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THE SINGULAR WORLD OF ELEMENTARY ELECTRIC PARTICLES

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Abstract. *The singular world of elementary electric particles.* Theoretical foundations for the detection of singularities in the body of elementary particles of matter – electron, proton, neutron – are proposed. The complexity of the problem lies in the fact that moving electrically charged bodies generate complex electric fields with which they interact, while being under the action of inertial forces caused by motion. Partial compensation of the effects of transverse motion in the form of magnetic fields is far from sufficient. Therefore, it was necessary to use longitudinal motion and the finite speed of propagation of force signals in an electric field to take into account the phenomenon as a whole.

Theoretical results are accompanied by the results of integration of differential equations of motion, as well as analytical calculations.

Keywords: singularities in the body of elementary particles, adapted Coulomb and Newton's laws for moving masses.

Introduction

The singularity of matter (i.e., black holes) in the Universe was first discovered in 1916 by K. Schwarzschild. Experimenting with the equations of the general theory of relativity in the megaverse of a stationary spherical body, he found the corresponding metric, and at the same time the gravitational radius of the gravitating mass M

$$r_g = \frac{2GM}{c^2}, \qquad (1)$$

where G is the gravitational constant; c is the speed of light in a vacuum.

Black holes are objects, whose density is so high that gravity creates a region of space that no object, including photons, can escape from. Everything inside it is in a state of physical singularity.

It is much easier to obtain (1) based on the Coulomb and Newton laws adapted by us for the case of moving masses [1, 2]

$$\mathbf{F} = k_\xi \frac{\xi_1 \xi_2}{r^2}\left(1 + \frac{v^2}{c^2} + 2\frac{v}{c}\mathbf{v}_0 \cdot \mathbf{r}_0\right)\mathbf{r}_0, \quad \xi = q, m, \qquad (2)$$

where F is the vector of the force of interaction of two point bodies ξ_1 i ξ_2; r is the instantaneous distance between them; k_ξ is a constant coefficient; $\mathbf{r}_0$ is the unit radius vector; $\mathbf{v}_0$ is the unit velocity vector. Moreover, $\xi = m$ (in the case of gravitational interaction) and $\xi = q$ (in the case of electrical interaction), where m is the mechanical mass; q is the electrical mass (charge). The required orientation of the space vectors is found from the coordinate equations of mechanical motion

$$\mathbf{v}_0 \cdot \mathbf{r}_0 = \frac{r_x v_x + r_y v_y + r_z v_z}{rv}; \quad r = \sqrt{r_x^2 + r_y^2 + r_z^2}; \; v = \sqrt{v_x^2 + v_y^2 + v_z^2}, \qquad (3)$$

where r, v are the modules of the spatial vectors.

Under the condition of rotational motion (2) simplifies to

$$\mathbf{F} = k\frac{q_1 q_2}{r^2}\left(1 + \frac{v^2}{c^2}\right)\mathbf{r}_0. \qquad (4)$$

At angular acceleration

$$a = \frac{v^2}{r}, \qquad (5)$$

the balance of the forces of gravity and centrifugal acceleration for the conditions $v = c$ based on (4), (5) can be written as

$$\frac{mc^2}{r_g} = G\frac{mM}{r_g^2}\left(1 + \frac{c^2}{c^2}\right) \qquad (6)$$

from where we obtain directly (1).

To avoid giving the impression that scientists do not think about the issue raised, we will refer to the thoughts cited in [3].

Firstly. Based on K. Gödel's theorem on the incompleteness of our knowledge, "there are more and more reasons to believe that it is already difficult to do without the concept of other universes". In literature, one can even find ideas that these universes are not located elsewhere, but in elementary particles. And singularities, which occur in our Universe in the case of black holes can serve as communication channels (with them). The barriers of space and time that separate us from other universes may not be as impenetrable as we think. Eventually, science may overcome them and take our

understanding of the Universe to a qualitatively new level. In this case, singularities of speed and force interaction are inevitable, as required by the boundary, on both sides of which different physical laws operate. It is clear that this discussion is at the level of hypotheses. *Microsingularity is inevitable if the multiplicity of universes is seen in the depths of matter.*

Secondly. We are talking about the speed threshold c, experimentally established as the speed of light in a vacuum. The impossibility of exceeding it is a postulate of the special theory of relativity. That is why Lorentz's radical rests on it. By the way, the name of the radical was given by Poincaré himself. At the same time, he treated the aforementioned postulate with some caution [4]. But it is not for us to judge such truths in an unknown world. Time will tell. For now, we remain and will remain on this side of the threshold for a long time to come, if not constants, then quasi-constants, because we do not know how to live otherwise.

We were the first to theoretically substantiate the inconstancy of the speed of light in a vacuum by simulating the effect of gravity on a light signal based on the equations of motion involving (2), (3) [2, 3], a phenomenon experimentally confirmed and known as the Shapiro effect. The results of the computer simulation are shown in Fig. 1

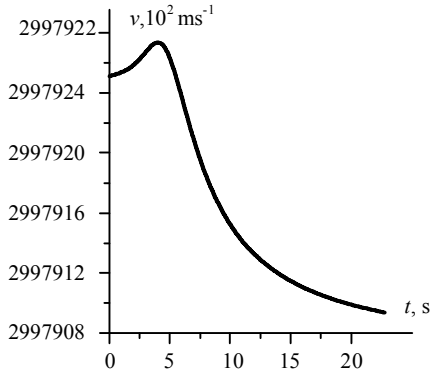

Fig. 1. Time dependence of the velocity of the gravitati-onal signal $c = c(t)$, in the transient process of passing around the Sun at a distance of 750,000 km

Not only Shapiro, but also Franson from the USA is a supporter of the inconstancy of the speed of light in a vacuum. But the former was prevented from giving a correct explanation of the physical phenomenon by the GTR with an emphasis on the curvature of space, and the latter by the quantum position, such as: "a photon spontaneously splits into a positron and an electron, and then quickly recombines into a photon again, and this can barely delay the motion of the photon".

The term "multiverse" was coined in 1895. This idea is actively used, for example, in string theory, in one of the interpretations of quantum mechanics, membrane theory, etc. As confirmed by the data of WMAP (Wilkinson Microwave Anisotropy Probe) and Planck Mission, variations in the density of the Universe, laid down in the first moments after the Big Bang, were further amp-lified due to gravitational attraction. Yes, tiny fluctuations have grown to the scale of gigantic structures.

Understanding these processes is a search for an answer to how micro- and mega-formations are combined into one harmonious whole. Researchers seek to "close the loop" between particle physics and cosmology: from the study of the smallest particles to the analysis of the formation of the Universe. Such synergy helps not only to reveal the nature and origin of matter, but also to understand the fundamental laws that govern our world.

Purpose of the work. Since in the hypothetical theory of the Multiverse, official science believes that separate universes are not located elsewhere, but in elementary particles, and singularities, which in our Universe occur in the case of cosmic black holes, can serve as communication channels (with them), it is logical that the corresponding channels must also exist in the elementary particles of our universe. Indeed, we were lucky to be the first to encounter the first one in the center of the electron in 2017 while refuting the "Poincaré springs" in the process of constructing the first conflict-free model of an electron [5]. This work will expand and extend the range of such singularities to all three particles – electron, proton, neutron.

Theoretical part

– First, let us consider, based on the phy-sical laws of nature, the types of its singularity at the micro level:
– white hole, purely electrical in origin;
– black hole, purely mechanical in origin;
– gray hole, electromechanical in origin.

If the first of them manifests itself in statics and is revealed by the energy balance, then the rest manifest themselves in dynamics, revealed by the balance of forces, attraction and centrifugal, provided that $c = \text{const}$.

1. Electron. White hole. Until recently, the theory of the electric field did not have a problem-free model of its own simplest charged elementary particle – the electron. The internal contradiction of the known const-ructions was reduced to two problems. The first of them is connected with the paradox of the self-action of the electron on itself. Its essence is that the electromagnetic mass of a moving electron, obtained from the impulse of the electric field, turns out to be greater than the rest mass. All known developments, in one way or another, required intervention in the fundamental equations of electro-magnetism. Only Poincaré, as a temporary way out of the situation, proposed the self-action of the elec-tron on

itself – the so-called "Poincaré springs". It was the energy of these magic springs that was intended to compensate for the necessary mass deficit. But a hun-dred years passed, and no one discovered these springs. The second problem is related to the infinite energy, and at the same time the mass of a point charge when the particle radius is directed to zero.

How we were able to solve the problem without contradicting either modern electrical theory or experimentation will be shown below.

The most reliable known method for calculating the mass of an electron is by its momentum:

$$m_e = \frac{2}{3}\frac{\alpha^2}{ac^2};\quad \alpha^2 = \frac{q^2}{4\pi\varepsilon_0}, \qquad (7)$$

where a is the radius of the electron; q is the charge of the electron.

There is no disagreement among physicists regarding the validity of (7). But the problem is different – in the deviation from (7) of the mass of a stationary particle, obtained by the universal expression of energy – If we assume that the charge of the particle is on its spherical surface (m'), or is evenly distributed throughout the volume inside (m''), then:

$$m'_e = \frac{1}{2}\frac{\alpha^2}{ac^2};\quad m''_e = \frac{3}{5}\frac{\alpha^2}{ac^2}. \qquad (8)$$

The conclusion of the first of these is not in question, as the distance limit of 10^{-16} m is not exceeded. However, the second one is questionable, because as a result of bombarding protons with fast electrons, it was established by their scattering that Coulomb's law does not apply at distances of 10^{-16} m! Our idea is very simple. Without going beyond the limits of classical electrodynamics, let us reconcile all three masses (7), (8) in favor of the first one. For this purpose, we consider the real charge to be distributed throughout the volume, but not evenly, as in the case of (8), but – unevenly!

The experimental fact of the collapse of Coulomb's law at distances of 10^{-16} m indicates one thing: there is no electric field within a sphere of this radius, and this will only be the case if the charges cannot cross it. Thus, an electric vacuum arises there, which we will conventionally call a "white hole". Of course, there is no point in talking about the laws of electromagnetism in such a vacuum. It is quite reasonable to look for the radius of such a white hole precisely in the elementary charge, which is the electron. Let us call it by analogy with the gravitational – electric.

The divergence of expressions (7), (8) clearly proves that the density of the charge must be distributed unevenly throughout the volume of the particle. One can look for different variants of this unevenness, but the simplest of them, as experience has shown, is quark.

According to quantum physics, an electron consists of three quarks (although there is an opinion that an electron as an elementary particle is indivisible) with an electric charge of a multiple of $e/3$. This multiplicity is quite common in physics. As will be shown below, the electric radius of an electron is about 2/3 of its actual radius a. Why actual? – Because the conditional $r_0 = 2{,}82\cdot10^{-15}$ m due to the uncertainty of the nu-merical coefficients in (7), (8) for the real mass m_e and charge e is overestimated by 3/2 times.

Quantum chromodynamics considers that an elec-tron consists of three conditionally "coloured" quarks (red, yellow, blue), and each of the first two having a charge of -e2/3, and the third colour quark having a charge of +e1/3. But there is also a frank one: "At present there are no experimental or theoretical ideas about the distribution of quarks in the volume of an electron... From this point of view, the hypothesis of an electron in the form of a sphere is the simplest and most acceptable" [6].

We do not consider the electron as a quark structure, but only assume the quark distribution of charge densities in three active zones of equal volume with radius r: $-e2/3$, $-e2/3$, $+e1/3$. Moreover, their sequence is determined by condition (7). This even somewhat simplifies the analysis, because it allows the first two zones to be combined into one. In certain zones, the charge density is considered constant. This model of the electron is perhaps the only one that does not affect the interests of either classical or quantum electrodynamics. This is because, according to classical electrodynamics, it preserves the monolithic nature of the elementary particle, and in accordance with quantum electrodynamics, it treats certain tuned zones as separate discrete quarks. In addition, the strength of such an electron design resembles the strength of a wooden wheel (-) compressed by a red-hot iron rim (+) in ancient vehicles.

With this structure of active zones and the presence of a white hole with a radius r_e in the center, the internal energy can be easily found using Maxwell's postulate of zones [5]

$$\begin{aligned} w_{ei}(\xi) = \frac{\alpha^2}{2a}\Bigg(& \frac{m_1}{4b^2}\left(\frac{k_{r2}^5 - \xi^5}{5}\right) - \xi^3\left(k_{r2}^2 - \xi^2\right) + \\ & + \xi^6\left(\frac{1}{\xi} - \frac{1}{k_{r2}}\right) + \frac{m_2^2}{5b^2}\left(1 - k_{r2}^5\right) - \\ & - \left(\frac{m_2^2 k_{r2}^3}{b^2} + \frac{m_1 m_2}{b}\right)\left(1 - k_{r2}^2\right) + \\ & + \left(\frac{m_2^2 k_{r2}^6}{b^2} + \frac{2m_1 m_2}{b} + m_1^2\right)\left(\frac{1}{k_{r2}} - 1\right)\Bigg), \end{aligned} \qquad (9)$$

where $m_1 = -4/3;\ m_2 = +1/3;\ r_e = \xi a,\ r_1 = k_{r1}a,$ $r_2 = k_{r2}a$ – radii of the white hole, the first and second active zones; the remaining coefficients are found based on the condition of equality of the volumes of individual active zones:

$$k_{r2} = \sqrt[3]{(2+\xi^3)/3};\ k_{r2} = \sqrt[3]{(2+\xi^3)/3}\ .$$

The only value ξ satisfying condition (7) is found as a solution to the nonlinear equation

$$w_{ei}(\xi) = \frac{\alpha^2}{6a}. \qquad (10)$$

As a result, $\xi = 0.6308965 \approx 0.6309$, what is, as expected, in the vicinity of 2/3 with a deviation of 5 %.

Substituting the numerical value ξ into (9) and dividing the obtained result by c^2, we obtain the mass of the electron, determined by its internal electric energy

$$m_{ei} = \frac{1}{6}\frac{\alpha^2}{ac^2}. \qquad (11)$$

The mass m'_e, appearing in (8), is determined by its external electric energy. This follows from the limits of integration when it is derived: $a \le r \le \infty$. Adding $m_e = m'_e + m_{ei}$, we obtain a result that coincides identically with (7). Which is what we needed to prove.

Let us assume that the laws of electricity are meaningless inside a "white hole" with a radius $r_e = \xi a = 1{,}185246 \cdot 10^{-15}$ m, since electric charges cannot penetrate beyond it. This is a very important conclusion, because it eliminates another problem of infinite energy, and at the same time the mass of a point charge at $r \to 0$. Because r cannot exceed the radius of the electron's "white hole" $r \ge r_e$.

The harmony of the outer spheres of the white hole and all three active zones is striking [1, 2]

0	$\xi = 0.6309$	$k_{r1} = 0.7901$	$k_{r2} = 0.9087$	1
$0 = \sqrt[3]{0/4}a$	$r_e = \sqrt[3]{1/4}a$	$r_1 = \sqrt[3]{2/4}a$	$r_2 = \sqrt[3]{3/4}a$	$a = \sqrt[3]{4/4}a$

According to H. Poincaré, only harmony expressed by the laws of mathematics can be objective reality. In this regard, I will quote one of the daily entries. It concerns not only the results obtained, but also lifts the veil on the mystery of creativity. For it was not without another miracle, perhaps the only one in science: the nonlinear (6th order) algebraic equation of the electric radius was solved without mathematical operations, based solely on the harmony of spheres, as: $x = \sqrt[3]{1/4}$! I do not know whether there is a more convincing confirmation of the dualistic interpretation of being anywhere else.

If we consider this structure of an electron to be quark-based, then a white hole can be interpreted as the fourth white (neutral) quark. But in this case, for the sake of the presence of orbital moments, we will not prohibit our quarks from "virtually rotating" relative to each other.

Interestingly, J. Zweig (the father of the quark idea) called quarks aces, but this name did not stick, because there were four aces, and there were three quarks in the original model. Perhaps our white one is the fourth (?).

Everything said here confirms once again the wisdom of: "never say never". Because how else can we explain what quantum physics says [7]: "In our time, most physicists already understand that attempts to create any classical model of the electron are meaningless".

Digression. Usually, quarks are represented as three balls of radius *r* in a spherical electron sphere of radius *a*. In this case

$$r = \frac{\sqrt{3}a}{\sqrt{3}+2} = 0.4641a. \qquad (12)$$

Thus, the volume of the pouring quarks is several times smaller than ours $(\xi / r)^3 = 2.5$. It is unlikely that nature would tolerate such wastefulness. Our distribution is based on the principle of constructing a collapsible doll of one of the seven Japanese Shinto gods of happiness, Fokurokuju. By the way, the Russians, after visiting Japan in 1895, built their own famous "matryoshka" doll based on this principle.

2. Electron. Black hole. It is found by expression (1) with known data

$$r_{ge} = \frac{2 \cdot 6.674 \cdot 10^{-11} \cdot 9.110 \cdot 10^{-31}}{(2.998 \cdot 10^8)^2} = 1.353 \cdot 10^{-57}\ \text{m}. \qquad (13)$$

As for the gray hole of the electron, it is of no practical interest since no moving masses have been detected around the electron in its orbit.

3. Proton. White hole. It is found by expressions (9)–(11) similarly to the case of the electron, but taking into account the mirror arrangement of quarks along the radius *r*: +e2/3, +*e*2/3, -*e*1/3. Then we have

$$r_{em} = \xi a. \qquad (13)$$

Substituting the digital information, we get

$$r_{gp} = 0.6309 \cdot 0.8482 \cdot 10^{-15} = 0.535 \cdot 10^{-15}\ \text{m}. \qquad (14)$$

4. Proton. Black hole. It can be found by the same expression (1) with real input information

$$r_p = \frac{2 \cdot 6.674 \cdot 10^{-11} \cdot 1.673 \cdot 10^{-27}}{(2.998 \cdot 10^8)^2} = 2.484 \cdot 10^{-44}\ \text{m}. \qquad (15)$$

5. Proton. Gray hole. It can also be found using expression (1) if the gravitational force interaction is replaced by an electric one while maintaining inertia

$$r_{sp} = \frac{2kq^2}{mc^2}. \qquad (16)$$

Substituting the numerical information into (16), we obtain

$$r_{sp} = \frac{2 \cdot 8.988 \cdot 10^9 \cdot (1.602 \cdot 10^{-19})^2}{1.673 \cdot 10^{-27} \cdot (2.998 \cdot 10^8)^2} = \\ = 3.069 \cdot 10^{-18}\ \text{m}. \qquad (17)$$

The proton gray hole has important practical significance in the problems of mathematical modelling of transient processes in the micro-world [1, 2].

Example. We will use the differential equations of motion in 2D Cartesian coordinate space obtained on the basis of (2), (3) [1, 2, 5]

$$\frac{dv_x}{dt} = -\frac{kq^2 r_x}{mr^3}\left(1 + \frac{v^2}{c^2} + 2\frac{r_x v_x + r_y v_y}{cr}\right);$$
$$\frac{dr_x}{dt} = v_x;$$
$$\frac{dv_y}{dt} = -\frac{kq^2 r_y}{mr^3}\left(1 + \frac{v^2}{c^2} + 2\frac{r_x v_x + r_y v_y}{cr}\right); \qquad (18)$$
$$\frac{dr_y}{dt} = v_y;$$
$$r = \sqrt{r_x^2 + r_y^2}; \quad v = \sqrt{v_x^2 + v_y^2}.$$

The results of the simulation of the collapse of physical laws in the gray hole of the electron-proton tandem of the hydrogen atom are shown in Fig. 2, 3 [8].

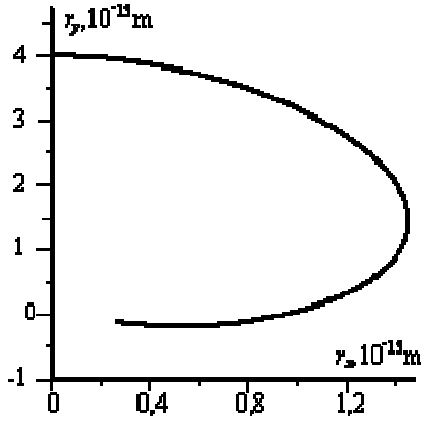

Fig. 2. Hodograph of the radius r = r(t) of the collapse of the electron trajectory inside electromechanical singularities in the field of force action of the proton

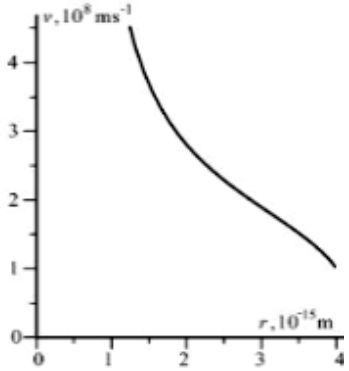

Fig. 3. The dependence v = v(r), demonstrating the collapse of the laws of mechanics in the depths of matter

6. Neutron. Black hole. With the exception of the black hole, the rest of holes in the proton are meaningless. We also find it according to (1) based on real information about the neutron

$$r_n = \frac{2 \cdot 6.674 \cdot 10^{-11} \cdot 1.675 \cdot 10^{-27}}{(2.998 \cdot 10^8)^2} = 2.486 \cdot 10^{-44}\ \text{m}. \qquad (19)$$

Neutron stars are a common phenomenon in the Cosmos.

As we can see, in Fig. 3, inside singularities, the speed of the electron collapses to infinity.

Curiosities about certain issues of the hypothetical Multiverse theory, which is widely used in cosmology, can be found in [9–11].

Conclusions

1. The collapse of physical laws is present not only in cosmic black holes, but also in the depths of matter at the level of its elementary particles. To detect them, it is not enough to take into account the effects of transverse motion using the concept of a magnetic field Here it was necessary to take into account longitudinal motion and the finite speed of propagation of electric waves. All these requirements are met by our adapted laws of Coulomb and Newton for the case of moving masses, both electrical (charges), and mechanical.

2. Assuming the hypothetical theory of the Multiverse about the existence of parallel worlds and the connection of mega- and microworlds through their singularities is true, then the results we have obtained are the first scientific confirmation of this possibility. However, this remains in the realm of surreal mathematical modelling, as discussed in [1, 2].

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СИНГУЛЯРНИЙ СВІТ ЕЛЕМЕНТАРНИХ ЕЛЕКТРИЧНИХ ЧАСТИНОК

Василь Чабан

Запропоновано теоретичні підстави виявлення сингулярностей в тілі елементарних частинок матерії – електрона протона, нейтрона. Складність задачі полягає в тому, що рухомі електрично заряджені тіла породжують складні електричні поля, з якими вони взаємодіють, перебуваючи водночас під дією інерційних сил, зумовлених рухом. Часткова компенсація ефектів поперечного руху у вигляді магнетних полів є далеко не достатньою. Тому довелося задіяти поздовжній рух і скінчену швидкість поширення силових сигналів у електричному полі, щоб урахувати явище в цілому.

Теоретичні результати супроводжуються результатами інтегрування диференціальних рівнянь руху, а також аналітичними розрахунками.

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