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Theory of compressible oscillating ether

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ABSTRACT

The paper considers ether as a dense inviscid compressible oscillating medium in the Euclidean three-dimensional space, given at each instant of time by the velocity vector of propagation of the ether density perturbations and satisfying the continuity equation and the ether momentum conservation law. It is shown that a generalized nonlinear system of Maxwell-Lorentz equations that is invariant with respect to Galileo transformations, the linearization of which leads to the classical system of Maxwell-Lorentz equations; laws of Biot-Savart-Laplace, Ampere, Coulomb; representations for Planck's and fine structure constants are obtained from the system of the two ether equations as well as formulas for electron, proton and neutron, for which the calculated by formulas values of their internal energies, masses and magnetic moments coincide with an accuracy to fractions of a percent with their experimental values which are anomalous from the point of view of modern science. A concept of an ethereal theory of atom and atomic nucleus is presented, which makes it possible to answer many questions about the structure of atom, on which modern science is unable to answer.

Introduction

It is well known that the contradictions between classical mechanics, obeying the equations and Newton's laws, and electrodynamics, described by Maxwell's equations, were the main reason for the emergence of the special theory of relativity as a result of the crisis in physics at the beginning of the twentieth century. It turned out that the basic laws of electrodynamics at transition from one inertial reference system to another remain invariant with respect to the Lorentz transformations, in contrast to the laws of mechanics, which remain invariant with respect to the Galileo transformations. It was necessary to choose between the following two options: 1) either to recognize that Maxwell's linear equations are not quite right and they need to be generalized in such a way that they satisfy Galileo transformations; 2) either to admit that the equations that satisfy the Lorentz transformations are true equations, and the equations of classical mechanics should be considered only as approximations to such true equations.

Unfortunately, despite the reasoned objections of many prominent scientists of the beginning of the twenties century, world science chose the second option. The chosen path led to the absolutization of Maxwell's equations and the light speed, which led to the complete cessation of research on the search for the equations of electrodynamics, which generalize Maxwell's equations and obey Galileo's principle of relativity. Such equations, in the opinion of the author, were derived in [1–3], based on the unique assumption of existence of ether as a dense inviscid compressible oscillating medium in the Euclidean three-dimensional space with density $\rho(t,\ \mathbf{r})$ and coordinates $\mathbf{r}(t)$ of the density perturbations propagation and their vector velocity $\mathbf{u}(t,\ \mathbf{r})$ at each moment of time t. In [1–3], the ether medium is proposed to be described in three-dimensional Euclidean space by the two nonlinear equations, which follow from the classical equations of Newtonian mechanics:

$$\frac{\partial\rho}{\partial t}+div(\rho\,\mathbf{u})=0,\quad \frac{d(\rho\,\mathbf{u})}{d\,t}=\frac{\partial(\rho\,\mathbf{u})}{\partial\,t}+(\mathbf{u}\cdot\nabla)(\rho\,\mathbf{u})=0, \tag{1.1}$$

that are the ether mass (continuity equation) and the ether momentum conservation laws. Note that the mass and density of ether are not the mass and density of a matter (see Section "Dimensions of basic physical quantities").

In the present paper, a complete generalized nonlinear system of Maxwell-Lorentz equations that is invariant with respect to Galileo transformations is derived from the system (1.1) of the ether equations, linearization of which leads to the classical linear system of Maxwell-Lorentz equations. This proves the existence of the first possibility exit from the crisis in science at the beginning of the last century. In addition, Biot-Savart-Laplace, Ampere and Coulomb laws, representations for Planck's and fine structure constants are derived from the system of the ether Eq. (1.1) as well as formulas for electron, proton and neutron for which the calculated by formulas values of their internal energies, masses, and magnetic moments are coincided up to fractions of a percent with their experimental values which are anomalous in terms of modern physical science. Foundations of ethereal theory of atom and atomic nucleus are developed.

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Derivation of the system of Maxwell-Lorentz equations

Ethereal definitions of the vectors of electric field intensity $\mathbf{E}$ and magnetic field induction $\mathbf{B}$ are given in [1–3]:

$$\mathbf{B} \equiv c\nabla \times (\rho\,\mathbf{u}), \tag{2.1}$$

$$\mathbf{E} \equiv (\mathbf{u}\cdot\nabla)(\rho\,\mathbf{u}), \tag{2.2}$$

where the positive constant c is the speed of propagation of perturbations (the speed of sound) in the ether medium. It will be shown below (formula (2.11)) that it is this value that is equal to the longitudinal component of the velocity of the helical wave of the ether (photon), whose transverse components written through the vectors $\mathbf{E}$ and $\mathbf{B}$ are an electromagnetic wave and satisfy Maxwell's equations. Consequently, the numerical value of the constant c used in the work coincides with the value of the speed of light and is approximately 300,000 km / s. The representation of the perturbations flux density of the ether $\rho\,\mathbf{u}$ in the form (2.1)-(2.2) is some special decomposition of it into two vectors $\mathbf{E}$ and $\mathbf{B}$. Let us show that the vectors $\mathbf{E}$ and $\mathbf{B}$ satisfy equations that can be interpreted as generalized Maxwell-Lorentz equations.

Derivation of nonlinear generalized system of Maxwell-Lorentz equations

Let us apply the operator $c\nabla\times$ to the second equation from (1.1). We get

$$\frac{\partial \mathbf{B}}{\partial t} + c\nabla \times \mathbf{E} = 0. \tag{2.3}$$

Taking the divergence from (2.1) and (2.2), we obtain

$$\nabla\cdot\mathbf{B} = 0, \tag{2.4}$$

$$\nabla\cdot\mathbf{E} = 4\pi\sigma, \quad 4\pi\sigma \equiv \nabla\cdot((\mathbf{u}\cdot\nabla)(\rho\,\mathbf{u})), \tag{2.5}$$

where second equation in (2.5) is the definition of the charge density σ through the ether parameters. Let us apply the operator of derivative along the curve $(\mathbf{u}\cdot\nabla)$ to the second equation from (1.1):

$$\frac{\partial \mathbf{E}}{\partial t} - \nabla \times \left(\frac{|\mathbf{u}|^2}{c}\mathbf{B}\right) + 4\pi\,\mathbf{j} = 0, \tag{2.6}$$

where $\mathbf{j}$ has the meaning of a vector of electric current density and

$$\begin{aligned}4\pi\,\mathbf{j} \equiv\ & (\mathbf{b}\cdot\nabla)\mathbf{u} + \mathbf{u}(\nabla\cdot\mathbf{b}) - \mathbf{b}(\nabla\cdot\mathbf{u}) - \nabla \times (\mathbf{u} \times (\nabla(\mathbf{u}\cdot\mathbf{a}) \\ & - (\mathbf{a}\cdot\nabla)\mathbf{u} - \mathbf{a} \times (\nabla \times \mathbf{u}))) + \nabla \times (\mathbf{u}(\mathbf{u}\cdot(\nabla \times \mathbf{a}))) - (((\nabla\cdot\mathbf{u})\mathbf{u} \\ & - (\mathbf{u}\cdot\nabla)\mathbf{u})\cdot\nabla)\mathbf{a}, \quad \mathbf{a} \equiv \rho\,\mathbf{u}, \quad \mathbf{b} \equiv \mathbf{E} = (\mathbf{u}\cdot\nabla)\mathbf{a} = (\nabla\,|\mathbf{a}|^2/2 - \mathbf{a} \times (\nabla \times \mathbf{a}))/\rho.\end{aligned}$$

In deriving Eq. (2.6), we use the known rules of action with the operator ∇:

$$\begin{aligned}(\mathbf{u}\cdot\nabla)((\mathbf{u}\cdot\nabla)(\rho\,\mathbf{u})) &= (\mathbf{u}\cdot\nabla)\mathbf{b} = (\mathbf{b}\cdot\nabla)\mathbf{u} + \mathbf{u}(\nabla\cdot\mathbf{b}) - \mathbf{b}(\nabla\cdot\mathbf{u}) - \nabla \times (\mathbf{u} \times \mathbf{b}), \\ \mathbf{u} \times \mathbf{b} &= \mathbf{u} \times ((\mathbf{u}\cdot\nabla)\mathbf{a}) = \mathbf{u} \times (\nabla(\mathbf{u}\cdot\mathbf{a}) \\ &\quad - (\mathbf{a}\cdot\nabla)\mathbf{u} - \mathbf{a} \times (\nabla \times \mathbf{u})) - \mathbf{u} \times (\mathbf{u} \times (\nabla \times \mathbf{a}))\ ,\end{aligned}$$

expression for a double vector product

$$\mathbf{u} \times (\mathbf{u} \times (\nabla \times \mathbf{a})) = \mathbf{u}(\mathbf{u}\cdot(\nabla \times \mathbf{a})) - (\mathbf{u}\cdot\mathbf{u})\nabla \times \mathbf{a}$$

and formula (3) from [4]: $\partial\,\mathbf{u}/\partial\,t = (\nabla\cdot\mathbf{u})\mathbf{u} - (\mathbf{u}\cdot\nabla)\mathbf{u}$.

As a result, we obtain a nonlinear, generalized system of Maxwell equations that is invariant under Galileo transformations in the same way as the initial system of ether equations (1.1):

$$\nabla \times \mathbf{E} = -\frac{1}{c}\frac{\partial \mathbf{B}}{\partial t},\ \nabla \times \left(\frac{|\mathbf{u}|^2}{c^2}\mathbf{B}\right) = \frac{1}{c}\frac{\partial \mathbf{E}}{\partial t} + \frac{4\pi\,\mathbf{j}}{c},\ \ \nabla\cdot\mathbf{B} = 0,\ \ \nabla\cdot\mathbf{E} = 4\pi\sigma \tag{2.7}$$

Taking the divergence from (2.6), we obtain the law of conservation of charge

$$\partial\sigma/\partial\,t + (\nabla\cdot\mathbf{j}) = 0.$$

Since $\mathbf{j} = \sigma\mathbf{w}$, then the velocity $\mathbf{w}$ of movement of charges can be found from the last equation. In some cases $\mathbf{w} = \mathbf{u}$ (Section "The derivation of the Biot-Savart-Laplace and Ampère laws"). It follows from the vector analysis formulas that

$$\mathbf{E} + \frac{\mathbf{u}}{c} \times \mathbf{B} \equiv ((\rho\mathbf{u}\cdot\nabla)(\rho\mathbf{u}) + \rho\mathbf{u} \times (\nabla \times (\rho\mathbf{u})))/\rho = \left(\frac{1}{2}\nabla(\rho\mathbf{u})^2\right)/\rho = |\mathbf{u}|\ \nabla(\rho\ |\mathbf{u}|), \tag{2.8}$$

Eq. (2.8) multiplied by the charge density, goes into the density of the Lorentz force $\mathbf{F}_L$:

$$\mathbf{F}_L = \sigma\left(\mathbf{E} + \frac{\mathbf{u}}{c} \times \mathbf{B}\right) = \sigma\ |\mathbf{u}|\ \nabla(\rho\ |\mathbf{u}|) \tag{2.9}$$

Thus, the systems of nonlinear Eqs. (2.7) and (2.9), where the unknown functions are functions $\mathbf{E}$, $\mathbf{B}$, can be interpreted as a system of generalized Maxwell-Lorentz equations. But more general solutions can be obtained by solving directly the system of Eq. (1.1) and then finding not only the vectors $\mathbf{E}$, $\mathbf{B}$, but also the distribution of charges and currents, which in Maxwell's theory should be considered given.

Derivation of the linear system of Maxwell equations

In the case $|\mathbf{u}| \approx c$ and experimentally determined σ and $\mathbf{j}$, equations (2.7) go over into the classical linear system of Maxwell's equations

$$\nabla \times \mathbf{E} = -\frac{1}{c}\frac{\partial \mathbf{B}}{\partial t},\ \nabla \times \mathbf{B} = \frac{1}{c}\frac{\partial E}{\partial t} + \frac{4\pi\mathbf{j}}{c},\ \nabla\cdot\mathbf{B} = 0,\ \nabla\cdot\mathbf{E} = 4\pi\sigma \tag{2.10}$$

According to [5], the introduction of dielectric and magnetic permeability of the medium is not necessary. All effects of the medium are in σ and $\mathbf{j}$.

It is important to note once again that the initial nonlinear equations of the ether (1.1) are invariant with respect to Galileo transformations [2,3]. The reason for the loss of such invariance in Maxwell's equations is the linearization of the ether equations (Eq. (2.7)) for $|\mathbf{u}| \approx c$. Expressions for σ and $\mathbf{j}$ in terms of the ether density and velocity of perturbations make it possible to calculate σ and $\mathbf{j}$ theoretically. We give the simplest example of the solution of the system (1, 1), which is satisfied by the density $\rho = const$ and velocity vector

$$\mathbf{u} = u_a\cos\left(\omega\,t - \frac{\omega\,z}{c}\right)\mathbf{i}_x + u_a\sin\left(\omega\,t - \frac{\omega\,z}{c}\right)\mathbf{i}_y + c\mathbf{i}_z, \tag{2.11}$$

where u_α is the amplitude of the transverse velocity. This is a helical wave of ether (photon). According to formulas (2.1), (2.2) such velocity and density of the ether correspond to a plane monochromatic circularly polarized electromagnetic wave. It is known that such a wave satisfies the classical Maxwell equations (2.10). The advantage of the ether representation of electromagnetic waves is the presence in an explicit form of the longitudinal velocity component in the direction of wave propagation in addition to the transverse oscillating component. Due to differentiation, in the vectors $\mathbf{E}$ and $\mathbf{B}$, there are no components in the direction of wave propagation. Moreover, energy during the motion of the helical wave of the ether is preserved in contrast to the sin-phase electromagnetic wave, the energy of which must periodically be equal to zero. In general, $\mathbf{E}$ and $\mathbf{B}$ carry incomplete information about the ether perturbations flux density $\rho\ \mathbf{u}$. The vector $\mathbf{A} = c\rho\,\mathbf{u}$ is a vector potential, since, from (2.1), $\mathbf{B} = \nabla \times \mathbf{A}$..

The difference between the ether equations and the equations of mechanics of continuous medium

In the classical mechanics of continuous medium, the continuity equation has the same form as the first equation from the system of Eq. (1.1). However, the equation of motion is different. In the classical mechanics of continuous medium, on the basis of the law of conservation of momentum in integral form and formula of the time-differentiation for the integral over moving volume [5, p. 37], that is, differentiating the volume integral, depending on the parameter, the following equation is derived

$$\rho(t,\mathbf{r})\frac{d\mathbf{u}(t,\mathbf{r})}{dt} = \mathbf{F}(t,\mathbf{r}) + (\nabla_{\mathbf{r}} p(t,\mathbf{r}))_{\mathbf{r}=\mathbf{r}(t)}. \tag{2.12}$$

Thus, the difference of the equation of motion of the ether (second equation in (1.1)) from the equation of motion in classical mechanics of continuous medium (2.12), including gas and hydrodynamics, consists in the absence of forces and a pressure gradient in the right-hand side of the second equation in (1.1), and in the presence of the term $\mathbf{u}(t,\mathbf{r})d\rho(t,\mathbf{r})/dt$ in its left-hand side.

The first difference is explained by the fact that the ether, as the first-born environment, itself forms the forces and pressure acting on the material objects generated by it. The second difference is due solely to the fact that there is no movement of the ether as a continuous medium, and only perturbations of its density move with conservation of the magnitude of the elementary volume in the propagation of these perturbations. Consequently, the locally oscillating compressible ether is globally stationary, forming an absolute fixed coordinate system in three-dimensional Euclidean space. All movements in the ether, including the movement of material objects, are movements of oscillations and perturbations of its density. The effect of changing the ether density in time $d\rho(t,\mathbf{r})/dt$ in the equation of motion (second equation in (1.1)) plays the important role, in particular, it determines the presence of electric charge, magnetic moment and mass of elementary particles, atomic nuclei and atoms of chemical elements. In addition, unlike Eq. (2.12), it is precisely from the equation of motion in (1.1) the Maxwell's equations and many other facts known from experiments, such as Coulomb, Ampere, Biot-Savart-Laplace laws, the structure of hydrogen atom, etc., follow immediately (see below and [1–3,6–8]).

Dimensions of basic physical quantities

If we assume that the dimension of the ether density has the form $[\rho] = tm^{1/2}/l^{3/2}$, then the dimensions of all the physical quantities of the ether theory are the dimensions in the SGS system [4]:

$$[\mathbf{B}] = \frac{m^{1/2}}{tl^{1/2}};\quad [\mathbf{E}] = \frac{m^{1/2}}{tl^{1/2}};\quad [q] = \frac{m^{1/2}l^{3/2}}{t};\ [m] = [m];$$
$$[\mathbf{j}] = \frac{m^{1/2}}{t^2 l^{1/2}};\quad [\mathscr{M}] = \frac{ml^2}{t};\quad [\varepsilon] = \frac{ml^2}{t^2}.$$

If we assume that the ether is dimensionless or non-material, then $m = l^3/t^2$ and all physical quantities have the same dimensions in SI and SGS systems, which can be expressed in terms of only dimensions of space and time

$$[\mathbf{B}] = [\mathbf{E}] = \frac{l}{t^2};\quad [q] = [m] = \frac{l^3}{t^2};\quad [\mathbf{j}] = \frac{l}{t^3};\quad [\mathscr{M}] = \frac{l^5}{t^3};\quad [\varepsilon] = \frac{l^5}{t^4};\quad [\mathbf{F}] = \frac{l^4}{t^4}$$

which means that there exist only three-dimensional Euclidean space and absolute time. All other physical quantities are their derivatives.

The derivation of the Biot-Savart-Laplace and Ampère laws

We derive the Biot-Savart-Laplace and Ampere laws from the generalized system of Maxwell-Lorentz equations. From the generalized nonlinear system of Maxwell's equations it follows that

$$\nabla\times\left(\frac{|\mathbf{u}|^2}{c^2}\mathbf{B}\right) = \frac{1}{c}\frac{\partial\mathbf{E}}{\partial t} + \frac{4\pi}{c}\mathbf{j} = \frac{4\pi}{c}\left(\mathbf{j} + \frac{1}{4\pi}\frac{\partial\mathbf{E}}{\partial t}\right) = \frac{4\pi}{c}\mathbf{j}_{tot}$$

Then, if the total current $\mathbf{j}_{tot}$ is distributed in the volume V and

$$\nabla\cdot\left(\frac{|\mathbf{u}|^2}{c^2}\mathbf{B}\right) = 0 \tag{3.1}$$

then

$$\frac{|\mathbf{u}|^2}{c^2}\mathbf{B}(\mathbf{r}) = \frac{1}{c}\int_V \frac{\mathbf{j}_{tot}\times(\mathbf{r}-\mathbf{s})}{|\mathbf{r}-\mathbf{s}|^3}dV,$$

and the expression for induction $\mathbf{B}$ of the magnetic field of the current $\mathbf{j}_{tot}$ is

$$\mathbf{B}(r) = \frac{c}{|\mathbf{u}|^2}\int_V \frac{\mathbf{j}_{tot}\times(\mathbf{r}-\mathbf{s})}{|\mathbf{r}-\mathbf{s}|^3}dV,\ \mathbf{s}\in V \tag{3.2}$$

Rewrite (3.1) in the kind

$$\nabla\cdot\left(\frac{|\mathbf{u}|^2}{c^2}\mathbf{B}\right) = \frac{|\mathbf{u}|^2}{c^2}\nabla\cdot\mathbf{B} + \left(\nabla\frac{|\mathbf{u}|^2}{c^2}\right)\cdot\mathbf{B} = \left(\nabla\frac{|\mathbf{u}|^2}{c^2}\right)\cdot\mathbf{B} = 0.$$

Therefore, condition (3.1) is satisfied if $\nabla\ |\mathbf{u}| = 0$ and under this condition the equation (3.2) is fulfilled. For a conductor L with a current at $\mathbf{j}_{tot} = j\mathbf{dl}$ and $|\mathbf{u}| \approx c$, $\nabla\ |\mathbf{u}| \approx 0$ we obtain the classical Biot-Savart-Laplace law for induction of the magnetic field of the conductor

$$\mathbf{B}(\mathbf{r}) = \frac{1}{c}\int_L \frac{j\mathbf{dl}\times(\mathbf{r}-\mathbf{s})}{|\mathbf{r}-\mathbf{s}|^3}.$$

It has long been well known that Ampère's law, describing the interaction of conductors with currents, works exclusively with parallel conductors. In addition, until now there is no clear understanding of what Ampère's force is, from which one conductor with current acts on another conductor. Let us consider two conductors l_1 and l_2, the second of which carries a current $\mathbf{j}_{2,tot} = j_2\mathbf{dl}_2$. In accordance with the Biot-Savart-Laplace law, the second conductor creates around itself a magnetic field with induction

$$\mathbf{B}_2(\mathbf{r}) = \frac{c}{|\mathbf{u}_2|^2}\int_{L2} \frac{j_2\mathbf{dl}_2\times(\mathbf{r}-\mathbf{s})}{|\mathbf{r}-\mathbf{s}|^3}$$

if$\nabla\ |\mathbf{u}| = 0$.This magnetic field excites the ether in the conductor l_1 so that the quartet $(\mathbf{E}_1, \mathbf{B}_2, \mathbf{u}_1, \rho_1)$ satisfies the generalized nonlinear system of Maxwell-Lorentz equations. Then the Lorentz force acts on the conductor l_1

$$\mathbf{F}_L = \sigma\left(\mathbf{E}_1 + \frac{\mathbf{u}_1}{c}\times\mathbf{B}_2\right) = \sigma\ |\mathbf{u}_1|\ \nabla(\rho_1\ |\mathbf{u}_1|).$$

The second term in the last expression is the generalized Ampere force

$$\mathbf{F}_{Ampere} = \sigma\frac{\mathbf{u}_1}{c}\times\mathbf{B}_2$$

In stationary mode, if $\partial\mathbf{E}_1/\partial t = 0$ and if $\mathbf{u}_1 = \phi(l_1)\mathbf{dl}_1$, $|\mathbf{u}_2| \approx c$, we obtain

$$\sigma\mathbf{u}_1 = \mathbf{j}_{1tot} = \mathbf{j}_1 = \rho\phi(\phi\phi')'\mathbf{dl}_1 = j_1\mathbf{dl}_1,$$

and

$$\mathbf{F}_{Ampere} = \frac{j_1\mathbf{dl}_1}{c}\times\mathbf{B}_2$$

which coincides with the classical expression for the Ampere's law.

Wave nature of proton and electron

The particles such as proton and electron are the main structural units of matter. They generate neutron, hydrogen atom, nuclei of atoms and the atoms of all chemical elements. They have the same on absolute value charge, can born from high-energy photons and annihilate with forming photons. So, they should have a single mechanism of their generation by the ether medium, and this mechanism should be described by solutions of the system of ether Eq. (1.1).

The system of equations for particles

Let us write the system of equations (1.1) in the stationary spherical coordinate system, that is taking into account the fact that the vector $\mathbf{u}$ is the velocity vector of perturbations propagation of the ether density, but not the velocity vector of motion of the ether itself. In this case

$$\mathbf{u} = u_r\mathbf{r} + u_\theta\theta + u_\phi\boldsymbol{\varphi} = V\mathbf{r} + \Omega\theta + W\boldsymbol{\varphi}; \qquad V = \frac{dr}{dt},$$
$$\Omega = r\frac{d\theta}{dt}, \qquad W = r\sin\theta\frac{d\phi}{dt},$$

where we can consider that the unit coordinate vectors of the stationary spherical coordinate system ($\mathbf{r}$, θ, $\boldsymbol{\varphi}$) do not depend on time and their total time derivatives are zero, because the ether is globally immobile. Then it follows from the ether equations (1.1), that

$$\frac{d\rho\mathbf{u}}{dt} = \frac{d\rho V}{dt}\mathbf{r} + \rho V\frac{d\mathbf{r}}{dt} + \frac{d\rho\Omega}{dt}\theta + \rho\Omega\frac{d\theta}{dt} + \frac{d\rho W}{dt}\boldsymbol{\varphi} + \rho W\frac{d\boldsymbol{\varphi}}{dt}$$
$$= \frac{d\rho V}{dt}\mathbf{r} + \frac{d\rho\Omega}{dt}\theta + \frac{d\rho W}{dt}\boldsymbol{\varphi} = 0,$$

Writing by coordinates the last vector equation along with the scalar continuity equation, we obtain the system of equations of compressible oscillating, but globally immobile ether in the form

$$\frac{\partial\rho}{\partial t} + \frac{1}{r^2}\frac{\partial(r^2\rho V)}{\partial r} + \frac{1}{r\sin\theta}\frac{\partial(\rho\sin\theta\,\Omega)}{\partial\theta} + \frac{1}{r\sin\theta}\frac{\partial(\rho W)}{\partial\phi} = 0,$$
$$\frac{\partial(\rho V)}{\partial t} + V\frac{\partial(\rho V)}{\partial r} + \frac{\Omega}{r}\frac{\partial(\rho V)}{\partial\theta} + \frac{W}{r\sin\theta}\frac{\partial(\rho V)}{\partial\phi} = 0, \qquad (\mathbf{r})$$
$$\frac{\partial(\rho\Omega)}{\partial t} + V\frac{\partial(\rho\Omega)}{\partial r} + \frac{\Omega}{r}\frac{\partial(\rho\Omega)}{\partial\theta} + \frac{W}{r\sin\theta}\frac{\partial(\rho\Omega)}{\partial\phi} = 0, \qquad (\theta)$$
$$\frac{\partial(\rho W)}{\partial t} + V\frac{\partial(\rho W)}{\partial r} + \frac{\Omega}{r}\frac{\partial(\rho W)}{\partial\theta} + \frac{W}{r\sin\theta}\frac{\partial(\rho W)}{\partial\phi} = 0. \qquad (\boldsymbol{\varphi})$$

where after the lines the unit vectors of their directions are shown.

Assuming in the last system that $u_\theta = \Omega = 0$ we get the elementary particles system of equations [3]:

$$\frac{\partial\rho}{\partial t} + \frac{1}{r^2}\frac{\partial(r^2\rho V)}{\partial r} + \frac{1}{r\sin\theta}\frac{\partial(\rho W)}{\partial\phi} = 0,$$
$$\frac{\partial(\rho V)}{\partial t} + V\frac{\partial(\rho V)}{\partial r} + \frac{W}{r\sin\theta}\frac{\partial(\rho V)}{\partial\phi} = 0, \qquad (\mathbf{r})$$
$$\frac{\partial(\rho W)}{\partial t} + V\frac{\partial(\rho W)}{\partial r} + \frac{W}{r\sin\theta}\frac{\partial(\rho W)}{\partial\phi} = 0. \qquad (\boldsymbol{\varphi}) \tag{4.1}$$

Proton, electron and their antiparticles (antiproton and positron) must be solutions of the equations system (4.1). We shall search such solutions as waves of ether density radial small oscillations moving around z axis along every parallel of radius $r\sin\theta$, $r \le r_0$ with constant $\omega = c/r_0$ angular velocity: $W = \omega r\sin\theta$, $\rho(r, \theta, \phi, t) = \rho_0(1 + g(r, \theta, \phi, t))$, where $|g| << 1$, $V << 1$ for small r. Such formulation of the problem assumes that every particle is a ball of radius r_0, and for every $r \le r_0$ the wave makes a parallel rotation along angle $0 \le \phi \le 2\pi$ at the same time $T = 2\pi r\sin\theta/W = 2\pi r_0/c = 2\pi/\omega$.. And when radius is increasing, then the linear velocity of such wave is increasing linearly too reaching the maximum value (the light speed c) at $r = r_0$, $\sin\theta = 1$. When $r > r_0$, i.e. outside the particle, we suppose $W = c\sin\theta$. We substitute the desired type of solutions into system (4.1) and then linearize the system, rejecting terms of the second order of smallness and the products of such terms including the gravitational field term $V\partial(\rho V)/\partial r\mathbf{r}$ [3]. Then we obtain the system

$$\frac{\partial g}{\partial t} + \frac{\partial V}{\partial r} + \frac{2V}{r} + \omega\frac{\partial g}{\partial\phi} = 0,\ \frac{\partial V}{\partial t} + \omega\frac{\partial V}{\partial\phi} = 0,\ (\mathbf{r}),\ \frac{\partial g}{\partial t} + V/r + \omega\frac{\partial g}{\partial\phi} = 0.\ (\boldsymbol{\varphi}) \tag{4.2}$$

Rolled up photon

Consider a birth of particle together with antiparticle from a helical photon wave with. a frequency 2ω. First, the helical photon wave is compressed to a ball of radius $r_{ph} = c/2\omega$ inside which an azimuth wave of radial periodic compression-stretching of ether density is forming. For every $r < r_{ph}$ this wave makes a full 2π-rotation at the same time $T = \pi/\omega$ and is described by the next solutions of the system (4.2):

$$V(r, \theta, \phi, t) \approx \frac{V(\theta)\cos(\omega t - \phi/2)}{r}, \qquad \frac{d\phi}{dt} = 2\omega,$$
$$g(r, \theta, \phi, t) \approx -\frac{V(\theta)\phi\cos(\omega t - \phi/2)}{r^2(2\omega)}, \quad W = (2\omega)r\sin\theta.$$

Such solution of the ether equations is a rolled up photon. Then the rolled up photon undergoes a period doubling bifurcation with energy conservation. Such the rolled up photon of a doubled period is described by the next solution of the system (4.2):

$$V(r, \theta, \phi, t) \approx \frac{V(\theta)\cos((\omega t - \phi)/2)}{r}, \qquad \frac{d\phi}{dt} = \omega,$$
$$g(r, \theta, \phi, t) \approx -\frac{V(\theta)\phi\cos((\omega t - \phi)/2)}{r^2\omega}, \quad W = \omega r\sin\theta.$$

In this case the radial periodic compression-stretching of ether density in azimuth wave of the rolled up photon of a doubled period occur with the average ether density equal to the unperturbed density ρ_0. Let's now define a density distribution of the intensity of electric field $\mathbf{E}$ and a density distribution of the electric charge δ of the rolled up photon of a doubled period

$$\mathbf{E} = E\,\mathbf{r} = \frac{W}{r\sin\theta}\frac{\partial(\rho V)}{\partial\phi}\mathbf{r}, \qquad \delta = \frac{1}{4\pi}div\left(V\frac{\partial(\rho W)}{\partial r}\boldsymbol{\varphi}\right). \tag{4.3}$$

And as

$$\partial V(r, \theta, \phi, t)/\partial\phi \approx V(\theta)\sin((\omega t - \phi)/2)/2r\,,$$

then in the first approximation the rolled up photon of a doubled period has the next density distribution of the electric charge

$$\delta_0(r, \theta, \xi) = \delta_0(r, \theta, \omega t - \phi) = \frac{\rho_0\omega}{8\pi r^2}V(\theta)\sin((\omega t - \phi)/2)\,. \tag{4.4}$$

Charges of electron, proton and their antiparticles

To describe the birth of a particle and an antiparticle from the rolled up photon of a doubled period, let's represent the wave of density distribution of electric charge (4.4) in the kind of two waves

$$\delta_+(r, \theta, \xi) = \frac{\rho_0\omega}{8\pi r^2}V(\theta)\sin\xi/2\,, \quad 0 \leqslant \xi < 2\pi, \qquad \delta_-(r, \theta, \xi)$$
$$= \frac{\rho_0\omega}{8\pi r^2}V(\theta)\sin\xi/2\,, \quad -2\pi \leqslant \xi < 0\,,$$

one of them bears only positive charge (particle) and another bears only negative charge (antiparticle or vice versa). The positive charge wave periodically performs an increase in the particle ball, which corresponds to a decrease in the ether density in it in comparison with its unperturbed density ρ_0. The negative charge wave periodically performs a decrease in the particle ball, which corresponds to an increase in the ether density in it in comparison with its unperturbed density. So, we can find the charges of particle and antiparticle, integrating their charge density distributions over the ball of radius r_0:

$$q_\pm = \pm\int_0^\pi\int_0^{2\pi}\int_0^{r_0}\frac{\rho_0\omega\,V(\theta)}{8\pi\,r^2}\sin(\xi/2)r^2\sin\theta\;drd\xi d\theta = \pm\frac{\rho_0\omega\,r_0V_q}{8\pi}\int_0^{2\pi}\sin(\xi/2)d\xi$$
$$= \pm\frac{\rho_0\omega\,r_0V_q}{2\pi} = \pm\frac{\rho_0 cV_q}{2\pi}; \qquad V_q = \int_0^\pi V(\theta)\sin\theta\,d\theta\,. \tag{4.5}$$

The functions $V(\theta)$ in formulas (4.4) - (4.5) for proton and electron (antiproton and positron) can be found as the expansions over the angle θ:

$$V_{e,p}(\theta) = V_0(a + \sin\theta \pm b\sin 2\theta + c_{e,p}\sin 3\theta), \tag{4.6}$$

with the parameters a, b, c_p, c_e. Substituting expressions (4.6) in (4.5), we obtain the law of universality of charge

$$|q_e| = |q_p| = \frac{\rho_0 c}{2\pi}V_0\int_0^\pi(a\sin\theta + \sin^2\theta)d\theta = \frac{\rho_0 cV_0}{4}\left(1 + \frac{4a}{\pi}\right) = q. \tag{4.7}$$

We see that the charge of elementary particle depends on only first two members of the expansion (4.6). At the same time, the rolled up photon of the doubled period has the zero charge. Parameters V_0, ρ_0, c in (4.7) are the world ether parameters, and all physical constants are expressed through them.

Electric fields and Coulomb law

When $r > r_0$, then $W = c\sin\theta$, and outside the ball of a particle, the density distribution vector of the intensity of electric field can be writed in the form

$$\mathbf{E}=E\mathbf{r}=\frac{c\rho_0}{r}\frac{\partial V}{\partial\phi}\mathbf{r},\quad r > r_0$$

So, the wave vector of the density distribution of the intensity of electric field of a rolled up photon of a doubled period has a kind of

$$\mathbf{E}_0(r,\theta,\phi,t) = \frac{c\rho_0}{2r^2}V(\theta)\sin((\omega t-\phi)/2)\mathbf{r},$$

and its half-waves can be considered as the density distributions of electric field intensities for the particle and antiparticle (proton - antiproton or electron - positron). Thus, averaging the obtained expressions for any $r > r_0$ over the sphere surface with this radius, we find the intensities of electric fields for the particles, depending on only the distance r from their centers:

$$\mathbf{E}_0(r)=0,\ \mathbf{E}_\pm(\mathrm{r}) = \pm\frac{\mathrm{c}\rho_0}{4\pi\mathrm{r}^2}\int_0^\pi\int_0^{2\pi}\frac{\mathrm{V_{e,p}}(\theta)}{2\mathrm{r}^2}\sin(\xi/2)\mathrm{r}^2\sin\theta\mathrm{d}\xi\mathrm{d}\theta\mathbf{r} = \pm\frac{\rho_0\mathrm{cV_q}}{2\pi\mathrm{r}^2}\mathbf{r} = \pm\frac{\mathrm{q}}{\mathrm{r}^2}\mathbf{r}$$

Consequently, any rolled up photon of a doubled period has no electric field. The particle which is charged positively has the electric field directed from its center. The particle which is charged negatively has the electric field directed toward its center. Therefore, because of the direction of electric field it is precisely particles with negative charges can create various structures of matter, such as neutron, hydrogen atom and other atomic nuclei and atoms, attracting and pulling on themselves the particles with positive charges. So, it would be more correct to assign a positive charge to large and light electron together with small and massive antiproton, and to assign a negative charge to small and massive proton together with large and light positron. Otherwise, the charged negatively antiprotons would have to attract and pull on themselves positrons with the formation of antimatter structures what is not in the Universe.

We assume in further everywhere, without violating the generally accepted agreements, that the electron and antiproton are negatively charged, and the proton and positron are positively charged. The result obtained, in fact, is the Coulomb law. It follows that negative charges (electrons) repel with a force determined by Coulomb's law, and with this force positive charges (protons) attract negative charges (electrons). However, it does not follow that positive charges (protons) should repel each other. So, it is quite probable that the Coulomb's barrier in the atoms nuclei simply does not exists. Its role a difference between the ether densities inside elementary particles and atoms nuclei can play.

Magnetic moments of electron and proton

Magnetic moment of any elementary particle in SGS system can be calculated by the formula

$$\mathbf{p}_m = \frac{1}{2c}\int_\Omega \Delta[\mathbf{W}\cdot\mathbf{s}]d\Omega, \tag{4.8}$$

where Δ is a density distribution of electric charges which move within a volume Ω with a linear velocity $\mathbf{W}$ and distance $\mathbf{s}$ from the axis of movement.

As total electric charge of a rolled photon of a doubled period has its density distribution $\Delta_0 = 4\pi\,\delta_0(r,\theta,\xi)$, then total electric charges of proton and antiproton (or positron and electron) have their density distributions

$$\Delta_p = \frac{\rho_0\,\omega_p}{2r^2}V_p(\theta)\sin(\xi_p/2),\quad 0\leqslant\xi_p<2\pi;\qquad \Delta_e = \frac{\rho_0\omega_e}{2r^2}V_e(\theta)\sin(\xi_e/2),\ -2\pi\leqslant\xi_e<0.$$

As electric charges move around the vertical axis, i.e. $|\mathbf{s}| = r\sin\theta$, and the vectors $\mathbf{W} = \omega\, r\sin\theta\,\boldsymbol{\varphi}$ and $\mathbf{s}$ are orthogonal then, substituting the obtained expressions into formula (4.8), we find that magnetic moment of a rolled up photon of a doubled period is zero, and proton and electron magnetic moments can be written as

$$p_{mp,e} = \pm\frac{1}{2c}\int_0^\pi\int_0^{2\pi}\int_0^{r_{p,e}}\frac{\rho_0\omega_{p,e}}{2r^2}V_{p,e}(\theta)\sin(\xi/2)\omega_{p,e}r\sin\theta\, r\sin\theta\, r^2\sin\theta\, dr d\xi\, d\theta$$
$$=\pm\frac{\rho_0\omega_{p,e}^2r_{p,e}^3}{3c}V_{me} = \pm\frac{\rho_0 cr_{p,e}}{3}V_{mp,e},\quad V_{mp,e} = \int_0^\pi V_{p,e}(\theta)\sin^3\theta\, d\theta \tag{4.9}$$

Let us express these magnetic moments through Bohr magneton μ_B and nuclear magneton μ_N. Since for every particle $mcr_0 = mc^2/\omega = \hbar\omega/\omega = \hbar$, where $\hbar$ is the Planck's constant (see below), then these magnetons can be written in SGS system in the form

$$\mu_B = q\hbar/(2m_e c) = qr_e/2,\quad \mu_N = q\hbar/(2m_p c) = qr_p/2, \tag{4.10}$$

Consequently, since $q = \rho_0 cV_q/(2\pi)$, then the values of proton and electron magnetic moments in (4.9) can be rewritten through the Bohr magneton and the nuclear magneton in a kind

$$p_{mp} = \frac{4\pi V_{mp}}{3V_q}\frac{qr_p}{2} = \beta_p\mu_N,\quad p_{me} = -\frac{4\pi V_{me}}{3V_q}\frac{qr_e}{2} = \beta_e\mu_B, \tag{4.11}$$

$$V_{me,p} = V_0\int_0^\pi (a+\sin\theta\pm b\sin 2\theta + c_{e,p}\sin 3\theta)\sin^3\theta d\theta$$
$$= V_0\left(\frac{4}{3}a+\frac{3\pi}{8}-\frac{\pi}{8}c_{e,p}\right) = \frac{\pi}{8}\left(\frac{32a}{3\pi}+3-c_{e,p}\right)V_0.$$

We see that the magnetic moments of elementary particles depends on only the first, second and fourth members of the expansion (4.6). Substituting the expressions for V_q and $V_{m\,e,p}$ in (4.11) we obtain

$$\beta_e = -\pi\left(\frac{32\mathrm{a}}{9\pi}+1-\mathrm{c_e}/3\right)/\left(\frac{4\mathrm{a}}{\pi}+1\right);\quad \beta_\mathrm{p} = \pi\left(\frac{32\mathrm{a}}{9\pi}+1-\mathrm{c_p}/3\right)/\left(\frac{4\mathrm{a}}{\pi}+1\right) \tag{4.12}$$

We note that the electron magnetic moment does not add up from the two halves of the orbital and spin magnetic moments, as modern science believes.

Internal energies and masses of electron and proton

We understand an internal energy of a particle as the work done by the force fields inside the particle over all its charges. As $\omega\, dt = d\phi$, then this work dA of the internal forces $\mathbf{F}$ done in time dt for moving the charges with density distribution Λ in the area $r\sin\theta\, d\theta\, dr$ with the linear velocity $\mathbf{W}$ is the same as the work on the displacement of these charges inside the angle $d\phi/\omega$ or inside the volume $r^2\sin\theta\, dr\, d\phi\, d\theta/\omega$. Consequently,

$$dA = \Lambda(\mathbf{F}\cdot\mathbf{W})r^2\sin\theta\, dr\, d\phi\, d\theta/\omega \tag{4.13}$$

Internal forces $\mathbf{F}$ of the force fields are described by the third equation of system (4.1), and its divergence is the density distribution of charges inside the particle. Thus, $\mathbf{F} = F\boldsymbol{\varphi}$, and for a rolled up photon

$$F = -\frac{\partial(\rho W)}{\partial t}\approx -\rho_0 2\omega\, r\sin\theta\frac{\partial g}{\partial t} = -\rho_0\omega\sin\theta\frac{V(\theta)}{r}\phi\sin(\omega\, t-\phi/2),$$
$$\Lambda = div\,\mathbf{F} = \frac{1}{r\sin\theta}\frac{\partial F}{\partial\phi} = -\rho_0\omega\frac{V(\theta)}{r^2}\frac{\partial\phi\sin(\omega\, t-\phi/2)}{\partial\phi}.$$

The work done by the internal force fields inside the particle of a rolled up photon over its charges at any instant of time can be found by integrating (4.13) over the volume of photon, taking into account the collinearity of vectors $\mathbf{F}$ and $\mathbf{W}$:

$$A_{ph}(t) = \int_0^\pi\int_0^{2\pi}\int_0^{r_{ph}}\Lambda F\,(2\omega)\, r\sin\theta\, r^2\sin\theta\, dr\, d\phi\, d\theta/(2\omega)$$
$$=\frac{1}{2}\int_0^\pi\int_0^{2\pi}\int_0^{r_{ph}}\rho_0^2\omega^2V^2(\theta)\frac{\partial}{\partial\phi}(\phi\sin(\omega\, t-\phi/2))^2\sin^3\theta\, dr\, d\phi\, d\theta$$
$$=2\rho_0^2\omega^2\pi^2r_{ph}\sin^2(\omega\, t)\int_0^\pi V^2(\theta)\sin^3\theta\, d\theta.$$

Averaging the obtained expression for the period $2\pi/\omega$ and using that $(2\omega)r_{ph} = c$, we can obtain the value of internal energy for the rolled up photon

$$\varepsilon_{ph} = \pi^2\rho_0^2c\, V_\varepsilon\,(2\omega)/4 = \hbar(2\omega),\quad V_\varepsilon = \int_0^\pi V^2(\theta)\sin^3\theta\, d\theta,\quad \hbar = \pi^2\rho_0^2c\, V_\varepsilon/4. \tag{4.14}$$

For a rolled up photon of a doubled period, we obtain

$$F \approx -\rho_0 \omega \sin\theta \frac{V(\theta)}{2r} \phi \sin((\omega t - \phi)/2),$$
$$\Lambda = -\rho_0 \omega \frac{V(\theta)}{2r^2} \frac{\partial \phi \sin((\omega t - \phi)/2)}{\partial \phi}.$$

The work done by the internal force fields inside the particle of a rolled up photon of a doubled period over its charges at any instant of time can be found as a doubled integral of (4.13) over the volume of the particle:

$$A_0(t) = 2\int_0^{\pi}\int_0^{2\pi}\int_0^{r_0} \Lambda F \,\omega\, r \sin\theta\; r^2 \sin\theta\; dr\,d\phi\, d\theta/\omega$$
$$= \frac{1}{4}\int_0^{\pi}\int_0^{2\pi}\int_0^{r_0} \rho_0^2\omega^2 V^2(\theta)\frac{\partial}{\partial \phi}(\phi \sin((\omega t - \phi)/2))^2 \sin^3\theta\, dr\, d\phi\, d\theta$$
$$= \rho_0^2 \omega^2 \pi^2 r_0 \sin^2(\omega t/2)\int_0^{\pi} V^2(\theta) \sin^3\theta\, d\theta.$$

Averaging the obtained expression for the period $2\pi/\omega$ and using that $\omega\, r_0 = c$, we can obtain the value of internal energy for the rolled up photon of a doubled period with conservation its energy at doubling the period

$$\varepsilon_0 = \pi^2 \rho_0^2 c\, V_\varepsilon \omega/2 = 2\hbar\omega = \hbar(2\omega) = \varepsilon_{ph}.$$

The value of internal energy for the particle and, in particular, for proton and electron is equal to half the energy of the rolled up photon of a doubled period that produced the particle

$$A_{e,p}(t) = \int_0^{\pi}\int_0^{2\pi}\int_0^{r_{e,p}} \Lambda_{e,p} F_{e,p}\, \omega_{e,p}\, r \sin\theta\; r^2 \sin\theta\; dr\, d\phi\, d\theta/\omega_{e,p}$$
$$= \frac{1}{8}\int_0^{\pi}\int_0^{2\pi}\int_0^{r_{e,p}} \rho_0^2 \omega_{e,p}^2 V_{e,p}^2(\theta)\frac{\partial}{\partial\phi}(\phi \sin((\omega_{e,p} t - \phi)/2))^2 \sin^3\theta$$
$$dr\, d\phi\, d\theta = \frac{1}{2}\rho_0^2 \omega_{e,p}^2 \pi^2 r_{e,p} \sin^2(\omega_{e,p} t/2)\int_0^{\pi} V_{e,p}^2(\theta) \sin^3\theta\, d\theta$$

Averaging the obtained expressions for the periods $2\pi/\omega_{e,p}$ and using that $\omega_{e,p}\, r_{e,p} = c$, we can find the values of internal energies for proton and electron (or antiproton and positron) :

$$\varepsilon_e = \pi^2\rho_0^2 c\, V_{\varepsilon e}\omega_e/4, \qquad \varepsilon_p = \pi^2\rho_0^2 c\, V_{\varepsilon p}\omega_p/4,$$
$$V_{\varepsilon\, e,p} = \int_0^{\pi} V_{e,p}^2(\theta)\sin^3\theta\, d\theta, \tag{4.15}$$

where the values $V_{\varepsilon e}$ and $V_{\varepsilon p}$ can be calculated through the functions $V_e(\theta)$ and $V_p(\theta)$ given by formula (4.6):

$$V_{\varepsilon\, e,p} = \int_0^{\pi} V_0^2 (a + \sin\theta \pm b \sin 2\theta + c_{e,p} \sin 3\theta)^2 \sin^3\theta\, d\theta$$
$$= V_0^2\left(\frac{4a^2}{3} + \frac{3a\pi}{4} + \frac{16}{15} + \frac{64}{105}b^2 - \left(\frac{32}{35} + \frac{a\pi}{4}\right)c_{e,p} + \frac{208}{315}c_{e,p}{}^2\right).$$

As $\varepsilon_{ph} = \hbar(2\omega)$, $\varepsilon_e = \hbar\omega_e$, $\varepsilon_p = \hbar\omega_p$ in (4.14) and (4.15), where $\hbar$ is the Planck's constant, it follows that $V_{\varepsilon e} = V_{\varepsilon p} = V_\varepsilon = V_0^2 d = const$ with a dimensionless constant d. This gives us a possibility to determine correctly the Planck's constant through the parameters of the world ether

$$\hbar = \pi^2\rho_0^2 c\, V_\varepsilon/4 = \pi^2\rho_0^2 c V_0^2 d/4 \tag{4.16}$$

and to define that the values of the constants c_e, c_p should be the roots of the one quadratic equation

$$\frac{4a^2}{3} + \frac{3a\pi}{4} + \frac{16}{15} + \frac{64}{105}b^2 - \left(\frac{32}{35} + \frac{a\pi}{4}\right)c + \frac{208}{315}c^2 - d = 0 \Rightarrow c_e + c_p = \frac{315}{208}\left(\frac{32}{35} + \frac{a\pi}{4}\right) \tag{4.17}$$

We can define also the other fundamental microworld constant, which is the fine structure constant $\alpha = q^2/\hbar c$. Substituting into this formula the obtained above values of the universal charge and Planck's constant, we find

$$\alpha = \frac{q^2}{\hbar c} = \frac{\rho_0^2 c^2 V_0^2 (4a/\pi + 1)^2}{16\pi^2\rho_0^2 c V_0^2 d\, c/4} = \frac{(4a/\pi + 1)^2}{4\pi^2 d}. \tag{4.18}$$

It follows from (4.15) that the internal energies of the particles are proportional to the angular velocities of the waves of the ether density perturbations inside the particles with the proportionality coefficient as the Planck's constant. Moreover, we can define the particle mass by the formula $m = \pi^2\rho_0^2 V_\varepsilon \omega/4c = \hbar\omega/c^2$. In this case we immediately obtain

$$\varepsilon_e = \hbar\omega_e = m_e c^2, \quad \varepsilon_p = \hbar\omega_p = m_p c^2, \quad \varepsilon_{ph\, e,p} = \hbar(2\omega_{e,p}) = 2m_{e,p}c^2. \tag{4.19}$$

We can conclude that the mass of an elementary particle is determined by the compression or rarefaction of the ether inside the particle compared to its density ρ_0 in the unperturbed state, and, of course, the mass is not a consequence of the meeting of a particle with some mythical boson. Thus, a rolled up photon has no mass, although it has an energy. It also has no magnetic moment and no charge. From formula (4.19) it follows also that the sphere of the elementary particle has the perimeter of its equator $2\pi\, r_{e,p}$ which is equal to the Compton wavelength of the particle $2\pi\hbar/(m_{e,p}c)$, and the particle ball radius is the Compton radius. Hence the proton ball radius is approximately 1836 times less than the electron ball radius. Moreover, the known experimental result that the birth of the pair of particles needs in a photon energy that more than doubled energy of each particle, also is explain by the formulas (4.19). The process of annihilation of the pair of particles (electron–positron for example) can be also explained by a process of combining particles with generation of the massless rolled up photon of a doubled period which has a doubled energy. This photon generates two photons having equal frequencies and energies, helical waves of which move with opposite spins and in opposite directions in the ether of constant density.

The quadrupole moment of proton

In is known from experiment that proton has the zero value of its quadrupole moment .Let's calculate this value, using the considered above ethereal model of proton:

$$Q_p = \frac{1}{q}\int_0^{\pi}\int_0^{2\pi}\int_0^{r_p} (3r^2\cos^2\theta - r^2)\frac{\rho_0\omega\; V_p(\theta)}{8\pi\; r^2}\sin(\xi/2) r^2 \sin\,\theta\; dr d\xi\, d\theta$$
$$= \frac{\rho_0\omega}{2\pi q}\int_0^{r_p} r^2 [\int_0^{\pi} 3\cos^2\theta\, V_p(\theta)\sin(\theta)d\theta - \int_0^{\pi} V_p(\theta)\sin(\theta)\, d\,\theta]\, dr$$
$$= \frac{\rho_0\omega}{2\pi q}\int_0^{r_p} r^2 V_0 [(2a + 3\pi/8 + 3c_p\pi/8) - (2a + \pi/2)]dr = 0,$$

Then equality $Q_p = 0$ makes it possible to determine the constant $c_p = 1/3$.

The wave model of neutron

The waves of ether density perturbations in the proton and the electron can interact in two ways: having unidirected or oppositely directed spins. Let us show that the neutron is an interaction (imposition) of the electron and proton waves with unidirectional spins. Another their combination with oppositely directed spins is the hydrogen atom (see below).

The structure of neutron

When a proton attracts an electron and pulls up it onto itself by its electric field so that the centers of their balls coincide and their waves of perturbations of the ether density have unidirectional spins, then their angular velocities of radial oscillations of the ether density begin to grow, and radii of particles begin to decrease. Let, after compression, the proton has an angular velocity of its wave of the ether density oscillations $\widetilde{\omega}_p > \omega_p$ and a radius $\widetilde{r}_p < r_p$, and the electron has an angular velocity of its wave of the ether density oscillations $\widetilde{\omega}_e = \omega_n >> \omega_e$ and a radius $\widetilde{r}_e = r_n << r_e$, which is the neutron radius. It is clear that the ether is compressed slightly inside the compressed proton and rarefied slightly inside the compressed electron and $\omega_n r_n = \widetilde{\omega}_p \widetilde{r}_p = c$. Thus, the central part of neutron (core) of radius $\widetilde{r}_p$ consists of the negative and positive charges waves, but a remote part (coat) of radius $\widetilde{r}_e = r_n$ consists of the only negative charges waves. And since the degree of compression of the ether is inversely proportional to the frequency of the wave, then the compression of the ether inside the compressed proton is less than the rarefaction of the ether inside the compressed electron. Consequently, the ether inside the core of neutron is also sparse like the ether inside its coat. In this is the meaning and purpose of neutrons in the atomic nucleus – to remove the excess compression of the ether, caused by protons.

Since the energy of the proton is expended on the compression of the electron, the frequency of the perturbation wave of the ether density in the electron when it is compressed by the proton should be in a resonant relationship with the frequency of the perturbation wave of the ether density in the proton. That is, to start the process of electron compression by a proton, the electron must first be compressed by a factor of δ to the radius $\bar{r}_e$ corresponding to the resonant frequency $\bar{\omega}_e = c/\bar{r}_e = \omega_p/l$ of the proton, by means of some external energy source, and after that its radius should decrease in a whole number of times $m = \omega_n/\bar{\omega}_e = \bar{r}_e/r_n$ in such a way that its initial radius also decreased in a whole number of times $n = \delta\, m$. Such an external source of energy that provides for the preliminary compression of an electron is the electron antineutrino, that is, the perturbation of the ether density, which has a charge density half-wave in the form

$$\delta\_(r,\,\theta,\,\xi) = \frac{\rho_0\omega_e}{8\pi\, r^2}V_0\widetilde{b}\,\sin(2\theta)\sin\xi_e/2\,,\quad -2\pi \leqslant \xi_e = \omega_e - \phi < 0. \tag{5.1}$$

As the integrals over the ball of the particle with the charge distribution density (5.1) for the charge and magnetic moment are zero together with a change in the average density of the ether in the particle ball, then the antineutrino has energy, but it does not have a charge, mass and magnetic moment. The particle, which has an additional positive half-wave of the charge distribution density, is neutrino. Note that the properties of neutrino and the antineutrino will remain unchanged if in the representation (5.1) we also include the members of the higher order of the expansion of the function $\delta\_(r,\,\theta,\,\xi)$ in a series on the angle θ. This remark applies also to neutrino and to the expansions (4.6) for proton and electron. Note also that such model of neutron describes its decay to an electron, proton and antineutrino.

Since the antineutrino energy during its interaction with an electron is consumed for increase in the electron frequency up to $\bar{\omega}_e = \delta\omega_e$, the energy of an electron compressed to a resonant frequency with a proton is

$$\bar{\varepsilon}_e = \quad \pi^2\rho_0^2 c\omega_e(V_{\varepsilon\, e} + \widetilde{V}_\varepsilon)/4 = \pi^2\rho_0^2 c\,\bar{\omega}_e V_{\varepsilon\, e}/4 = \delta\varepsilon_e, \quad \widetilde{V}_e = V_0^2(64/105)\widetilde{b}^2.$$

After establishing the resonance frequencies of electron and proton, the formation of neutron begins in the process of electron and proton compression. We assume that the θ angle-dependent radial oscillating components of the perturbations of the ether density are identical in core and coat of neutron and can be found as half-sum value of such components for proton and electron

$$V_n(\theta) = V_0(a + \sin\theta + (c_e/2 + c_p/2)\sin 3\theta).$$

It follows from this assumption that the energy of proton is spent on the electron compression until the θ angle-dependent components coincide. In this case, the ratio $k = \widetilde{\omega}_p/\omega_n = r_n/\widetilde{r}_p$ of frequencies of the perturbation waves of the ether density in core and coat of neutron should be preferably integer.

The charge of neutron

Neutron consists of compressed electron and proton, the charges of which, as integrals of their ether density distributions over their balls, are equal in absolute value and have opposite signs. The neutron charge q_n is equal to the sum of these charges and, therefore, is zero.

$$q_n = \int_0^\pi\int_0^{2\pi}\int_0^{\widetilde{r}_p}\frac{\rho_0\widetilde{\omega}_p}{8\pi r^2}V_n(\theta)\sin(\xi_p/2)r^2\sin\theta dr d\xi_p d\theta$$
$$-\int_0^\pi\int_0^{2\pi}\int_0^{r_n}\frac{\rho_0\omega_n}{8\pi r^2}V_n(\theta)\sin(\xi_n/2)r^2\sin\theta dr d\xi_n d\theta = \frac{\rho_0 cV_n}{2\pi} - \frac{\rho_0 cV_n}{2\pi} = 0$$

The neutron magnetic moment

The neutron magnetic moment can be calculated as the sum of the magnetic moments of the compressed proton and compressed electron:

$$p_{mn} = \frac{1}{2c}\int_0^\pi\int_0^{2\pi}\int_0^{\widetilde{r}_p}\frac{\rho_0\widetilde{\omega}_p}{2r^2}V_n(\theta)\sin(\xi_p/2)\widetilde{\omega}_p r\sin\theta r\sin\theta r^2\sin\theta dr d\xi_p d\theta$$
$$-\frac{1}{2c}\int_0^\pi\int_0^{2\pi}\int_0^{r_n}\frac{\rho_0\omega_n}{2r^2}V_n(\theta)\sin(\xi_n/2)\omega_n r\sin\theta r\sin\theta r^2\sin\theta dr d\xi_n d\theta = \frac{\rho_0\widetilde{\omega}_p^2\widetilde{r}_p^3}{3c}V_{mn}$$
$$-\frac{\rho_0\omega_n^2 r_n^3}{3c}V_{mn} = \frac{\rho_0 c}{3}V_{mn}(\widetilde{r}_p - r_n),\ V_{mn} = \int_0^\pi V_n(\theta)\sin^3\theta d\theta.$$

In terms of nuclear magnetons

$$p_{mn} = -\frac{\rho_0 cr_n V_{mn}}{3}\left(1 - \frac{1}{k}\right) = -\frac{2\rho_0 cr_n}{3}\left(1 - \frac{1}{k}\right)\frac{\pi}{8}\left(\frac{32a}{3\pi} + 3 - \frac{(c_e + c_p)}{2}\right)V_0$$
$$= -\frac{qr_p}{2}\left[\pi\frac{r_n}{r_p}\left(1 - \frac{1}{k}\right)\left(\frac{32a}{9\pi} + 1 - \frac{(c_e + c_p)}{6}\right)\right]\Big/\left(\frac{4a}{\pi} + 1\right).$$

And, since $r_n/r_p = \omega_p/\omega_n = (\bar{r}_e/r_p)/(\bar{r}_e/r_n) = l/m$, then the value of the magnetic moment of neutron in units of the nuclear magnetons is:

$$\beta_n = -\left[\frac{\pi\, l}{m}(1 - \frac{1}{k})(\frac{32a}{9\pi} + 1 - \frac{(c_e + c_p)}{6})\right]/(\frac{4a}{\pi} + 1). \tag{5.2}$$

Neutron internal energy and mass

We calculate firstly the work done by the force fields of the compressed electron and proton over the moving charges inside them:

$$A_e(t) = \tfrac{1}{8}\int_0^\pi\int_0^{2\pi}\int_0^{r_n}\rho_0^2\omega_n^2V_n^2(\theta)\tfrac{\partial}{\partial\phi}(\phi\sin((\omega_n t - \phi)/2))^2\sin^3\theta\, dr d\phi\, d\theta$$
$$= \tfrac{1}{2}\pi^2\rho_0^2\omega_n^2 r_n V_{\varepsilon\, n}\sin^2(\omega_n t/2)\,,$$
$$A_p(t) = \tfrac{1}{8}\int_0^\pi\int_0^{2\pi}\int_0^{\widetilde{r}_p}\rho_0^2\widetilde{\omega}_p^2V_n^2(\theta)\tfrac{\partial}{\partial\phi}(\phi\,\sin((\widetilde{\omega}_p t - \phi)/2))^2\sin^3\theta\, dr d\phi\, d\theta$$
$$= \tfrac{1}{2}\pi^2\rho_0^2\widetilde{\omega}_p^2\,\widetilde{r}_p\,V_{\varepsilon\, n}\sin^2(\widetilde{\omega}_p t/2).$$

Averaging the obtained expressions over the time of period and summing obtained expressions, we find the energy ε_n and mass m_n of the neutron as the sum of the energies and masses of compressed electron and proton:

$$\varepsilon_n = \quad \pi^2\rho_0^2 c(\widetilde{\omega}_p + \omega_n)V_{\varepsilon\, n}/4 = \pi^2\rho_0^2 c\,(k + 1)V_{\varepsilon\, n}\omega_n/4, \quad m_n$$
$$= \varepsilon_n/c^2, \quad V_{\varepsilon\, n} = \int_0^\pi V_n^2(\theta)\sin^3\theta\, d\theta = V_0^2\left[\frac{4a^2}{3} + \frac{3a\pi}{4} + \frac{16}{15}\right.$$
$$\left. - \left(\frac{32}{35} + \frac{a\pi}{4}\right)\frac{(c_e + c_p)}{2} + \frac{208}{315}\left(\frac{c_e + c_p}{2}\right)^2\right] = V_0^2 d_n. \tag{5.3}$$

Comparison of theoretical results with experiments

Parameters in the formulas of the ethereal models of electron, proton and neutron can be found as follows. From the experimental values of their masses in MeV: $m_{p\ \exp} = 938\,.\,272\ = l\delta\, m_e$, $m_{n\ \exp} = 939\,.\,5654\ = (l + 1)\delta\, m_e$, where $m_{e\exp} = 0.511$, and from the condition $m\delta = n$ we find: $l = 726$,$m = 682, n = 1725$, $\delta = 2.529326$, $l/m = r_n/r_p = 726/682 = 33/31$. The last is the ratio of the neutron radius to the proton radius. Then we find approximate model values $m_p\ = 938\,.\,342$,$m_n\ = 939\,.\,635$. Further, since the neutron energy is the sum of the proton energy and the electron energy compressed in δ times, then

$$\pi^2\rho_0^2 c(k + 1)V_{\varepsilon n}\omega_n/4 = \pi^2\rho_0^2 c(k + 1)V_{\varepsilon n}m\bar{\omega}_e/4 = \varepsilon_p + \bar{\varepsilon}_e$$
$$= \pi^2\rho_0^2 c(l + 1)V_\varepsilon\bar{\omega}_e/4, \tag{6.1}$$

from which we find that

$$(k + 1)md_n = (l + 1)d. \tag{6.2}$$

Then from (5.2), (4.17) and (4.18), (6.2), (5.3) we find that

$$\beta_{n\exp} = -(1 - 1/k)f(a) = -1.9131,\ \alpha_{\exp} = g(a)/(k + 1) = 0.00729735 \tag{6.3}$$

Solving the system (6.3) with respect to the parameters $(a,\,k)$, we

Table 1
Comparison calculations with experimental data.

Value		Experiment	Calculation	Error (%)
Magnetic moments (in Bohr and nuclear magnetons)	p(^{1}H)	2.7927	2.792526	0.01%
	e	−2.0023	−2.0058	0.17%
	n	−1.9131	−1.9154	0.13%
Internal energy (MeV)	p(^{1}H)	938.272	938.342	0.0075%
	e	0.5109989	0.5109989	0%
	n	939. 565	939.635	0.0075%
Fine structure constant (α)		0.00729735	0.0073128	0.2%

find approximately $a = 1/7$, $k = 4$, $d_n = 1.0315501$, $d = 4.8384949$. Then from (4.17) we find c_e, since $c_p = 1/3$, and then from (4.12) we find the magnetic moments of proton $\beta_p = 8\pi/9 = 2.79253$ and electron $\beta_e = -2.0058$ ($\beta_{e\ \exp} = -2.0023$ is the experimentally found value of magnetic moment of electron ([9], p.126)). Then from (4.18) and (5.2) we find the approximate value for the fine structure constant $\alpha = 0.0073128$, and the value of the neutron magnetic moment $\beta_n = -1.7993895\, r_n/r_p = -1.9154$. The results of comparison of data calculated by the ether formulas and experimental data are given in Table 1.

Spectra of the hydrogen atom

The hydrogen atom is an interaction (imposition) of the electron and proton ether density perturbation waves with oppositely directed spins which are binding by their external fields. The radius of the atom is determined by the levels of their binding energy.

The hydrogen atom structure

The binding between a proton and an electron in a hydrogen atom is that, at some $r > r_b$ the electron and proton fields are mutually compensated (there is no binding at $r_b \to \infty$). The loss of energy E_b (binding energy) of an electron in this case must be compensated by the wave structure of the rolled up photon, which is a solution of the system of ether equations (4.1) in a stationary spherical coordinate system, i.e. the ball of the radius r_e, inside which the wave of the ether density perturbations moves with a angular velocity ω_b (linear velocity $\omega_b r \sin\theta$) in the opposite direction of the electron wave direction. In [7], such a wave structure, which is a solution of the system of ether equations, is called a nikron. The energy of the nikron, which is the kinetic energy of the electron, the binding energy and energy of the photon that produced the nikron (or rather, the photon emitted by the electron) is found by the formula:

$$E_{nik} = \frac{\rho_0^2\omega_b^2\pi^2 V_\varepsilon r_e}{2} = 2\left(\frac{\hbar}{c}\right)(\omega_b)^2 r_e = E_b = \frac{m_e v^2}{2} = E_{ph}. \tag{7.1}$$

Thus, the hydrogen atom in every its state has the structure of four balls nested into each other: a proton, an electron, a nikron and a ball of radius r_b, outside of which the fields of the electron and the proton are mutually compensated. The radius of the atom is the binding radius r_b. The lower the binding energy, the larger the binding radius and the size of atom.

Let us calculate the binding energy of a proton and an electron by the formula

$$E_b = \frac{1}{2}\int_{r>r_b}\delta\phi dV, \tag{7.2}$$

where δ is the density of the electron charge distribution outside the sphere of radius $r = r_b$ and $\phi = q/r$ is the potential of the proton field in this region of space. The factor 1/2 appears in (7.2) because of the equality of the constraints $q_i(q_j/r) = q_j(q_i/r)$.

Since $\delta = div\mathbf{E}_0/4\pi$, where $\mathbf{E}_0$ is the electric field of a rolled up photon of the doubled period (nikron) at $r > r_b$, then

$$E_b = \frac{1}{8\pi}\int_{r>r_b}\phi div\mathbf{E}_0 dV = \frac{1}{8\pi}\left[\int_{r>r_b} div(\phi\mathbf{E}_0)dV - \int_{r>r_b}\mathbf{E}_0 grad\phi dV\right]$$
$$= \frac{1}{8\pi}\left[\oint_S \phi\mathbf{E}_0 dS - \int_{r>r_b}\mathbf{E}_0 grad\phi dV\right] \approx -\frac{1}{8\pi}\int_{r>r_b}\mathbf{E}_0 grad\phi dV,$$

since the integral over the surface can be neglected due to the fact that S $\sim r^2$, and $\phi\,\mathbf{E}_0 \sim 1/r^3$. Consequently,

$$E_b = \frac{1}{8\pi}\int_0^\pi\int_0^{2\pi}\int_{r_b}^\infty \frac{c\rho_0}{2r_2}V(\theta)\sin(\xi/2)\frac{q}{r^2}(\mathbf{r}\cdot\mathbf{r})r^2\sin\theta dr d\xi d\theta$$
$$= \frac{c\rho_0 q V_q}{4\pi}\int_{r_b}^\infty\frac{dr}{r^2} = \frac{q^2}{2r_b}. \tag{7.3}$$

The hydrogen atom ground state

Introducing in (7.1) $v = \alpha c$, where $\alpha < <1$ is the constant to be determined (the fine structure constant), we rewrite (7.1) with regard to (7.3) in the form

$$E_{nik} = 2\left(\frac{\hbar}{c}\right)(\omega_b)^2 r_e = E_b = \frac{q^2}{2r_b} = \frac{m_e(\alpha c)^2}{2} = \frac{\alpha^2\hbar\omega_e}{2} = \frac{\alpha^2 E_e}{2} = E_{ph}. \tag{7.4}$$

Let the radius of the hydrogen atom be equal r_1 in the ground state. This means that a nikron with an energy E_1, that is equal to the binding energy, and with the wave propagation angular velocity ω_1 is a rolled up photon of the same energy compressed to the size of an electron but with the wave propagation angular velocity $\omega_{\rm ph} = c/r_1$. We assume that, in the ground state in the hydrogen atom, the law of conservation of momentum is also fulfilled. Then the momentum transferred to the nikron by an electron (or obtained by an electron from a photon) should be equal to the momentum of a packet of waves of a rolled up photon at $r > r_1$, i.e.

$$p_{ph} = \hbar\omega_{ph}/c = \hbar/r_1 = p_{nik} = \sqrt{2m_e E_1} = \sqrt{4m_e\hbar(\omega_1)^2/\omega_e} = 2(\hbar/c)\omega_1. \tag{7.5}$$

Consequently, $\omega_1 = c/2r_1$. Substituting the last expression in (7.4), we find

$$r_1 = r_e/\alpha,\quad \alpha = q^2/\hbar c,\quad \omega_1 = \alpha c/(2r_e) = \alpha\omega_e/2,\quad E_1 = \alpha^2\hbar\omega_e/2 = \alpha^2 E_e/2.$$

Thus, in the ground stable state of the hydrogen atom

$$\mathrm{E}_b = \alpha^2 E_e/2 \approx 13.6\text{eV},\ r_b = r_1 = r_e/\alpha \approx 137\cdot 0.386\cdot 10^{-12}\ \mathrm{M} \approx 52.8\cdot 10^{-12}\mathrm{M}$$

The hydrogen atom excited states and hydrino states

The hydrogen atom excited states have a lower binding energies $E_{b\,n}$ corresponding to nikron states in which the wave propagation angular velocities of the ether density perturbations resonate with angular velocity of such a wave in the atom ground state, i.e. $\omega_n = \omega_1/n = \alpha\omega_e/2n$. Moreover, as follows from (7.4),

$$E_{b\,n} = E_{nik,\,\mathrm{n}} = 2\left(\frac{\hbar}{c}\right)\left(\frac{\alpha\omega_e}{2n}\right)^2 r_e = \frac{q^2}{2r_{\mathrm{n}}} = \frac{\alpha^2 E_e}{2n^2} = E_{ph,\,n},\quad r_n = \frac{r_e}{\alpha}n^2 = r_1 n^2. \tag{7.6}$$

Consequently, for the transition of a hydrogen atom to the higher level of excitation with the lower value of the binding energy and the larger atomic radius additional energy is required. Accordingly, a certain amount of energy is released when the hydrogen atom transitions to the lower level of excitation with a bigger value of binding energy and a smaller atomic radius. The hydrogen atom transition from a level n to a level m with a higher energy is obviously described by the well-known formula

$$\hbar\nu = E_{b\,m} - E_{b\,n} = \frac{\alpha^2 E_e}{2}\left(\frac{1}{m^2} - \frac{1}{n^2}\right) = R\left(\frac{1}{m^2} - \frac{1}{n^2}\right),\quad n > m,$$

where R is the Rydberg constant. We note that the last formula contains the positive values of binding energies in contrast to similar formulas of modern physics, in which the energies are negative and do not have a reasonable interpretation.

Obviously that wave propagation angular velocities of the ether density perturbations in nikrons can resonate with angular velocity of such wave in the atomic ground state when $\omega_n = n\omega_1$, but not only when $\omega_n = \omega_1/n$. These hydrogen atom states are the hydrino states. In these states the binding energies and binding radii of the hydrogen atom are the following

$$E_{b\,n} = 2\left(\frac{\hbar}{c}\right)\left(\frac{n\alpha\omega_e}{2}\right)^2 r_e = \frac{q^2}{2r_n} = \frac{n^2\alpha^2 E_e}{2}, \qquad r_n = \frac{r_e}{\alpha\, n^2} > r_e.$$

The transition of the nikron to a hydrino state when it has a higher binding energy and smaller radius should be followed by a decrease in the hydrogen atom energy and, consequently, by release an energy to the external medium (for more details, and ethereal explanation of Stern-Gerlach, Einstein-de Haas, Zeeman experiments and fine structure of the hydrogen atom, see [7]).

Fundamentals of the ether theory of the atomic nucleus

Since the neutrons in the nucleus are necessary to remove the excess compression of the ether caused by the protons, then a limited number of neutrons should be present in the nucleus of the atom, and their number should increase with the number of protons. Thus, the nucleus of any atom is a superposition (imposition) of perturbation waves of ether density in several protons and several neutrons having a common center and propagating around the common axis in one direction or in opposite directions, i.e. having unidirectional or oppositely directed spins. This explains the approximate equality of the sizes of all atomic nuclei. In this case, the radii of protons and neutrons entering into atomic nuclei can vary slightly, providing resonance relations between their frequencies. Thus, any atom whose nucleus consists of M protons and N neutrons actually consists of N + M protons and N + M electrons, some of which (N) have unidirectional spins forming nuclear neutrons, and the other part (M) have oppositely directed spins, forming the so-called electron shell of the atom. This leads to the important conclusion that each electron of the electron shell is associated mainly with its own proton of nucleus.

Let the protons and neutrons have radii $\bar{r}_p$ and $\bar{r}_n$ in the nucleus. Let us denote $\lambda_p = \bar{r}_p/r_p$, $\lambda_n = \bar{r}_n/r_p$, where r_p is the Compton radius of a free proton, for which $\lambda_p = 1$. In accordance with the formulas given above, the internal energy of a nucleon (proton or neutron) in the nucleus of an atom is proportional to its frequency, and the magnetic moment is proportional to its radius. For all the protons and neutrons of the nucleus, we have

$$\bar{\varepsilon}_p = \frac{\varepsilon_p}{\lambda_p}, \quad \bar{\beta}_p = \pm\lambda_p\beta_p = \pm\lambda_p\frac{8\pi}{9}, \qquad \bar{\varepsilon}_n = \frac{s}{\lambda_n}\varepsilon_p, \quad \bar{\beta}_n = \mp 1.7993895\lambda_n, \tag{8.1}$$

where $s = (l+1)/m = 1.0659824$. Then, if the nucleus of an atom (any nuclide) consists of M protons and N neutrons, then its internal energy in MeV is

$$\varepsilon = \sum_{i=1}^{M}\bar{\varepsilon}_{pi} + \sum_{j=1}^{N}\bar{\varepsilon}_{nj} = \sum_{i=1}^{M}\frac{\varepsilon_p}{\lambda_{p\,i}} + \sum_{j=1}^{N}\frac{s\varepsilon_p}{\lambda_{n\,j}} = \left(\sum_{i=1}^{M}\frac{1}{\lambda_{p\,i}} + \sum_{j=1}^{N}\frac{s}{\lambda_{n\,j}}\right)\varepsilon_p$$
$$= \left(\sum_{i=1}^{M}\frac{1}{\lambda_{p\,i}} + \sum_{j=1}^{N}\frac{s}{\lambda_{n\,j}}\right)938\,.\,342\,, \tag{8.2}$$

and its magnetic moment in nuclear magnetons is

$$\beta = \sum_{i=1}^{M}\bar{\beta}_{p\,i} + \sum_{j=1}^{N}\bar{\beta}_{n\,j} = \sum_{i=1}^{M}(\pm\lambda_{p\,i}\frac{8\pi}{9}) + \sum_{j=1}^{N}(\mp 1.7993895\,\lambda_{n\,j}), \tag{8.3}$$

where signs of the terms depend on the directions of proton and neutron spins. The task of the ethereal description of all nuclides of the periodic Mendeleev's table consists in finding the quantities λ_{pi} and $\lambda_{n\,j}$ such that the values of the energies of the nuclides and the binding energies of the nucleons in the nuclei would exactly coincide with their experimental values, and the errors in calculating the magnetic moments of nuclei would be fractions of a percent [8]. The solution of the posed problem for the deuteron, triton, helion, and α-particle is presented in the Table 2.

Table 2
Ethereal characteristics of nuclides of the first period.

Nucleus	Characteristics		Magnetic moments		
	λ_{pi}	λ_{nj}	Experiment	Calculation	Error
$d(^2_1H)$	0.99680	$29/27\lambda_p$	0.8574	0.8571	0.04 (%)
$t(^3_1H)$	0.995612	$45/44\lambda_p$	2.9788	2.9835	0.17 (%)
		$25/22\lambda_p$			
$h(^2_3He)$	0.99583	$27/28\lambda_p$	−2.1276	−2.1252	0.11 (%)
	$8/7\lambda_p$				
$\alpha(^4_2He)$	1.00733	$49/46\lambda_p$	0	0	0 (%)
	1.00733	$49/46\lambda_p$			

The solution of the posed problem for other nuclides of the periodic Mendeleev's table of chemical elements including all the stable and many unstable isotopes is currently received, which has already made it possible to answer the following important questions: why are there no complex nuclei consisting only of protons or only of neutrons; what keeps protons and neutrons together in the nucleus; why the sizes of atomic nuclei practically do not depend on the atomic number of the chemical element; how to calculate the energy of nuclides; why stable nuclides are located in a narrow band almost along the diagonal in the "proton-neutron" plane and why not along the diagonal; what does α-, β- and γ-decays of nuclides depends on, as well as their decays with the release of protons and neutrons; what is the mechanism of the natural origin of complex nuclei in nature; why there is no stable nuclei ^8Be; what is the reason for the different percentage in nature of different stable isotopes of one chemical element; what determines the decay time of unstable isotopes? Answers this questions require a separate large publication.

Conclusion

In the paper, the equations of compressible oscillating ether derived from the laws of classical mechanics are considered. A generalized system of nonlinear Maxwell-Lorentz equations, which is invariant with respect to Galileo transformations and the linearization of which leads to the classical system of Maxwell-Lorentz equations, is derived from the ether equations. The laws of Biot-Savart-Laplace, Ampere, and Coulomb, the mechanism of creation and annihilation of elementary particles are obtained. Ethereal models of electron, proton, neutron and formulas of their energies, magnetic moments, charges and masses are presented. Calculated by these formulas values have coincided with an inaccuracy of less than 0.2%, with the experimental so-called "anomalous" values. Ethereal representations for Planck's and fine structure constants are obtained. Foundations of the ethereal theory of atom and atomic nucleus are developed.

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