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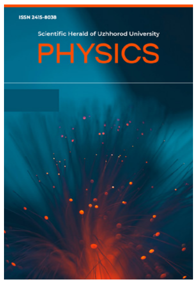

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Electron modelling in conjunction witch vacuum modelling

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Abstract

Relevance. The relevance of the study and the corresponding results is based on the need for digital transfer of scientific physical and mathematical devices for modelling the studied objects and phenomena of the real world into a digital programme environment, which forms a powerful research tool with the possibility of multi-reading and multi-vector calculation and forecasting of the nature and qualities of simulated elements of the physical world with a different scientifically based configuration of the initial data. The quality and reliability of digital models depend on the quality and completeness of consideration of various physical aspects in the simulated research objects and phenomena. Therefore, it is appropriate and relevant to formulate the initial iteration of digital transfer – the creation of a dependence-correlation apparatus. The second aspect that confirms the relevance of the current study is the fact that there is no integral model of the electron: currently, the world scientific community knows models describing individual characteristics and elements of the studied elementary particle, but there are no models describing the electron as an integral object.

Purpose. The purpose of the study is to develop a model of an electron associated with a simulated vacuum using appropriate analogue models from recognised fundamental studies.

Methodology. The study uses the methods of analogue Dirac models, spinor field models, the six-dimensional space-time model of the Bartini world, and the Planck oscillator model.

Results. Based on the results of experiments and physical and mathematical transformations in the current study, by integrating elements of the Ehrenfest paradox theory into the above models and basic elements of physical science, a complete model of the electron was formulated, which not only received a description of spatial and energy characteristics, but also allowed assessing the oetiological and morphological features of the development of the elementary particle, and individual physical and correlation dependencies were established.

Conclusions. First, the Hubble constant is necessary as a vacuum parameter in modelling elementary particles; second, the Hubble constant is included in the equation of the classical electron radius; and third, based on model calculations, the hypothesis of differences between the electron, muon, and tauon is proposed

Keywords: vacuum quantum, electron radius, magnetic moment, Hubble constant, Ehrenfest paradox

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Introduction

The relevance of the study follows from the trends in the development of the scientific sphere, which strives for deep diffusion involvement in the research environment of digital programme modelling tools, which provides not only a more structured and holistic physical picture of any phenomenon or process of manifestation of the real world, but also allows achieving the ability to predict the development of the studied objects with an acceptable degree of confidence. The basis of the qualitative transition of analogue processes to digital programme modelling (within the framework of global trends of the 4th iteration of the industrial progress of the multi-industry activity field) is a mathematical model adequate to real physical processes and conditions, the formula expressions and dependencies of which are the basis for the development of a software and digital model of objects and processes that carry out digital transfer. Software modelling of any physical phenomena and processes is as qualitative and adequate as the defined formula dependencies describing the studied aspects of real-world manifestations are more accurately and empirically converging. In the horizon of scientific research on the problems of simulation of electrons and electron-related processes, it is worth noting the studies by C. Lamy (on the possibility of using artificial neural networks for modelling non-local electron transport in plasma) [1], B. Tang (on numerical modelling of the processes of suprathermal electron transport in the solar wind) [2], X. An (on modelling the effects of bound electrons in the process of model studies of particles in a cell) [3], Y. Liu (on toroid modelling of electron loss processes flowing out of a 3D field in the organisation of research in the international experimental thermonuclear reactor (ITER)) [4], X. Li (on modelling the processes of acceleration and electron transfer in the early pulsed phase of a solar flare) [5], “Modelling of non-local electron transport in laser-driven double-ablation fronts” [6], “Relaxation of electron beams/strahls in solar outflows: observations vs. modelling” (on the correlated analysis of the results of modelling and full-scale measurements of electron beam/strahl relaxation processes in solar flows) [7], H. Funaba (on the study of the Thomson scattering effect in modelling and estimating electron temperature) [8], D. Vatansever et al. (on modelling surfaces that emit electrons when boundary layers are immersed in plasma) [9], V. Lazurik (on the investigation of semi-empirical models of electron beam control in radiation technologies) [10], O. Linder (on self-matching modelling of electron run-up during breakdowns in Tokamak (ITER)) [11], L. Adhikari (on modelling the process of heating protons and electrons in a fast solar wind) [12], M. Wibowo (on modelling the dynamics of ultra-fast electrons in strong magnetic fields using real-time electronic structure methods) [13], Y. Huang (on modelling strong electron heating by radio frequency waves at EAST) [14], Z. Wang (on real-time modelling and estimation of the total electron content in the vertical global ionosphere using hourly IGS data) [15]. When analysing these specialised publications, it was found that in modern physics, electron models only describe its properties. Known electron models do not answer questions about the structure of the electron, the nature of the electric charge, the nature of the fine structure constant, and the relationship between electron parameters and vacuum parameters. Building a model of an electron, in the study of which it is possible to establish new physical patterns, is an urgent task. As part of the current study, when modelling an electron in combination with vacuum modelling, oetiological and morphological features of the generation of the studied elementary particles are established, which provides a more complete physical picture of reality.

Materials and Methods

To achieve the established goals and objectives, the study uses recognised methods of microparticle modelling based on the application of analogue models implemented in accordance with the recommendations of R. Gaudenzi [16], A.J. Daley [17], V.V. Mdzinarishvili [18], S.D. Bass & E. Zohar [19], D. Hangleiter [20]. The use of these analogue models allowed involving in the process of target modelling the recognised physical-theoretical and physical-empirical formulations and dependencies, based on the results of integration of which the corresponding first-iterative calculations were performed. The electron model was developed in the following methodological sequence:

– the general parameters of the space-time continuum are determined, in particular, the concept of the density of matter determined using the gravitational constant and the Hubble constant;

– the model of physical vacuum is developed using the conceptual basis and theoretical background of P.A.M. Dirac models, spinor field models, di Bartini model of six-dimensional spacetime (Bartini world), and M.K.E.L. Planck oscillator model;

– the energy characteristics of the simulated vacuum are determined, in particular, the meager spinor energy, the electric field density, the energy due to the magnetic field, the oscillator energies, etc., the derived dependences of which allowed formulating the electron model (in particular, determining the spatial and energy parameters of the electron and the parameters of the membrane of the elementary particle under study);

– for the purpose of correlation and scientific evaluation of the developed model of the object under study, the previous scientific experience in modelling the electron as an elementary particle is established with the allocation of an appropriate vector for the development of analogue modelling with a focus on the model development directly for the studied atomic element associated with the vacuum model, in particular, by R. Solomon (on establishing the correlative dependence of the mass and Hubble constant of an electron on the environment) [21], G. Qu & G. Tatara (on the study of massive electrons by P.A.M. Dirac) [22], A. Uka & S. Nazarko (on the use of di Bartini models in energy expression and the use of spatial parameters to achieve unification based on the ideas of Einstein and Wheeler) [23], H.P. Le (on quantum modeling of Fokker – M.K.E.L. Planck degenerate electrons) [24], L. Nash (on the dynamics of Euclidean space-time at the M.K.E.L. Planck scale) [25], J. Walkowiak (on approximate atomic models for fast calculation of the Fokker – M.K.E.L. Planck equation in thermonuclear plasma with high Z impurities and superthermal electrons) [26];

– the parameters of the electron for which it is advisable to perform modelling are determined;

– analogue models are used to develop an electron model with the appropriate definition of derived quantities that establish the simulation quality and physical parameters of the model;

– the energy parameters of the generated electron model are calculated;

– a correlation is established between the parameters of the simulated electron and Hubble's fundamental studies, in particular, on the direct participation of the Hubble constant in the development of the electron model.

Based on the results of modelling with the development of an appropriate mathematical framework (based on specialised physical and empirical formulations and expressions), analytical conclusions are formed regarding the scientific value of the developed model of an electron associated with vacuum modelling and the presence of a correlative relationship with recognised aspects of the physical picture of the real world.

Results and Discussion

The space-time continuum is characterised by a critical density of matter [21]:

$$\rho = \frac{3H^2}{8\pi G}\,, \tag{1}$$

where G – gravitational constant; H – Hubble constant. ($H = 3 \cdot 10^{-18} c^{-1} \div 4 \cdot 10^{-18} \mathrm{c}^{-1}$).

Known models of physical vacuum:

– model proposed by P.A.M. Dirac, where vacuum is considered as an environment consisting of pairs of particles and antiparticles;

– models of spinor fields, where the vacuum is considered an environment consisting of non-mass spinors [22].

There is also a well-known theory of the (3+3)-dimensional continuum (Bartini world), which was developed by a prominent aircraft designer, theoretical physicist, cosmologist, and philosopher R.O. di Bartini [23]. He considered his six-dimensional space-time to be quantum. As the quantum of space, R.O. di Bartini [23] adopted the classical electron radius. Assuming that the vacuum is quantum, there is an element of the microstructure of the vacuum – a particle with a spin $\frac{\hbar}{2}$, with localisation radius r_0 and a density ρ equal in magnitude to the critical density of the space-time continuum. The meager spinor energy is equal to the product of the density by the volume of the localisation sphere and the square of the speed of light:

$$W = \frac{H^2 r_0^3 c^2}{2G} \tag{2}$$

This minuscule energy is equated with the minuscule energy of a vacuum quantum $\frac{\hbar}{2}H$ and after algebraic transformations, the radius of the spherical surface equal to the classical radius of the electron is obtained:

$$r_0 = \left(\frac{G\hbar}{Hc^2}\right)^{\frac{1}{3}} \tag{3}$$

Classical electron radius r_0 – a fundamental constant of the length dimension, which is included in a number of equations of classical and quantum electrodynamics. From equation (3), it is advisable to express and perform a numerical calculation of the Hubble constant, since only its approximate value is known in physics. Calculated value: $H \approx 3{,}5 \cdot 10^{-18} c^{-1}$.

The modelling technique requires the established formulas to be derived from other model constructions. For the first time, the membrane model of the Electron was proposed by P.A.M. Dirac [22]. The elementary charge in his model is evenly distributed over the spherical surface of the membrane. Next, the study considers the membrane model of an electron, with the following model constructions. One spatial coordinate from a three-dimensional space is collapsed, compacted, and its thickness is minimised. The resulting membrane has the following surface density:

$$\sigma = \frac{cH}{8\pi G} \tag{4}$$

Equation (4) was obtained by multiplying the critical density value ρ by the volume of a sphere with a radius c/H and dividing the resulting mass by the surface area of this sphere. The surface energy density of the membrane correlates with the energy density of the electric field of an electron:

$$w = g\sigma, \tag{5}$$

where g – parameter with the acceleration dimension.

Electric field energy density:

$$w = \frac{\varepsilon_0 E^2}{2}\,, \tag{6}$$

where E – electric field strength; ε_0 – electric constant.

Thus, the parameters of the two-dimensional electric field of an electron are correlated with the parameters of a two-dimensional membrane. The magnetic field of an electron is characterised by one-dimensionality – the magnetic moment of the electron (N.H.D. Bohr magneton) is projected in any fixed direction, taking the value $\pm\mu_{\text{Б}}$. Thus, a one-dimensional continuum element is observed in three-dimensional space. The study provides a mechanical analogy of the N.H.D. Bohr magneton. Let the tube be fixed at one end in the swivel joint. A miniature robot inside the tube captures freedom of movement in one coordinate. For him, space is one-dimensional. The observer in a three-dimensional space records different positions of the tube, which has two degrees of freedom of rotational motion, and notes its constant length. The realisation of an electron in a space-time continuum is associated with the splitting of three-dimensional space into two-dimensional and one-dimensional. In this case, the charge sign is determined by the symmetry variants of the space-time continuum. Mass of a spherical membrane with radius r_0 is equal to $4\pi\sigma r_0^2$, and the energy corresponding to this mass is equal to:

$$W_e = \frac{Hr_0^2c^3}{2G} \tag{7}$$

This energy can be identified as conditioned by an electric field. The value c/r_0, which has the dimension of the cyclic frequency, is denoted by the letter ω_0. Then, by analogy with rotational motion, the energy conditioned by the magnetic field:

$$W_m = \frac{\hbar}{2}\cdot\omega_0 = \frac{\hbar c}{2r_0} \tag{8}$$

By analogy with an electromagnetic oscillator or with an electromagnetic standing wave, where the energy of the electric and magnetic fields are equal, the right-hand sides of equations (7, 8) are equated, and the equation (3) of the classical electron radius is obtained from the resulting equality. The bar frequency is determined by the equation:

$$\omega_p = \left(\frac{c^5}{G\hbar}\right)^{\frac{1}{2}} \tag{9}$$

Then, a compact formula for the electron is obtained from equation (3):

$$\omega_0 = \left(H\omega_p^2\right)^{\frac{1}{3}} \tag{10}$$

Next, as an analogue, the study considers a model of the rotational motion of a ring or cylindrical surface rotating around its axis at a linear speed close to the speed of light. In this case, there is a paradox of the special theory of relativity, formulated by P. Ehrenfest in 1909. The essence of the paradox is that the velocity of each element of the ring is directed tangentially and the ring must undergo Lorentz reduction in length. Then, for an external observer, the ratio of the ring length to its radius will not be equal to 2π and, accordingly, the positions of the Euclid geometry are not met. However, when formulating the paradox, the phenomenon of relativistic aberration of light was not taken into account. From the special theory of relativity, it is known that the direction of light propagation transverse to the velocity V will be for an external observer at an angle θ to the velocity V [27]. Then:

$$cos\ cos\ \theta = \frac{V}{c} \tag{11}$$

The wavelength of light in this direction is reduced due to the C. Doppler effect. In the rotating ring model, this is manifested by a reduction in the length of the radius. Thus, in the relativistic case, the radius of rotational motion, i.e., the radius along which the centripetal force acts, is directed at an angle θ to the linear velocity of the ring elements and equal to:

$$R = R_0\left(1 - \frac{V^2}{c^2}\right)^{\frac{1}{2}}, \tag{12}$$

where R_0 – geometric radius of the ring.

The centre of a circle is not a point, but an inner sphere with a radius $\frac{R_0V}{c}$, to which radius R is directed tangentially (Figure 1).

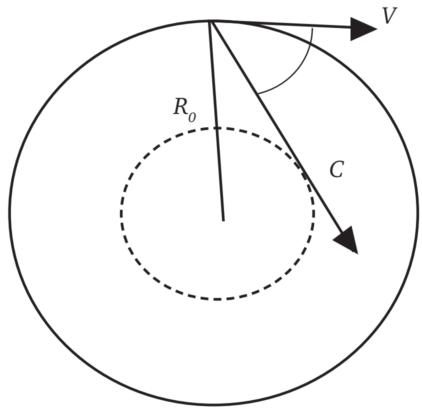

Figure 1. Concept diagram of a model environment for determining electron parameters

Shortening the length of the radius of rotational motion along which the centripetal force acts can be defined as compressing or folding a single spatial coordinate. When the ring moves with linear acceleration, there are two possible options:

1. Acceleration with a "+" sign and the spatial coordinate collapses.
2. Acceleration with a "-" sign and the spatial coordinate unfolds.

Obviously, by analogy with the model of a rotating ring, in an electron and positron, there is a convolution or sweep of one spatial coordinate and the implementation of a two-dimensional membrane. The acceleration sign determines the charge sign of the particle.

Next, the study environment considers the oscillator model by M.K.E.L. Planck [28; 29]. According to Planck's quantum hypothesis, the energy of an oscillator can only take certain discrete values equal to an integer number of elementary portions of energy – energy quanta. According to the theory of M.K.E.L. Planck, the average value of the oscillator energy with frequency ν is determined by the equation [28; 29]:

$$\langle E_\nu \rangle = \frac{h\nu}{expexp\left(\frac{h\nu}{kT}\right) - 1}, \tag{13}$$

where k – Boltzmann constant; T – radiation temperature of the oscillator.

In accordance with law of W. Wien, the frequency ν is related to the radiation temperature by the ratio [30]:

$$T = \frac{b\nu}{c}, \tag{14}$$

where Wien’s constant b is determined by the equation:

$$b = \frac{hc}{4{,}965k} \tag{15}$$

Thus, $b=2.9 \cdot 10^{-3}$ mK. Substituting equations (14) and (15) into equation (13), the following is obtained after algebraic transformations:

$$\langle E_\nu \rangle = \frac{h\nu}{expexp\,(4{,}965) - 1} \approx \frac{h\nu}{143} \tag{16}$$

The coefficient 1/143 was obtained for the M.K.E.L. Planck oscillator model [28; 29]. Interestingly, there is a similar coefficient for an electron. This is the so-called fine structure constant:

$$\alpha \approx \frac{1}{137} \tag{17}$$

That is, for an electron, the following equation is valid:

$$m_0 c^2 = \alpha \hbar \omega_0 \tag{18}$$

where m_0 – the rest mass of the electron.

The physical nature of the fine structure constant in modern physics is unknown. There is also no comprehensive knowledge of the structure of the electron. Therefore, it is premature to comment on the obtained ratios of physical quantities. Next, the study calculates physical quantities that have the dimension of limit frequencies. A well-known equation that is required for calculations [31; 32]:

$$e^2 = \alpha 4\pi\varepsilon_0 \hbar c \tag{19}$$

where e – elementary charge.

As a result of algebraic transformations, the following is obtained from equation (5):

$$\begin{gathered} \frac{\varepsilon_0 E^2}{2} = g\sigma \\ \frac{e^2}{4\pi\varepsilon_0 r^4} = \frac{gcH}{G} \\ \frac{\alpha\hbar c}{r^4} = \frac{gcH}{G} \\ \left(\frac{c}{r}\right)^4 = \frac{g\alpha^{-1}}{c} \cdot H\omega_p^2 \end{gathered} \tag{20}$$

Equation $f = \frac{g\alpha^{-1}}{c}$ has a frequency dimension. Values of f within the lowest and highest possible frequencies in nature:

$$H < f < \omega_p \tag{21}$$

Then the possible frequencies in the mathematical model of the oscillator are within:

$$\left(H\omega_p\right)^{\frac{1}{2}} < \frac{c}{r} < \left(H\omega_p^3\right)^{\frac{1}{4}} \tag{22}$$

The frequency of the upper limit corresponds to the frequency of the fermium energy quantum. It is known that in particle accelerators, an electron can be given an energy not exceeding 294 GeV [33]. This is the value of the fermium energy of the weak interaction. Numerical calculations in the first approximation confirm the ratio. Next, the study considers the nature of the lower frequency limit.

Analysing the spectra of galaxies, E.P. Hubble [34] concluded that most galaxies are moving away from us at speeds proportional to their distance. Galaxies are moving away not only from our galaxy, but also from each other. The universe bound by the law of E.P. Hubble, the same for an observer located at any point in space. The fundamental fact of observation is that the absorption lines in the spectra of nearby galaxies are shifted towards the red part of the spectrum [34].

Two types of redshift are known: Doppler and gravitational. In the 1920s, the general theory of relativity was not yet as widespread as it is now. Therefore, it is natural that observers interpreted the red shift in the spectra of galaxies as Doppler. But in modern cosmological theories, the expansion of the universe is related to the curvature of the space-time continuum, which is equivalent to a gravitational field. The Doppler and gravitational redshifts are equivalent when deriving the E.P. Hubble law [34] and are described by the equation:

$$\nu = \left(1 - \frac{Hl}{c}\right)\nu_0 \qquad (23)$$

where ν_0 – frequency of light emitted by the object; ν – frequency of light reaching the observer; l – distance from the object to the observer.

The equivalence of Doppler and gravitational redshifts allows introducing into theoretical calculations a value with the dimension of the potential of the gravitational field [35]:

$$(1 + \varphi) = \left(1 - \frac{Hl}{c}\right) \qquad (24)$$

The distance $r=l$ from a compact object with mass M is determined, on which the potential of its gravitational field is equal to:

$$(1 + \varphi) = \left(1 - \frac{GM}{c^2 r}\right) \qquad (25)$$

From equations (24, 25), the following is obtained:

$$r = \left(\frac{GM}{cH}\right)^{\frac{1}{2}} \qquad (26)$$

Next, the study determines at what value of r the mass of a microparticle has the value:

$$r = \left(\frac{G\hbar}{Hc^2}\right)^{\frac{1}{3}} \qquad (27)$$

Equation (27) is substituted into equation (26) and after algebraic transformations:

$$r = \left(\frac{G\hbar}{Hc^2}\right)^{\frac{1}{3}} \qquad (28)$$

The formula for the classical electron radius in the third model construction is obtained. The Planck mass is expressed by the equation:

$$m_p = \left(\frac{\hbar c}{G}\right)^{\frac{1}{2}} = \frac{\hbar\omega_p}{c^2} \qquad (29)$$

The distance r_1 is defined for Plank mass:

$$r_1 = \left(\frac{Gm_p}{cH}\right)^{\frac{1}{2}} = \frac{c}{(H\omega_p)^{\frac{1}{2}}} \qquad (30)$$

The denominator in equation (30) is the value of the lower limit of the frequency f in equation (22). Interestingly, the surface density of a membrane with a Planck mass and a spherical surface radius r_1 amounts to 2σ.

Elementary particles (electrons, muons, and tauons) belong to the class of leptons. It is a well-known hypothesis that muons and tauons are states of an excited electron. The main provisions of the theory of the six-dimensional world developed by R.O. di Bartini are used as a basis for model constructions [23]. In this model, in addition to the usual Cartesian coordinates of three-dimensional space, R.O. di Bartini [23] proposed to consider the same three-dimensional time model with three orthogonal coordinate axes. Physical phenomena of the microcosm, in particular, the crushing of elementary particles into quarks, suggest the application of the theory of R.O. di Bartini [23] in particle physics. In the (3+3)-dimensional continuum of the microcosm, it is possible to implement the addition of mutually perpendicular velocity fluctuations. Analogue models with calculations based on the formulas of relativistic addition of velocities are published in [36].

Let in the relativistic case be mutually perpendicular fluctuations in the velocity of a material point at the same oscillation frequency and phase difference. Setting the values of the speeds at which circular motion can be implemented:

$$V_x = c\ sin\ sin\ \omega t \qquad (31)$$

$$V_y = c\ cos\ cos\ \omega t \qquad (32)$$

$$V_z = c\ cos\ cos\ \omega t \qquad (33)$$

where c – speed of light in a vacuum.

In accordance with the law of relativistic addition of velocities, the resulting velocity when adding mutually perpendicular vibrations is equal to:

$$V_\mu = \left(V_x^2 + V_y^2 - \frac{V_x^2 V_y^2}{c^2}\right)^{\frac{1}{2}} \qquad (34)$$

Substituting equations (31) and (32) into equation (34), and after algebraic transformations, the following is obtained:

$$V_\mu = c(1 - 0.25 \cdot sin^2 2\omega t)^{\frac{1}{2}} \qquad (35)$$

Therefore, the resulting linear velocity of circular motion is pulsating.

In the case of relativistic addition of mutually perpendicular velocity fluctuations along three Cartesian coordinate axes, the resulting velocity is equal to:

$$V_\tau = \left(V_x^2 + V_y^2 + V_z^2 - \frac{V_x^2 V_y^2}{c^2} - \frac{V_x^2 V_z^2}{c^2} - \frac{V_y^2 V_z^2}{c^2} + \frac{V_x^2 V_y^2 V_z^2}{c^4}\right)^{\frac{1}{2}} \qquad (36)$$

Substituting the values of velocities from equations (31-33) into equation (36) and after algebraic calculations, the following is obtained:

$$V_\tau = c(1 - 0.25 sin^2 2\omega t \cdot cos^2 \omega t)^{\frac{1}{2}} \qquad (37)$$

Pulsations of the resulting velocities in analogue models give an idea of the nature of the excited states of the electron, which are manifested in the implementation of the muon and tauon.

Conclusions

In the current study, in accordance with the formulated goal and the identified scientific problem regarding the absence of electron models in the scientific space (moreover, in combination with the vacuum model), proper results were obtained.

With the help of a multilocal literature review, it is established that currently existing mathematical and physical models carry out model reproduction of only certain characteristics of the studied elementary particle, while the entire object of research (electron) (according to scientific research in the current chronometric horizon) is not reproduced in any of the relevant specialised studies in the digital model environment.

It is established that modelling with the development of an appropriate mathematical framework (through algebraic transformations) for a certain scientific aspect under study (development of an integral electron model) can be carried out using analogue models and corresponding recognised scientific results of modelling spinor fields, modelling six-dimensional space-time, and modelling an oscillator.

Using recognised scientific results, a model of the electron is created that reproduces not only its spatial and energy characteristics, but also determines the oetiological and morphological features of the generation of the elementary particle under study, which provides a more complete physical picture of reality.

When modelling the electron in combination with vacuum modelling, it became obvious that the constant is a vacuum parameter necessary for modelling and calculating elementary particles. The simulation results allow going beyond the paradigms of modern physics. It becomes obvious that elementary particles are not just material objects in the void of vacuum, but are created as a result of its splitting, crushing, oscillating movements, and interaction with vacuum quanta.

The prospect of further development of models consists in visual modelling of elementary particles made up of quarks as oscillating systems in which the distance between the components is a multiple of $\lambda/4$ and the transfer of the obtained physical and mathematical framework to a digital program environment for the development of an already direct electronic model of the elementary particle under study.

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Моделювання електрона в поєднанні з моделюванням вакууму

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Анотація

Актуальність. Актуальність дослідження та відповідних результатів формується з урахуванням необхідності здійснення цифрового трасферинга наукових фізико-математичних апаратів моделювання досліджуваних об'єктів та явищ реального світу в цифропрограмне середовище, що формує потужній дослідницький інструмент можливістю багатоітераційного та різновекторного обчислення та прогнозування характеру та якостей змодельованих елементів фізичної картини світу з різною науково обґрунтованою конфігурацією вихідних даних. Якість та достовірність цифрових моделей залежить від якості та повноти врахування різних фізичних аспектів в модельованих дослідницьких об'єктах та явищах. Відтак, доцільним та актуальним є формулювання початкової ітерації цифрового трансферингу – створення залежністно-кореляційного апарату. Другим аспектом, що засвідчує актуальність поточного дослідження є факт відсутності цілісної моделі електрону: наразі у світовій науковій спільноті відомі моделі, що описують окремі характеристики та елементи досліджуваної елементарної частинки, проте моделі, що описувала б електрон як цілісний об'єкт – відсутні.

Мета. Мета статті – розробка моделі електрону, що пов'язана з модельованим вакуумом з використанням відповідних аналогових моделей визнаних фундаментальних наукових праць.

Методологія. В поточному дослідженні використані методи аналогових діракових моделей, моделей спінорних полів, модель шестивимірного простору-часу бартінівського світу та модель планківського осцилятору.

Результати. За результатами дослідів та фізико-математичних трансформацій у поточному дослідженні шляхом інтеграції елементів теорії еренфестського парадоксу в зазначені вище моделі та базові елементи фізичної науки сформулювана цілісна модель електрону, яка не лише отримала опис просторових та енергетичних характеристик, а й дозволила оцінити етіолого-морфологічні особливості формування досліджуваної елементарної частинки, а також встановлені окремі фізико-кореляційні залежності.

Висновки. По-перше, хабблова постійна необхідна як параметр вакууму при моделюванні елементарних частинок, по-друге, хаблова постійна входить до формули класичного радіуса електрона, по-третє, на основі розрахунків моделей запропонована гіпотеза відмінностей електрона, мюона і таона

Ключові слова: квант вакууму, радіус електрона, магнітний момент, постійна Хаббла, парадокс Еренфеста