A possible explanation for the results of some experiments with LENR

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Experiments with LENR in “New Inflow” Company

- Experimental results conducted in company “New Inflow” and directly confirmed by spectral methods [1], have revealed the presence of transmutation of chemical elements with the release of additional heat without detection of conventional products of nuclear fusion (tritium, helium-3 and helium-4, thermal neutrons, gamma rays). The results of transmutation can be very good explained in the proposal of formation of cold neutrons in the conditions of these experiments [2]. This indicates the existence of non-conventional mechanism of occurring of low energy nuclear reactions (LENR).
- One possible explanation of processes occurring in the experiments [1,2] is based on the ether theory of elementary particles, developed by the author in the company «New Inflow».

1.A. Klimov, A. Efimov, et. al. “High-Energetic Nano-Cluster Plasmoid and Its Soft X-radiation” (in proc. of ICCF-19, 2015).
2.D.Burov, N.Evstigneev, A.Klimov, O.Ryabkov “On the Kinetic Calculations of Elements Transmutations in the Presence of Cold Neutron Flux”(in proc. of ICCF-19).

Articles on mathematical theory of ether

The mathematical model of ether was proposed by the author in the next articles:

1. Magnitskii, N.A. “To electrodynamics of physical vacuum”, Complex systems, vol.1, issue 1, pp. 83-91, 2011 (in Russian).
2. Magnitskii, N.A. “Mathematical Theory of Physical Vacuum”, Comm. Nonlin. Sci. and Numer. Simul., Elsevier, 2011 vol.16, issue 6, p.2438-2444.
3. Magnitskii, N.A. “Theory of elementary particles based on Newtonian mechanics”. In “Quantum Mechanics/Book 1”- InTech, 2012, p.107-126.
4. Magnitskii, N.A. “Physical vacuum and electromagnetic laws”, Complex systems, vol.2, issue 1, pp. 80-96, 2012 (in Russian).
5. Magnitskii, N.A. “Ether equations - a classical alternative to the Schrödinger equation”, IJLRST, 2012, vol.1, issue 3, p.229-233.
6. Zaitsev, F.S., Magnitskii, N.A. “On the dimensions of variables and some properties of the system of physical vacuum (ether) equations”, Complex systems, 2012, vol.2, issue 2, pp. 93-97(in Russian).
7. Magnitskii N.A. “Ethereal models of electron and proton”, IJRSET, 2014, v.3, issue 11, p.p. 17585-17594.

Ether equations

Postulate. Ether is a dense nonviscous compressible medium in three-dimensional Euclidean space with coordinates $\vec{r}=(x,y,z)^T$, having at each time t the density $\rho(\vec{r},t)$ and the velocity vector $\vec{u}(\vec{x},t)=(u_1(\vec{x},t),u_2(\vec{x},t),u_3(\vec{x},t))^T$ of propagation of small perturbations of the density. It was proposed to describe the dynamics of the ether by two nonlinear equations:

1) continuity equation

$$\frac{\partial\rho}{\partial t}+(\nabla\cdot\rho\vec{u})=0, \qquad (1)$$

2) momentum conservation law of ether

$$\frac{d(\rho\vec{u})}{dt}=\frac{\partial\rho\vec{u}}{\partial t}+(\vec{u}\cdot\nabla)(\rho\vec{u})=0, \qquad (2)$$

These equations follow from the classical mechanics of Newton and are invariant under Galilean transformations

Electrodynamics of ether

Let $\vec{n}$ is the direction of propagation of ether perturbations and

$$\vec{u}(\vec{r},t) = v(\xi,t)\vec{n} + w(\xi,t)\vec{m}, \ (\vec{m}\cdot\vec{n}) = 0, \xi = (\vec{r}\cdot\vec{n}),$$

We introduce the intensities of electric and magnetic fields and densities of charge and current distributions as:

$$\vec{E} = c(\vec{n}\cdot\nabla)(\rho\,\vec{u}) = \vec{E}_{\rightarrow} + \vec{E}_{\perp}, \ \vec{E}_{\rightarrow} = c(\vec{n}\cdot\nabla)(\rho\, v\vec{n}),$$

$$\vec{E}_{\perp} = c(\vec{n}\cdot\nabla)(\rho\, w\vec{m}), \qquad \rho_{ch} = div\ \vec{E}/4\pi, \ \vec{j} = \rho_{ch} v\vec{n}.$$

$$\vec{H} = c\,rot\ (\rho\ \vec{u}) = rot\ \vec{A} = c\,rot\ (\rho\, w\,\vec{m}).$$

Then we have a nonlinear generalization of Maxwell's equations

$$\frac{\partial\vec{H}}{\partial t} + v(\xi,t)rot\ \vec{E} + \frac{\partial v}{\partial\xi}(\xi,t)\vec{H} = 0, \ \ div\,\vec{H} = 0,$$

$$\frac{\partial\vec{E}}{\partial t} - v(\xi,t)rot\,\vec{H} + \frac{\partial v}{\partial\xi}(\xi,t)\vec{E} + 4\pi\,\vec{j} = 0, \ \ div\,\vec{E} = 4\pi\,\rho_{ch}.$$

If $v(\xi,t)=c$, it is exactly a system of Maxwell's equations, and if also $\rho = const$, then it is a system of Maxwell's equations in the “void”.

The system of equations of elementary particles in stationary spherical coordinates

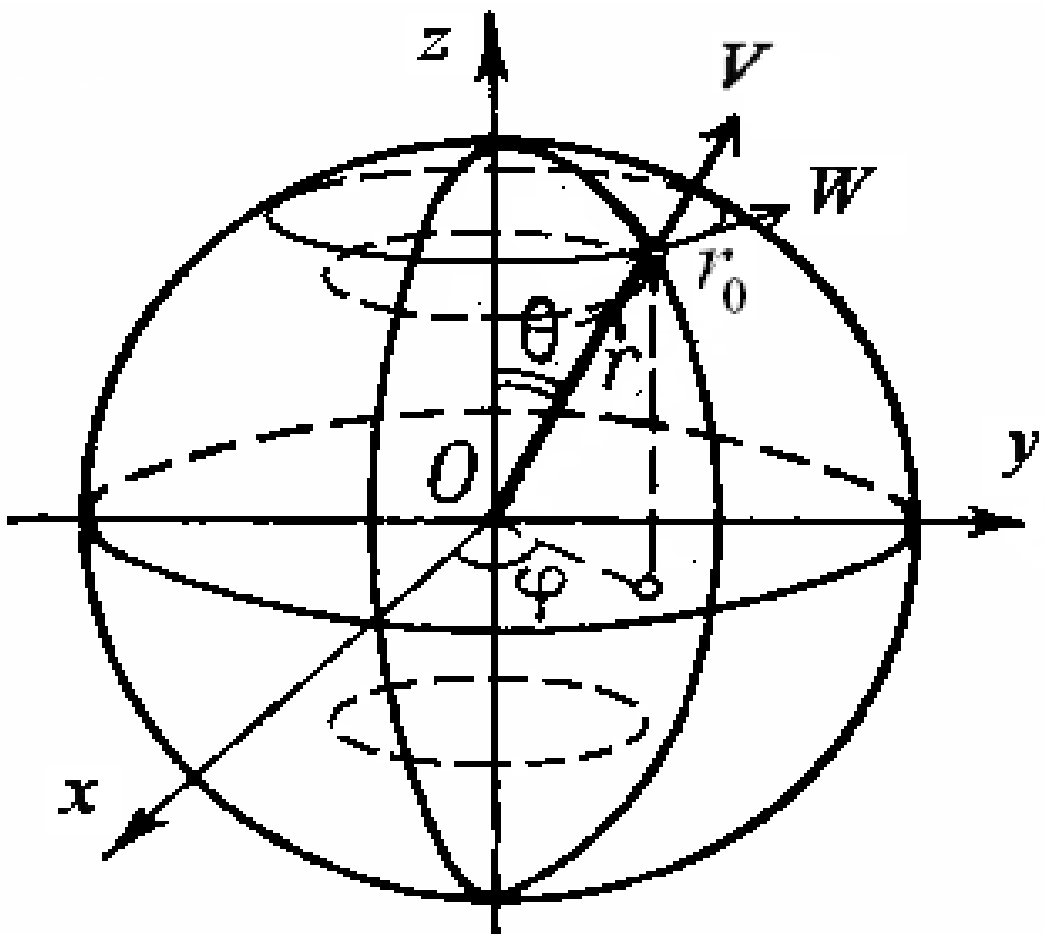
$$\frac{\partial\rho}{\partial t}+\frac{1}{r^2}\frac{\partial(r^2\rho V)}{\partial r}+\frac{1}{r\sin\theta}\frac{\partial(\rho W)}{\partial\varphi}=0,$$

$$\frac{\partial(\rho V)}{\partial t}+V\frac{\partial(\rho V)}{\partial r}+\frac{W}{r\sin\theta}\frac{\partial(\rho V)}{\partial\varphi}=0,\ (\vec{r})$$

$$\frac{\partial(\rho W)}{\partial t}+V\frac{\partial(\rho W)}{\partial r}+\frac{W}{r\sin\theta}\frac{\partial(\rho W)}{\partial\varphi}=0,\ (\vec{\varphi})$$

$$\vec{u}(r,\theta,\varphi)=(V_r,V_\theta,V_\varphi)^T,\ V_\theta=0,\ V_r=V,\ V_\varphi=W.$$

Schematic representation of an elementary particle



Birth of particle and antiparticle

Linearize the system of spherical ether equations, neglecting the gravitational member $V\,\partial(\rho V)/\partial r\,\vec{r}$, we obtain the wave solutions:

$$V(r,\varphi,\theta,t)=\frac{V(\theta)}{r}\cos((\omega t-\varphi)/2),\quad \rho(r,\varphi,\theta,t)=\rho_0(1-\frac{V(\theta)}{r^2\omega}\varphi\cos((\omega t-\varphi)/2)),$$

$$\delta=\frac{1}{4\pi}div(V\frac{\partial(\rho W)}{\partial r}\vec{\varphi})\approx\frac{\rho_0\omega V(\theta)}{8\pi r^2}\sin((\omega t-\varphi)/2),\quad W=\omega r\sin\theta,\quad \omega=\frac{d\varphi}{d\,t},$$

Charge density half-waves for proton (antiproton) and electron (positron) carrying only positive (negative) or only negative (positive) charges are defined as:

$$\delta_p(r,\theta,\xi)=\frac{\rho_0\omega_p}{8\pi r^2}V_p(\theta)\sin\xi/2,\qquad 0\le\xi=\omega t-\varphi<2\pi\quad(-2\pi\le\xi=\omega t-\varphi<0),$$

$$\delta_e(r,\theta,\xi)=\frac{\rho_0\omega_e}{8\pi r^2}V_e(\theta)\sin\xi/2,\qquad -2\pi\le\xi=\omega t-\varphi<0,\ (0\le\xi=\omega t-\varphi<2\pi).$$

Functions $V_e(\theta)$ and $V_p(\theta)$ for electron (positron) and proton (antiproton) have a series expansion on the angle θ:

$$V_e(\theta)=V_0(a+\sin\theta+b\sin 2\theta+c_e\sin 3\theta),$$

$$V_p(\theta)=V_0(a+\sin\theta-b\sin 2\theta+c_p\sin 3\theta),$$

Charges, magnetic moments, energies and masses of electron and proton

Calculating corresponding integrals on a ball of a particle and using that $\omega_p r_p = \omega_e r_e = c,$, we receive

$$|q_e| = |q_p| = \frac{\rho_0 c}{2\pi} V_0 \int_0^{\pi} (\mathrm{a}\sin\theta + \sin^2\theta) d\theta = \frac{\rho_0 c V_q}{2\pi} = \frac{\rho_0 c V_0}{4}(1 + \frac{4a}{\pi}) = q,$$

$$p_{me} = -\frac{4\pi V_{me}}{3V_q}\frac{qc\, r_e}{2} = \beta_e \mu_B, \qquad p_{mp} = \frac{4\pi V_{mp}}{3V_q}\frac{qc\, r_p}{2} = \beta_p \mu_N ,$$

$$\varepsilon_e = \pi^2 \rho_0^2 c V_\varepsilon \omega_e / 4 = \hbar\omega_e = m_e c^2, \;\; \varepsilon_p = \pi^2 \rho_0^2 c V_\varepsilon \omega_p / 4 = \hbar\omega_p = m_p c^2, \quad V_\varepsilon = \int_0^{\pi} V_{e,p}^2(\theta)\sin^3\theta\, d\theta,$$

where μ_B and μ_N are the Bohr magneton and the nuclear magneton, $\hbar$ is the Planck constant,

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

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

Consequently,

$$\beta_e = -\pi(\frac{32a}{9\pi} + 1 - c_e/3)/(\frac{4a}{\pi} + 1); \qquad \beta_p = \pi(\frac{32a}{9\pi} + 1 - c_p/3)/(\frac{4a}{\pi} + 1).$$

Proton and electron - the basic structural units of matter

Ether is slightly compressed inside positively charged little proton with Compton radius $\lambda_p = 2\pi r_p = 2\pi\hbar / m_p c,$ and it is slightly stretched inside negatively charged large electron with Compton radius $\lambda_c = 2\pi r_e = 2\pi\hbar / m_e c$. It follows from the equality $Q_p = 0$ for quadruple moment of proton that c_p = *1/3*. The numerical value for c_e is defined from the condition that c_p and c_e are the roots of the same quadratic equation

$$\frac{4a^2}{3} + \frac{3a\pi}{4} + \frac{16}{15} + \frac{64}{105}b^2 - (\frac{32}{35} + \frac{a\pi}{4})c + \frac{208}{315}c^2 - d = 0 \Rightarrow c_e + c_p = \frac{18}{13} + \frac{315}{208}\frac{a\pi}{4}.$$

Then for a = π/20 and γ = 4a/π = 0.2, the values of the magnetic moments of proton and electron are: $\beta_p = 2.79253$, $\beta_e = -2.00295$, that is different from their experimentally determined so called "anomalous" values: $\beta_p \approx 2.7928$, $\beta_e \approx -2.0023$ less than on 0.01% and 0.04%.

Neutron

There are two natural combinations of the interaction of waves of perturbations of ether density inside proton and electron: the combination with opposite spins and the combination with the same spins. As shown earlier by the author, the interaction (superposition) of the waves of electron and proton with opposite spins is a hydrogen atom.

We show that neutron is interaction (superposition) of waves of electron and proton with the same spins. In this case angular velocities of propagation of perturbations of ether density inside the electron and proton should be increased, and their radiuses should be decreased. That is they must be compressed, as it shown in the Figure 1.

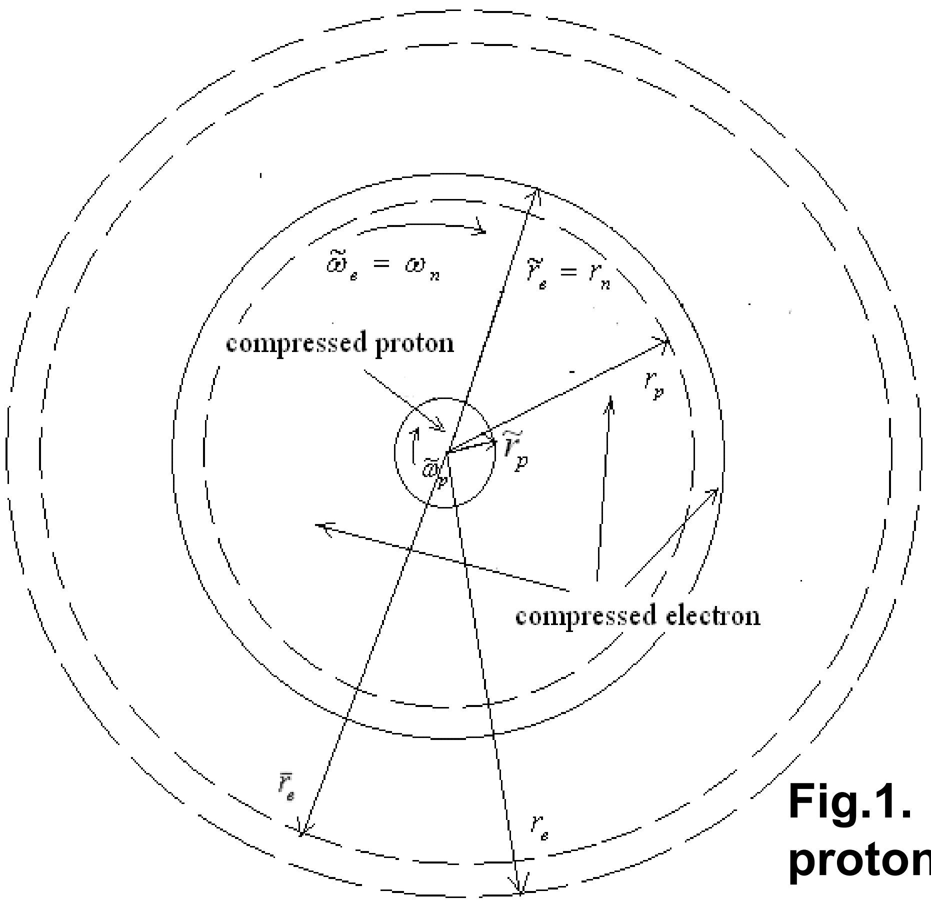


Fig.1. Formation of neutron from compressed proton and electron (top view).

Precompression of electron

To begin the process of compression of electron by proton, electron must first be compressed in δ times up to radius $\bar{r}_e$, corresponding to the resonant frequency $\bar{\omega}_e = c/\bar{r}_e = \omega_p / l$ of proton due to some external energy source, and after this its radius should decrease in an integer of times $m = \omega_n / \bar{\omega}_e = \bar{r}_e / r_n$, in such a manner that its initial radius should decrease also in an integer of times $n = \delta\, m$. The frequencies of the waves of perturbations of ether density in both parts of the neutron must also be in the resonance $k = \tilde{\omega}_p / \omega_n = r_n / \tilde{r}_p$. Such external energy source providing preliminary compression of electron, can be an electronic antineutrino, having a half-wave of a charge density in a kind:

$$\delta_{-}(r,\theta,\xi) = \frac{\rho_0 \omega_e}{8\pi\, r^2} V_0 \tilde{b} \sin(2\theta) \sin\xi_e / 2, \qquad -2\pi \le \xi_e = \omega_e - \varphi < 0.$$

A particle, having such negative half-wave of a charge density distribution, has energy, but has no charge, magnetic moment and mass, because corresponding integrals of the charge, magnetic moment and the change of the average density of ether inside a particle are equal to zero.

Charge, magnetic moment, energy and mass of neutron

We find charge, magnetic moment, energy and mass of neutron as sum of these quantities for compressed proton and electron

$$q_n = \frac{\rho_0 c V_q}{2\pi} - \frac{\rho_0 c V_q}{2\pi} = 0, \quad p_{mn} = \frac{\rho_0 \tilde{\omega}_p^2 \tilde{r}_p^3}{3} V_{mn} - \frac{\rho_0 \omega_n^2 r_n^3}{3} V_{mn} = -\frac{\rho_0 c^2 r_n V_{mn}}{3}(1 - \frac{1}{k}),$$

$$V_{mn} = \int_0^\pi V_n(\theta)\sin^3\theta\, d\theta, \quad V_n(\theta) = V_0(a + \sin\theta + (c_e/2 + c_p/2)\sin 3\theta).$$

$$\varepsilon_n = \pi^2 \rho_0^2 c(\tilde{\omega}_p + \omega_n) V_{\varepsilon n}/4 = \pi^2 \rho_0^2 c\left(k+1\right) V_{\varepsilon n}\omega_n/4, \quad m_n = \varepsilon_n / c^2,$$

$$V_{\varepsilon n} = V_0^2\left[\frac{4a^2}{3} + \frac{3a\pi}{4} + \frac{16}{15} - (\frac{32}{35} + \frac{a\pi}{4})\frac{(c_e + c_p)}{2} + \frac{208}{315}(\frac{c_e + c_p}{2})^2\right] = V_0^2 d_n.$$

Consequently,

$$p_{mn} = \beta_n \mu_n, \quad \beta_n = -\left[\frac{\pi l}{m}(1 - \frac{1}{k})(\frac{8}{9}\gamma + 1 - \frac{(c_e + c_p)}{6})\right] / (\gamma + 1).$$

Comparison with experimental data

The energy of neutron is equal to the energy of proton and electron precompressed by antineutrino in δ times:

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

and $(k+1)md_n=(l+1)d.$ Let $k=4,\ m=684, l=726, m\delta=n=1730$. Then

$$\delta=n/m=1730/684\approx 2.52924, \qquad d=1.06202(k+1)m/(l+1)=4.99602,$$

$$m_p=l\delta\, m_e\approx 1836.23m_e,\ m_n=(l+1)\delta\, m_e\approx 1838.76m_e,\ \ m_n-m_p=\delta\, m_e\approx 2.52924m_e.$$

Thus, the values of masses of proton and neutron, obtained from the formulas of the ether theory, are different from their experimentally determined values $m_p\approx 1836.16m_e,\ m_n\approx 1838.68m_e$ less than on 0.01%. The values of the fine structure constant

$$\alpha=\frac{q^2}{\hbar c}=\frac{(\rho_0 cV_0)^2}{16}\frac{(1+\gamma)^2}{(\pi^2\rho_0^2 cV_0^2 d)c/4}=\frac{(1+\gamma)^2}{4\pi^2 d}=0.0073009$$

and the magnetic moment of neutron $\beta_n=-1.909$ are different from their experimentally determined values $\alpha\approx 0.0072973,\ \ \beta_n\approx -1.913$ less than on 0.05% and 0.2%.

Ethereal explanation for LENR results

In the considered experiments, at the beginning hydrogen atoms are released by electrolysis from water molecules, then plasma is generated by discharge with the dissociation of the hydrogen atoms into protons and electrons.

But hydrogen atom is a superposition of ethereal waves of electron and proton with opposite spins. Then revolution of spins of electrons or protons and formation of new superpositions of their waves with the same spins occurs in plasma. In this case, protons can compress electrons up to cold neutrons. Such compression occurs in the needle nanostructures of the metal powder. These nanostructures create conditions for precompression of electrons up to resonant frequencies with protons. The given birth cold neutrons can easily penetrate into metal atoms, giving rise to new chemical elements, in beta decays of which additional energy is released in experiments.

Dimensions of the basic quantities

If we set the dimension of the ether density $[\rho]=\dfrac{tm^{1/2}}{l^{3/2}}$, then

$$[\vec{H}]=\frac{m^{1/2}}{tl^{1/2}};\quad [\vec{E}]=\frac{m^{1/2}}{tl^{1/2}};\quad [q_{ch}]=\frac{m^{1/2}l^{3/2}}{t};$$

$$[m]=[m];\quad [\vec{j}]=\frac{m^{1/2}}{t^2 l^{1/2}};\quad [\hbar]=\frac{ml^2}{t};\ [\varepsilon]=\frac{ml^2}{t^2};$$

which coincides with the dimensions of these quantities in the CGS system.

But we can assume that density of the ether is dimensionless. Then $m=l^3/t^2$ and dimensions of all quantities in the CGS and SI systems coincide

$$[\vec{H}]=[\vec{E}]=\frac{l}{t^2};\quad [q]=[m]=\frac{l^3}{t^2};\ [\vec{j}]=\frac{l}{t^3};\quad [\hbar]=\frac{l^5}{t^3};\ [\varepsilon]=\frac{l^5}{t^4};\ [\vec{F}]=\frac{l^4}{t^4}.$$

In this case, there is only a three-dimensional space filled with ether, and the absolute time.