M and its momentum $P = M\upsilon$ are the coordinates of two independent processes: mass transfer and acceleration and have different dimensions. The fundamental difference between the mass M and the momentum P is that the former is a function of the state, and the latter is a function of the process. Outwardly, this difference is manifested in the absence of speed and time in the mass, but the presence of density and volume, and, conversely, the presence of the magnitude of speed and time in the impulse. Professor Valery Abramovich Etkin in his work "On the inconsistency of the principle of equivalence of mass and energy" indicates that thermodynamic analysis leads to the conclusion that this principle is completely inconsistent and the derivation of the principle of proportionality of mass and energy can be obtained without involving relativistic theories [7].

3. UNCONVENTIONAL WAYS TO ACCELERATE CHARGED PARTICLES

The European Strategic Group (ESG) considers for research a fundamentally new the projects to create more efficient and less expensive accelerators and colliders. The article proposes to consider fundamentally new ways of accelerating charged particles: acceleration of protons on a backward wave (Professor Bogomolov's AcceleratTor). In fact, in all

projects of the last 30 years, the developers of linear accelerators focused on the capabilities of the SCS. In particular:

- In the USA (2006) the world's most powerful proton laser was created - a source of neutrons - SNS (proton energy 1 gev, power 1.56 MW, length 258 m);
- In the USA (2008-2018) a multifunctional 8 gev ion DL (L=692 m) is being created;
- The European Community (2010-2018) is designing the ESS neutron complex at the beam of the H-linear proton accelerator with an energy of 1.33 gev and a beam power of 5 MW;
- China, India, Japan, South Korea are implementing programs based on the creation LUP for fundamental and applied research that determines the future of AE.

In these programs, the accelerators are “single-technology” - all on superconductivity. The creation of these accelerators consumes billions of dollars of resources. Designs of “warm” LU (for ADS), different from traditional schemes, not discussed anywhere. According to the author last known a serious discussion of the problem was at EPAC-96. In the article [8] provides the research materials, in order to create ADS – an accelerator-driven nuclear facility for industrial purpose, on the subject of BWLAP (Backward Wave Linear Accelerator of Particles), applied to the problem of developing a compact proton accelerator on the high-performance linear accelerating structures of the “room-temperature” with a clearly marked backward spatial harmonic of the high-frequency electromagnetic field propagating against the flow of the accelerated particles. It proves the BWLAP (with water-cooled accelerator structures) advantage over superconducting accelerators in general efficiency (Pbeam/PAC) at analogous energy of protons. Application of BWLAP appropriate in the complexes with sub-critical nuclear reactors for transmutation the radioactive waste (RW) and blowing minor actinides, and to produce nuclear energy. A modular three-dimensional back-wave accelerator producing a huge stream of protons can become a formidable weapon. The BWLAP can provide the regime with a low duty cycle and continuous-wave operation. A group of researchers led by Alexei Sergeyevich Bogomolov developed a technology for accelerating positively charged particles (protons, deuterons) on a backward wave - BWLAP. The essence of this technology is the acceleration of elementary particles by the electric component of an electromagnetic wave traveling in the same direction and at the same increasing speed as accelerated ions. In this case, the source of electromagnetic waves is installed at the end of the accelerator, which is opposite to the injection one, and the wave runs towards the energy flow - thereby the wave (spatial harmonic) is oppositely directed with respect to the direction of the energy flow [8]. The article [8] by Professor Alexei Bogomolov discusses the achievements in the development of linear accelerators based on highly efficient “thermal” frequency structures, the value of the overall and electronic efficiency and the loss of particles during their acceleration in BWLAP's. Accelerator complexes, if they are implemented according to the reverse wave accelerator scheme with a heat removal system with room temperature water, will provide power in accelerated proton beam ~ 2-3 (30) MW and proton energy 1-10 GeV and will have a huge superiority compared to accelerators based on superconducting structures [8].

Figure 2: Alexey Bogomolov's Modular Three-Dimensional Accelerator on the Backward Wave.

4. THE "PAMELA EFFECT" MAKES IT POSSIBLE TO SUBSTANTIATE THE UNACCEPTABILITY OF USING MAGNETIC SPECTROMETERS TO MEASURE THE ENERGY SPECTRUM OF CONSTANT AND PULSED BEAMS OF ULTRARELATIVISTIC CHARGED PARTICLES AND THEIR SEPARATION IN A CONSTANT MAGNETIC FIELD.

A magnetic spectrometer is a device that allows particles to be separated depending on the radius of the cyclotron orbit, guided by the relativistic formula $W \approx qBr$, where W is the kinetic energy of the particle, q is the particle charge, B is the magnetic field induction, and r is the radius of the cyclotron orbit. However, in the original formula, the equality of the Lorentz force and the centrifugal force, when the particle moves in a circle in a uniform magnetic field, leads to the equation:

$$qv\mathbf{B} = \frac{mv^2}{r} \tag{7}$$

- Where q is the particle charge, v is its velocity, B is the magnetic field induction,
- r is the radius of the cyclotron orbit, $m = m_o / \sqrt{1 - v^2 / c^2}$, m_o = rest mass,
- c is the speed of light.
- From the known q, r, B, we can calculate the kinetic energy of a particle:

$$W = m_o c^2 \{ \sqrt{\frac{q^2 B^2 r^2}{(m_o c^2)^2} + 1} - 1 \} \tag{8}$$

- In modern spectrometers, an approximate relation is used to estimate the kinetic energy of ultrarelativistic charged particles in a magnetic field when $qBr >> m_o c^2$ [9].

$$W \approx q\mathbf{B}r \tag{9}$$

- where q is the particle charge,
- B is the induction of a homogeneous magnetic field,
- r is the radius of a circle described by a particle.

It is seen from expression (9) that the kinetic energy of a charged particle in a magnetic spectrometer is directly proportional to the charge value, which in classical electrodynamics does not depend on the velocity of the particle and the radius of the cyclotron orbit.

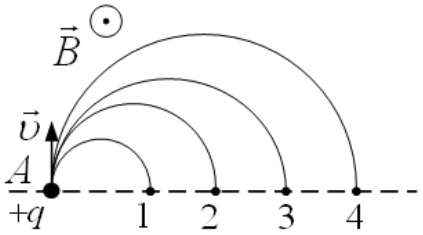

Figure 3: Radii of Cyclotron Trajectories of Positrons and Protons in a Magnetic Spectrometer.

In astrophysics, researchers for 15 years now cannot explain the so-called "PAMELA Effect", in which the magnetic spectrometer of the PAMELA space detector shows an increase in the number of positrons relative to electrons in the total number of registered secondary electrons and positrons, with an increase in the energy of relativistic protons, ranging from 1 GeV to 1 TeV. I believe that in reality the effect is really absent, since it is generated by systemic errors in the design of the PAMELA detector [10]. In this case, the energy spectrum of secondary positrons and electrons is very "soft" with a sharp drop above 100 MeV [11]. It can be seen from chart 1 that the value of the radius of the cyclotron orbit of primary relativistic protons increases with the growth of the particle mass up to the velocity $v \sim 10^8$m/s, and then the mass stops growing, having reached resonance, and has an inverse dependence on the growth of the particle velocity, accompanied by the effect decrease in the force of interaction of the proton with the magnetic field of the spectrometer. Therefore, instead of secondary positrons, relativistic primary protons are registered in the magnetic spectrometer, since the radius of the cyclotron orbit of a relativistic proton in the field of a permanent magnet turns out to be close to the radius of a positron and the sign of the charge of the proton and positron is positive. (Fig. 3).

As a result, the shielding coefficient of protons from positrons at the level of 10^{-5} declared by the researchers in the PAMELA magnetic spectrometer is not fulfilled, which does not allow one to reliably distinguish positrons from the background of protons. Let us pay attention to the fact that up to an energy of 0.8-1 GeV, a time-of-flight system with a resolution of about 300 ps participated in the separation of low-energy protons from positrons, and then the separation of positrons and relativistic protons was carried out without its participation, with the help of other systems. It is from this moment that the "PAMELA Effect" begins to appear (Figure 4).

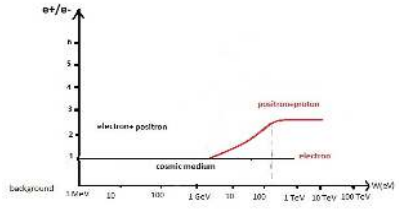

Figure 4: Positron-Electron Ratios (E+/E-) in PAMELA Experiments.

This confirms the statement of Yu.V. Galaktionov that in the AMS-2 magnetic spectrometer the spectrum for relativistic protons exactly corresponds to the spectrum of the "source" of primary positrons in the energy range of 20-200 GeV" [12]. I draw your attention to the fact that in the PAMELA detector, up to an energy of 1 GeV, a time-of-flight system with a resolution of about 300 ps participated in the separation of low-energy protons from positrons, and then the separation of positrons and relativistic protons was carried out without its participation, using a magnetic spectrometer and others systems [11]. Namely, from that moment on, the appearance of the "PAMELA Effect" was noted. For comparison, in the more advanced Alpha Magnetic Spectrometer AMS-2, which is also designed to measure high-energy charged particles, equipped with a 160 ps time-of-flight system (against 300 ps of the PAMELA detector) and the largest coordinate detector (tracker) with an area of 6.7 m², the PAMELA effect has been detected since proton energy 20 GeV [12] According to Yu.V. Galaktionov, "the mechanism of cosmic-ray acceleration in expanding non-relativistic shock waves arising from supernova explosions predicts a power-law cutoff at high energies for the proton energy spectrum that exactly corresponds to the spectrum of the" source "of primary positrons in the PAMELA effect in the range energies of 20-200 GeV " (10) [12].

$$\Phi = C \left(\frac{E}{E_0}\right)^{-\gamma} \exp\left(-\frac{E}{E_0}\right), \quad (10)$$

The spectral index γ is usually 2, although with great uncertainty. Conclusion Yu.V. Galaktionova may indicate that together with positrons the PAMELA and AMS-02 space detectors fix relativistic protons. The reason for this should be sought in the method of measuring the energy of charged particles in a magnetic spectrometer.

Of course, the opinion presented in the article requires careful verification, since it expresses a refusal to use magnetic spectrometers in experiments related to measuring the energy spectrum of constant and pulsed ultrarelativistic charged particle beams and their separation in a constant magnetic field. The conclusion suggests itself quite definite, astrophysicists owe the discovery of the "PAMELA effect" to a systemic error in the design of the PAMELA and AMS-2 detectors, associated with the imperfection of the Maxwell-Lorentz-Einstein electrodynamic theory.

5. CONCLUSIONS

In conclusion, the collapse of relativism forces the scientific community to propose a new paradigm for the development of science. Like classical mechanics, the relativistic theory does not consider internal processes in moving particles and the influence polarization of the physical vacuum vacuum on them. This is what Lev Sapogin's Unitary Quantum Theory does.

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