

## **"Fundamental" means the underlying principles, laws, essence, structure, constants and properties of matter**

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### **Essay Abstract**

The conception «fundamental» means basic. Proceeding from this basis, the properties of the investigated object, the laws of its existence, the structure and interaction with other objects are determined. Fundamental science should be based on the fundamental principles of research, without the use of abstract and ideal concepts.

The proposed essay uses the single entity - toroidal gravitational waves (real and observable objects, rather than hypothetical strings), on the basis of which all objects are built. The formation of de Broglie waves and fundamental quantum mechanics is based not on probabilistic, but topological principles and laws of quantum parametric resonance in a nonideal medium of a physical vacuum, from micro to macro scales. All matter in the universe is fractal. In the process of existence of matter, there are continuous quantum parametric processes of its transformation. The fundamental laws of formation of the fractal structure of matter determine the strict topology and hierarchy of the elements of a lot, of neutrino for each other, levels of matter.

The essay describes the laws of existence of the fractal structure of matter, which are confirmed by a large number of calculations and observations. The property of formation of gravitational potential well of stability of orbital bodies is connected with the law of inertia and is a fundamental property of all interactions. Orbital bodies are in potential pits of stability of toroidal gravitational waves of de Broglie. Therefore, the law of motion of bodies by inertia is also valid for the curvilinear motion of orbital bodies. Therefore, the Newton's law of gravitation cannot be used not only for stars in galaxies, but also for all orbital bodies.

The gravitational constant reflects Kepler's third law in the solar system and is not fundamental constant for other planetary systems.

***“The most incomprehensible thing about the world is that it is comprehensible”***

Albert Einstein

### **Introduction**

The purpose of this essay: to show the principles of formation of science outlook, free from abstractions and ideals.

An example of incorrect use of ideals properties is the abstract distortion of space-time, which must be replaced by the equivalent property of a non-ideal medium of the physical vacuum-the variable velocity of propagation of the gravitational fundamental interaction that allows to adequately explain the lensing of galaxies and redshift (without the Big Bang).

A series of figures is presented in [1], which clearly shows the mechanism of formation of the force of interaction between cosmic bodies with the help of toroidal gravitational waves de Broglie of bodies. The toroidal gravitational waves of de Broglie are forcedly generated as vortexes of turbulence in the rigid and superfluid medium of the physical vacuum [1], ■■■<sup>23</sup> [4] and provide stability of the limiting elements («of Compton waves»), either by adding energy or by removing excess perturbation energy in the process of parametric resonance in a soliton structure.



The matter of the fundamental elements in the universe can be in two basic phase states: in the form of toroidal gravitational waves and in the form of photons. Toroidal gravitational waves

concentrate energy in the center of gravitation (in accordance with the principle of the action of the heat pump) and form vortex gravispheres from fundamental elements of the medium of the physical vacuum. Photons dissipate energy from the center of gravitation. The transformation of toroidal waves into photons and back leads to the formation of impulses of force and to the circulation of energy. All processes in the universe are based on energy circulation. The phase state of matter in photons and gravitational waves is determined by the extreme principle of least action, which is carried out by energy circulation in parametric resonant processes.

Parametric resonances of the set of stable de Broglie waves of electrons and other limiting elements form a single grid of stable resonant frequencies (18) in different frequency ranges and are synchronizers of all processes in the universe. It is assumed that the formation and transformation (fission and synthesis) of deterministic toroidal gravitational waves (gravitons, bosons, pairs of de Broglie waves with mass) occur quantum on harmonics and subharmonics of parametric resonance. In this case, a pulse of force (of inertia, of attraction or of repulsion) is formed with the simultaneous formation of photons (Unruh effect). The presence of photons is a sign of the formation of force.

Any recorded photon is preceded first by the formation and then the transformation of one pair of toroidal gravitational waves into two pairs of spiral fermions of photons that are screwed into the medium of a physical vacuum with an equilibrium velocity and have a much smaller interaction cross section than the original toroidal waves. The equilibrium velocity of motion of matter with the speed of propagation of interaction provides an optimal rate of perturbation to all elements of a single level of matter [8, Section 5.]. Therefore, photons almost do not require a gravisphere, they do not form a significant mass, they are neutrino elements, elements more of a deep matter level (of quark level of matter) than electrons.

Distortion of space-time is more of an abstract concept than a physical process. The physical equivalent of the distortion of the space of time is the change in the speed of propagation of the gravitational interaction, as a change in the derivative of spatial coordinates in time. The speed of photons propagation has a small dispersion. The speed of propagation of gravitational interaction has dispersion in 770 times greater and depends on the gravitational potential, density and temperature of the deterministic medium of the physical vacuum.

Orbital velocity of the Earth is equal to the orbital speed of rotation of the medium of the physical vacuum in the vortex gravisphere of the Sun and determines the gravitational potential, which is equal to the square of the equilibrium orbital velocity. The Earth in orbit is stationary relative to the medium of the physical vacuum in the vortex gravisphere of the Sun. Therefore, there is no dynamic reason for the formation of the force of attraction to the Sun, and the Earth does not experience the force of centrifugal inertia. Those, the Earth is in orbit in gravitational potential well of stability  <sup>21</sup> [5], like an orbiting electron  [2-3]. Thus, Newton's law of gravitation is not valid for orbital bodies. Due to the invariable gravitational potential in the disks of galaxies, the stars move approximately at the same speed, which does not correspond to Newton's law of gravitation and Kepler's laws. The dynamic cause of gravity makes it possible to describe their motion without using an insufficiently substantiated "dark matter".

On the basis of the fundamental principle of non-ideality of the properties of matter, the essay is affirmed the "aging" of photons in the material and deterministic medium of the physical vacuum due to its viscosity. Dissipation of photon energy with the Hubble parameter, allows us to understand the mechanism of energy circulation in the Universe (energy circulation occurs due to transformation of toroidal gravitational waves into photons and photon transforms into toroidal waves). Dissipation and circulation of wave energy explains the red shift of galaxies, allows to abandon the concept of "dark energy" and supernatural "Big Bang", and also explains the mechanism of anomalous acceleration of "Pioneers 10-11" associated with the Hubble parameter [5].


The energy of toroidal gravitational waves of Earth's gravisphere can be used as a fundamental renewable energy source, whose power is 80 times greater than the power of the electromagnetic radiation of the sun falling on the Earth.

### **Fundamental constants**


Most phenomenological constants cannot be fundamental. Their application leads to insufficiently justified generalizations. The use of phenomenological constants in the laws of the

universe requires their verification for each calculated system, by deciphering their physical meaning. Substituting the physical parameters of phenomenological constants in the formula, we obtain physical forms of laws. For example, the well-known law of the formation of de Broglie waves is leads to unreasonable generalizations about of Planck parameters. Therefore, it is necessary to transform this law into the physical form. As a result, we get that the Planck parameters are the parameters of the electron. When the speed of motion is changing, the de Broglie wavelength of an electron

$$\lambda_{dB_e} = \frac{h}{m_e \cdot v} = \frac{m_e \cdot c \cdot \lambda_e}{m_e \cdot v} = \lambda_e \cdot \frac{c}{v} \quad (1)$$

while maintaining the angular momentum  $h_{dB_e} = h = m_e \cdot c \cdot \lambda_e = m_e \cdot v \cdot \lambda_{dB_e} = m_{dB_e} \cdot c \cdot \lambda_{dB_e}$ . Moreover, the de Broglie wave are formed as, a result of the quantum parametric resonance with the precession frequency of with Compton wave  on common resonant frequency

$$v_{dB_e} = \frac{c}{\lambda_{dB_e}} = v_e = \frac{v}{\lambda_e} \quad (2)$$

It should be noted that in these in fundamental physical laws de Broglie wave has a mass  $m_{dB_e} = m_e \cdot \frac{v}{c}$ , and there is a particle in the electronic level of matter  $n=-1$ . I.e., the whole set of elements of the electronic level of matter this is analogues of Maxwell's cogwheel/idle . There are secondary de Broglie waves from the de Broglie waves of electron.

For example, it is known that at a voltage of  $1 \mu V$  frequency of photons on Josephson junction is  $483 \text{ MHz}$ . Under the influence of this voltage each electron pair of Cooper accelerates to the speed

$$v_e = \sqrt{\frac{2 \cdot e \cdot U_D}{m_e}} = 593 \cdot \frac{m}{s}. \text{ In this case, the frequency of the photons equal}$$

$$v_{D2dB} = \frac{E_{D2dB}}{h} = \frac{2 \cdot e \cdot U_D}{h} = \frac{c}{\lambda_{D2dB}} = 483 \cdot \text{MHz}. \text{ The length of the secondary de Broglie wave of an}$$

$$\text{electron is } \lambda_{D2dB} = \lambda_{D1dB} \cdot \frac{c}{v_e} = \lambda_e \cdot \left( \frac{c}{v_e} \right)^2 = \frac{c}{v_{D2dB}} = 0.62 \cdot m. \quad (3)$$

Moreover, the kinetic energy of the pairs of electron Cooper equal to the energy of the pair (to boson) of secondary electron de Broglie waves

$$E_{ke} = 2 \cdot m_e \cdot \frac{v_e^2}{2} = E_{D2dB} = E_{D2ph} = 2 \cdot m_{D2dB} \cdot \frac{c^2}{2} = 2 \cdot 10^{-6} \cdot eV. \text{ It should be noted that the de Broglie wavelength equal to the wavelength Compton, at the speed of motion of the electron, equal to the speed of light.}$$

Consequently, the relativistic electron mass is equal to the mass of the plurality of de Broglie waves in its gravisphere, mass of which are close to the mass of the electron. Consequently, the electron this is the limit particle, which is "pressed" to the limit speed of propagation of interaction, like to wall. The use of the gravitational coefficient for the solar system, along with the Planck constant (angular moment of an electron) in the calculation of the Planck length

$$\lambda_{Pl} = \sqrt{\frac{\hbar \cdot G}{c^3}} = 1.616 \cdot 10^{-35} \cdot m \text{ and mass } m_{Pl} = \sqrt{\frac{\hbar \cdot c}{G}} = 0.0218 \cdot mg, \text{ is a gross mistake.}$$

If we equate for Earth the physical form of the law of gravity and recording in phenomenological form of Newton's law, we can determine from which parameters bodies and their orbits depends the gravity coefficient for the specific planetary systems

$$F = m_b \frac{\varphi_E}{r_E} = m_b \frac{v_{1E}^2}{r_E} = (G) \frac{m_E \cdot m_b}{r_E^2} = \left( \frac{v_{1E}^2 \cdot r_E}{m_E} \right) \frac{m_E \cdot m_b}{r_E^2}. \quad (4)$$

Where: The gravitational potential  $\varphi_E = v_{1E}^2$  is equal to the square of first cosmic speed of the Earth.

The multiplication result  $v_{1E}^2 \cdot r_E$  is constant for given planetary system and is an analog of the 3-rd Kepler's law  $K_{3K} = \frac{r_E^3}{T_E^3} = \frac{r_E^3}{(2 \cdot \pi \cdot r_E / v_{1E})^2} = \frac{v_{1E}^2 \cdot r_E}{4 \cdot \pi^2}$ ,  $G = \frac{K_{3K} \cdot 4 \cdot \pi^2}{m_E} = \frac{v_{1E}^2 \cdot r_E}{m_E}$ .


Substituting gravitational coefficient of planetary system of electron

$G_e = \frac{c^2 \cdot r_e}{m_e} = 5.709 \cdot 10^{44} \cdot G$  in the formulas for calculating the Planck mass and length, we get the



parameters of the Planck value equal to the parameters of the electron


$$m_{Pl} = \sqrt{\frac{\hbar \cdot c}{G_e}} = \sqrt{\frac{m_e \cdot r_e \cdot c \cdot c}{(c^2 \cdot r_e / m_e)}} = m_e, \quad \lambda_{Pl} = \sqrt{\frac{\hbar \cdot G_e}{c^3}} = \lambda_e. \quad (5)$$

It means that there are no fundamental particles of electronic level of matter with a greater mass than the electron. Therefore, the Planck mass and Planck length waves, the event horizon and the black holes are not sufficiently substantiated the abstract generalizations, which have no physical meaning. Thus, gravitational and other phenomenological coefficients for every system must always be calculated, otherwise their use does not make sense.

The rigidity of the medium of the physical vacuum is ensured by its structure - the lattice of the interrelated de Broglie waves of electrons, which is of Maxwell's cogwheel/idle . In its elements (in the electrons and its de Broglie waves), the internal elements move with the limiting and equilibrium velocity (the speed of light), and consequently, in them the limiting gravitational potential is reached. In accordance with limiting gravitational potential of the elements of matter of physical vacuum medium, photons or gravitons (of quark level) forced and equilibrium move with the speed of light in soliton potential wells of stability of waves de Broglie. Elements of electronic level of matter can move equilibrium in superconductivity with speed in 43.6 times slower than the speed of light.

## The fundamental fractal structure of matter

It is shown in [1] and [8] that all elements of the medium of the physical vacuum and atoms have a fractal structure , the laws of construction of which are fundamental. An analogous structure in a macro scale can be seen in Fig. . The geometric and physical parameters of the fundamental elements are strictly defined by the fundamental laws.

For example, , the ratio of the radius of the electron to the radius of one from 137 quarks of the electron  $r_e / r_{qe} = 1 / (\pi \cdot \alpha) = 43.6$ . (6)

The continuity and stability of the periodic process of the rotation of matter in an electron at the speed of light determines the continuity and fundamental nature of time. The fine structure constant  $\alpha$  has a geometric meaning and is a fundamental constant, as the number  $\pi$ . The constant  $\alpha$  is used together with  $\pi$  to calculate the geometric parameters of fundamental fermions. The fine structure constant  $\alpha$  - is the ratio of the quark diameter (one of 137 quarks) and the Compton wavelength of the electron. The ratio of the radius quark to the radius of Compton wave of the electron is equal to the product of  $\pi\alpha$  (6). In each level of matter  $n$  there is a complex of constant quantities - of the quantum limit parameters of particles:

- the limiting speed of propagation of interaction of elements of different levels  $c_n = c \cdot (\pi \cdot \alpha)^{-n}$  (7)

- on the basis of (1), the limiting moment of the momentum of the elements of matter of different levels  $\hbar_n = \hbar \cdot \alpha^{n+1} = m_n \cdot c_{n+1} \cdot r_n$ . (8)

Where:  $n$  - the number of level of matter for limit element.

To calculate of any the fundamental element can be formed generalized relations of similarity in which the initial parameters - the parameters of the electron and the speed of light  $c$ . On the basis of

the assumption of fractal structure of matter  $\circ\circ$  [8, Section 5.] and of ultimacy of parameters of basic elements (7) and (8), the energy of any element of fundamental fermions is equal

$$E_{n,u} = E_\varepsilon \cdot (\pi^2 \cdot \alpha)^{-(n+1)} \cdot \alpha^{u-n}. \quad (9)$$

Where:  $u$  - number of level of matter of element constituting the limit element.

The wavelength and the radius for any element in the fundamental fermion

$$\lambda_{n,u} = \lambda_\varepsilon \cdot (\pi \cdot \alpha)^{3(n+1)+u-n} \quad r_{n,u} = r_\varepsilon \cdot (\pi \cdot \alpha)^{3(n+1)+u-n} \quad (10)$$

The equivalent speed of required external disturbance of any element in the fundamental

fermion 
$$v_{n,u} = c \cdot \frac{\lambda_{0,0}}{\lambda_{0,(n-1)}} \cdot \frac{\lambda_{0,0}}{\lambda_{0,n}}. \quad (11)$$

The speed of motion of the elements of matter at all levels of matter on the ring axis of

fundamental fermion  $\circ\circ$  
$$v_{n,u} = c \cdot \frac{\lambda_{0,n}}{\lambda_{(n+1),(u-n-1)}}. \quad (12)$$

All limiting elements of matter level  $n$  differ from neighboring limit elements of matter level

$n-1$  in  $\frac{E_{n,u}}{E_{n-1,u-1}} = 1/(\pi^2 \cdot \alpha) = 13.9$  times by energy, in  $\frac{r_{n-1,u-1}}{r_{n,u}} = 1/(\pi \cdot \alpha)^3 = 83000$  times by

radius and in  $\frac{h_{n,u}}{h_{n-1,u-1}} = 1/\alpha = 137.036$  times by angular momentum.

Investigation of the structure of the medium of the physical vacuum must proceed from its parameters: the critical temperature of stability of the elements of the medium of the physical vacuum (the temperature of the maximum of the Planck spectrum of its radiation) and the region of the radiation spectra under perturbation of the medium of the physical vacuum.

Investigation of the structure of the physical vacuum medium is based on the well-known in the kinetic theory of gases depending of the speed of motion of matter from the temperature. With help of this law, you can determine the most probable speed of motion of molecules of hydrogen  $m = 2 \cdot m_H$

on the Sun's surface for temperature  $T_s = 5778K$  
$$v_H = \sqrt{\frac{2 \cdot k \cdot T_s}{2 \cdot m_H}} = 6.9 \cdot \frac{km}{s}. \quad (13)$$

It should be noted that the energy of the positronium annihilation  $E_{ae} = 6.8 \cdot eV$ , measured on Earth, consists of kinetic and potential energy of an electron-positron pair. The potential energy is characterized by the gravitational potential; the dimension of gravitational potential coincides with the square of the speed  $v_{ae} = 773 \cdot km/s$  of the necessary perturbation positronium. Unlike conventional representation, the potential energy depends on the speed - is the kinetic energy of the field lines (of

gravitational waves) 
$$E_{ae} = 2 \cdot m_\varepsilon \cdot \frac{v_{ae}^2}{2} + 2 \cdot m_\varepsilon \cdot \frac{v_{ae}^2}{2} = 2 \cdot m_\varepsilon \cdot v_{ae}^2 = 6.8 \cdot eV. \quad (14)$$

From (14) we can write the relation for energy of "annihilation" of the electron-positron pair  $E_{ae}$  to the electron energy  $E_\varepsilon$  and the energy of annihilation for any fermion of electron level of

matter  $E_a$  to its energy  $E$  
$$\frac{E_{ae}}{E_\varepsilon} = \frac{v_{ae}^2}{c^2} = \frac{E_a}{E} = \frac{v_a^2}{c^2}. \quad (15)$$

Knowing the minimum speed of positronium, from the kinetic theory of gases can be determined the minimum temperature of stability positronium 
$$T_{ae\min} = \frac{E_\varepsilon \cdot v_{ae}^2}{k \cdot c^2} = 39450^\circ K.$$

## The grids of the resonant frequencies of the elements of matter are the inherent fundamental properties of the medium of the physical vacuum.

Unlike photons (pairs of spirals that are practically without mass and therefore having one resonance frequency), the fundamental elements of matter are toroidal gravitational waves of different levels of matter. They have masses and a complex fractal structure, where each element of many different levels of matter has a grid of a lot of resonance frequencies. Resonances of many levels of matter form a single periodic grid of fundamental resonant frequencies. At present, we have the opportunity to register resonances only elements of the electronic level of matter. For this reason, it makes sense to give the calculated formulas of the grid of fundamental resonances, only of the electronic level of the mother  $n=-1$ . The length of toroidal gravitational waves of the entire main grid


$$\text{of the first harmonics of fundamental resonances } \lambda f_{n1,n2,n3} = \lambda_e \cdot (\pi \cdot \alpha)^{-n1} \cdot \alpha^{-n2} \cdot \left( \frac{c}{v_{1CE}} \right)^{n3}, \quad (16)$$

where  $n1$  and  $n2$  are the resonance numbers associated with the fundamental constants  $\pi$  and  $\alpha$ ;  $n3$  is number of the resonance associated with the gravitational potential on the Earth, and is determined by the first cosmic velocity  $v_{1CE} = 7.9097 \cdot km/s$ . The energy and frequency of toroidal gravitational

$$\text{waves for the fundamental resonances of the grid } Ef_{n1,n2,n3} = E_e \cdot (\pi \cdot \alpha)^{n1} \cdot \alpha^{n2} \cdot \left( \frac{c}{v_{1CE}} \right)^{-n3}. \quad (17)$$

$$v f_{n1,n2,n3} = c / \lambda f_{n1,n2,n3} = Ef_{n1,n2,n3} / h. \quad (18)$$

The fundamental grid of resonance frequencies (18) can be divided into 4 paths.

The first grid is a global grid, it is valid for the calculations of the entire universe and is related to the topological parameters of the fractal structure of the elements of the electron matter  by the ratios of the coefficients  $n1$  and  $n2$  (for  $n3=0$ ) when calculating various de Broglie waves.

The second grid is valid only for the Earth (for  $n3>0$ ) and is related to the gravitational potential of its surface (that is equal to the square of the Earth's first cosmic velocity


$$v_{1CE} = \sqrt{\varphi_E} = 7.9097 \cdot km/s, \text{ as with perturbation factor of toroidal gravitational waves (1).}$$

The third grid is also valid only for the Earth and is associated with the topology of its orbital toroidal gravitational wave, whose wavelength is in 10.165 times (the constant coefficient linking the [9]) is less than the wavelength of the limiting element of the matter level  $n=-6$  (6 % larger than Saturn's orbit)  $\lambda_{-6,-6} = 9555 \cdot \text{million km}$ . The fourth grid is associated with the parameters of intensity maxima of all background radiation, which differ from the energies (frequencies) of the first grid, approximately 2.845 times. Let us give some illustrative examples of calculating the parameters of the fundamental resonances of the first grid for the elements of the medium of the physical vacuum:

The parameters  $n1=n2=n3=0$  determine the energy of the electron  $Ef_{0,0,0} = 511 \cdot keV$ ; Stable de Broglie waves with energy  $Ef_{1,0,0} = 11.72 \cdot keV$ ; Elements of Cerenkov radiation -


$$Ef_{2,0,0} = 268 \cdot eV; \text{ An exciton with energy } Ef_{3,0,0} = 6.16 \cdot eV \text{ with a wavelength}$$



$$\lambda f_{3,0,0} = 0.2014 \cdot \mu m \text{ that is equal to the wavelength of the limiting element } \lambda_{-2,-2} = 0.2014 \cdot \mu m$$

responsible for the dispersion of light in the glasses; Phonon  $\lambda f_{4,0,0} = 8.78 \cdot \mu m$ , responsible for dispersion absorption in the infrared range in the Earth's atmosphere ; Resonance

$$v f_{5,0,0} = 782 \cdot GHz \text{ responsible for the formation of the microwave background and dispersion}$$



interaction in the [Sunyaev-Zeldovich effect](#) . Resonance  $\nu_{6,0,0} = 17.94 \cdot GHz$ , with the wavelength of the limiting element of matter level  $n=-3$   $\lambda_{-3,-3} = 16.71 \cdot mm$ .


Resonance  $\nu_{7,0,0} = 411.2 \cdot MHz$  will play a significant role in the development of devices for extracting energy from the environment of the physical vacuum and devices that regulate the force of inertia of bodies. For example, the most effective diameter of a  $235 \cdot mm$   cylindrical resonator for the EM Drive  spacecraft, which exactly corresponds to the radius of inertia of the resonator, in which a toroidal gravitational wave of inertia with a close frequency is formed, is empirically found  $\nu_{7,0,0} = 411.2 \cdot MHz$ .

The resonance of the medium of the physical vacuum  $\nu_{8,0,0} = 9.43 \cdot MHz$  forms on the Earth the boundary of the near dead propagation zone of short waves. Those, at short wavelengths above this frequency, communication is impossible at a distance of 30 to 800 km, because these waves do not propagate along the surface of the Earth, but they are reflected from the ionosphere.

Stable de Broglie waves of an electron from the first grid ( $n1=n3=0$ ) formed at the resonance of periodic acting 137 times:


The orbital toroidal gravitational wave of an electron in the Hydrogen atom  $Ef_{0,1,0} = 3.73 \cdot keV$  with a wavelength  $\lambda f_{0,1,0} = 3.325 \cdot \text{\AA}$  has 137 quarks (moving at the speed of light) and 137 times periodically acts on an electron per revolution of the orbital wave. This frequency of action is equal to the frequency of the electron's own rotation along the Compton wave with the speed of light (2).

The toroidal gravitational wave of de Broglie of the orbital electron in the Hydrogen atom  $Ef_{0,2,0} = 27.2 \cdot eV$  with the wavelength  $\lambda f_{0,2,0} = 455.6 \cdot \text{\AA}$  is the 2nd subharmonic of the element forming the boundary of the Lyman series. This wave is formed at the frequency of rotation of the orbital electron in the Hydrogen atom.

The stable de Broglie wave of an electron (phonon)  $\lambda f_{0,3,0} = 6.244 \cdot \mu m$ , together with a phonon  $\lambda f_{4,0,0} = 8.78 \cdot \mu m$ , is responsible for infrared dispersive absorption in the Earth's atmosphere , etc.
















The de Broglie waves of an electron from the second grid of resonance frequencies associated with gravity on the Earth form the known anomalous propagation frequencies of electromagnetic waves. Resonance  $\nu_{3,0,2} = 1.036 \cdot MHz$  is supposed to be used in the new version of GPS to determine the coordinates in the bowels of the Earth. The frequency range near resonance  $\nu_{4,0,2} = 23.76 \cdot kHz$  has long been used for communication with underwater objects around the globe.












An interesting resonance  $\nu_{0,0,4} = 59.87 \cdot Hz$ , which was discovered by Tesla and he suggested a frequency of an alternating current network of 60 Hz. At this frequency, Tesla did not receive a wireless transmission of energy, but he found a minimum of losses.

We present the calculations of the parameters of the majority of the intensity maxima of the background radiation  1 from the fourth grid. To do this, in the calculation formulas (16) (17) (18) it is necessary to use the coefficient 2.845.

All 14 of the observed background radiation and calculated in a single system differ from each other by their parameters in 43.6 times. Thus, the validity of quantum processes and the fractal structure of matter from micro- to macro-scales is confirmed experimentally. Let's begin the description of background radiation from background elements with the maximum wave energy forming a background of toroidal gravitational waves that form a large number of electron orbits of


heavy atoms. The maximum intensity of the background  $Ef_{0,0,0}/2.845 = 179.6 \cdot keV$  is related to the electron  $Ef_{0,0,0} = 511.07 \cdot keV$ . Wavelength of the background maximum  $\lambda_{44} = 0.069 \cdot \text{\AA}$  practically coincides with the parameters of the wave of the first electron's orbit from the nucleus of the Ruthenium atom with atomic number 44. Its orbit's length is only 3 times larger than the wavelength of the electron and the positron  $\lambda_e = 0.0243 \cdot \text{\AA}$ . Those, the maximum of concentration of the orbits of the electrons of all heavy atoms coincides with the maximum of the background wavelength  $\lambda_{44} = 0.069 \cdot \text{\AA}$ .


The next background with a lower energy of X-ray waves is formed in the region of the orbits of the latter from the nucleus of the electrons of the atoms. The maximum background intensity  $Ef_{1,0,0}/2.845 = 4.118 \cdot keV$  has a wavelength  $\lambda_{f_{1,0,0}}/2.845 = 3.011 \cdot \text{\AA}$  of  2,  3. For comparison, the wavelength of the electron's orbit in the Hydrogen atom  $\lambda_{f_{0,1,0}} = 3.325 \cdot \text{\AA}$ . Background of X-ray radiation  $Ef_{2,0,0}/2.845 = 94.41 \cdot eV$   $\lambda_{f_{2,0,0}}/2.845 = 131.3 \cdot \text{\AA}$   4. Background of solar radiation  $Ef_{3,0,0}/2.845 = 2.164 \cdot eV$   $\lambda_{f_{3,0,0}}/2.845 = 0.573 \cdot \mu m$   5. In the area of the Earth's orbit around the Sun, two known backgrounds, white  $\lambda_{f_{3,0,0}}/2.845 = 0.573 \cdot \mu m$  and infrared  $\lambda_{f_{4,0,0}}/2.845 = 25 \cdot \mu m$  zodiacal glow of the medium of the physical vacuum are observed  6,  7. The most famous microwave background with the maximum intensity  $\lambda_{f_{5,0,0}}/2.845 = 1.09 \cdot \mu m$   $\nu_{f_{5,0,0}}/2.845 = 275 \cdot GHz$ . Known centimeter background with the maximum intensity  $\lambda_{f_{6,0,0}}/2.845 = 4.755 \cdot cm$   $\nu_{f_{6,0,0}}/2.845 = 6.305 \cdot GHz$ . Known meter background with maximum intensity  $\lambda_{f_{7,0,0}}/2.845 = 2.074 \cdot m$   $\nu_{f_{6,0,0}}/2.845 = 6.305 \cdot GHz$ . Known 3 MHz background with maximum of intensity  $\lambda_{f_{8,0,0}}/2.845 = 90.5 \cdot m$   $\nu_{f_{8,0,0}}/2.845 = 3.314 \cdot MHz$ . There are almost no known backgrounds with a maximum intensity at frequencies  $\nu_{f_{9,0,0}}/2.845 = 75.97 \cdot kHz$   8,  $\nu_{f_{10,0,0}}/2.845 = 1.74 \cdot kHz$  [Shot noise](#) , [noise](#) ,  9,  10,  14,  $\nu_{f_{11,0,0}}/2.845 = 39.93 \cdot Hz$  -  11,  12,  14.


The most interesting background is the background with a maximum intensity at a frequency  $\nu_{f_{12,0,0}}/2.845 = 0.9153 \cdot Hz$  of  13,  14. At this frequency, toroidal gravitational waves with a radius of the outer toroid  $\nu_{f_{12}} = \lambda_{f_{12,0,0}}/2.845 / (2 \cdot \pi) = 52.13 \cdot \text{thousand km}$   15 affect the Earth. The inner toroid is formed by the limiting elements (10) with a radius  $\lambda_{f_{12,0,0}}/(2 \cdot \pi) = r_{-5,-5} = 18.32 \cdot \text{thousand km}$  with frequency  $\nu_{f_{12,0,0}} = 2.604 \cdot Hz$  that is fixed as a resonance (with its harmonics) of gravitational waves in the LISA project  [LISA](#), , [LISA](#),  [LISA](#), HAARP  22. Thus, the magnetosphere of the Earth is an analog of a heavy atom. It is assumed that, similar to the Earth, the nucleus of an atom from protons and neutrons is surrounded by a toroidal bundle of positrons (limit elements). The outer toroid of the magnetosphere is analogous to the set of electron orbits of heavy atoms. In the solar photosphere, a lot of toroidal formations are observed from the same limiting elements  $\lambda_{f_{12,0,0}}/(2 \cdot \pi) = r_{-5,-5} = 18.32 \cdot \text{thousand km}$  as in the inner toroid around the Earth  15. Same the elements on the Sun form a continuous granulation  16. The toroidal coronal loops  17 on the Sun represent the analogue of the outer background toroid around the Earth  15. Toroidal gravitational waves on the 3rd harmonic (Schumann waves







with a frequency of 7.83 Hz) of the limiting elements  $\lambda f_{12,0,0} / (2 \cdot \pi) = r_{-5,-5} = 18.32 \cdot \text{thousand km}$


form the quantum state of the surfaces of the Earth and Venus. The dimensions of the limiting elements (*1-harmonic*) are equal to the radii of inertia of Uranus and Neptune and thus determine their quantum state. The next low-frequency background is characterized by a maximum intensity at frequency  $\nu f_{13,0,0} / 2.845 = 0.021 \cdot \text{Hz}$   <sup>14</sup>. The radius of toroidal gravitational waves

$\nu f_{13} = \lambda f_{13,0,0} \cdot 2.845 / (2 \cdot \pi) = 779 \cdot \text{thousand km}$  has period  $1/(\nu f_{13,0,0} / 2.845) = 47.7 \cdot \text{s}$   <sup>18</sup>.

It should be noted that with such a radius around the Sun there is a vast region of the Sun's corona . Thus, this background determines the quantum state of the Sun.

The natural background noise interferes with the [development of EM Drive](#) . The spectral lines of such a noise signal with  coincide with the lines of gravitational waves fixed [LISA Pathfinder](#) in a million kilometers from the Earth. It should be noted that regardless of the type of waves (gravitational, electromagnetic, seismic or acoustic waves), their spectra contain a lot of common resonant frequencies (spectral lines) for all types of waves  <sup>19</sup>,  <sup>20</sup> that form. Those, it can be assumed that all waves have a single nature, which causes the formation of gravisphere (of potential well of stability in the form of a complex of waves) for all moving objects.

For example, only toroidal gravitational waves form the force of interaction, including the force of inertia of particles, atoms and bodies. Toroidal gravitational waves can be transformed into photons, which can again be transformed into toroidal gravitational waves. Mutual transformations of waves occur at the quantized frequencies of parametric resonances in the medium of a physical vacuum.

All perturbations of matter occur in accordance with the extreme principle of least action and lead to the formation of waves on a common grid of resonant frequencies in the medium of the physical vacuum (16) (17) (18). Parametric resonance forms a lot of toroidal gravitational waves on the harmonics and subharmonics of the main resonances. However, the most significant are the first second and third harmonics and subharmonics. In addition, the first and second harmonics and subharmonics of toroidal gravitational waves form structures in the form of baryons . They do not have a strong resonant connection, but there is a weak parametric connection between the elements, which causes the stability of baryons, in comparison with bosons.

The fundamental property of toroidal gravitational waves is the formation of a lot of secondary toroidal gravitational waves of de Broglie (16) (17) (18), including the wavelength with a wavelength commensurate with the dimensions of the solar system. This entire complex of de Broglie waves forms the mass of each object and the corresponding emission spectrum of electromagnetic waves. These relationships allow us to identify the majority of resonant frequencies in the spectra [9] and significantly expand the possibilities of spectral analysis for practical purposes. We know the lines of spectra of specific atoms, the photons of which are formed from specific toroidal gravitational waves. Therefore, instead of the wavelength of the electron, we can substitute the wave length of the spectral line of the atom into formulas (16) (17) (18) and obtain all grids [9] of characteristic resonant frequencies in all ranges, up to fractions of Hz. By identifying the spectral lines in different wave ranges, we can more accurately determine the presence of specific atoms and molecules on exoplanets or on the Earth's surface, for example, from a satellite.

## Conclusion

Thus, "fundamental" implies the absence in nature of ideal properties of matter and abstract concepts, and also requires a rethinking of the physical essence of phenomenological constants.

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## The technical endnotes

<sup>1</sup> «The dominant [component of EMR in space](#) is cosmic microwave background (CMB) with color temperature  $T=2.72548(57)$  K».

<sup>2</sup> «HETG: [Chandra](#) High Energy Transmission Grating. ... The HETGS provides high resolution spectra (with  $E/\Delta E$  up to 1000) between 0.4 keV and 10.0 keV for point and slightly extended (few arcsec) sources».

<sup>3</sup> «Peak pile-up shown to occur near 2.9 Angstroms». «Pile-up is a concern for point sources viewed with the [Chandra CCDs](#)».

<sup>4</sup> «The German *ROSAT Observatory* was launched in 1990». «Once it became clear that the [CXB](#) is largely due to distant point sources, we still needed to verify that the responsible source populations have the right spectral characteristics to synthesize the integrated [background spectrum](#)».

<sup>5</sup> «My Question is, why exactly does the intensity vanish [below 240 nm?](#)».

<sup>6</sup> «*The expected intensity of infrared emission versus wavelength at various radial distances from the Sun. The cosmic [infrared background](#) was measured at 3 and >100 microns by the COBE satellite, but measurements from 5 to 100 microns were obscured by the zodiacal light*».

<sup>7</sup> «[Zodiacal light intensity](#) as a function of the radial distance from the Sun, based on the Pioneer 10 dust density estimates [112] normalized to a radial profile from the Sun of  $r^{-1.5}$ . For reference, we also show the optical to near-IR spectrum of the Galactic interstellar medium (ISM)».

<sup>8</sup> «Spectrogram measured by the WIND spacecraft on April 08 2003. This [spectrogram](#) represents, as a function of time, the radio power spectral density in the frequency range between 16 to 256 kHz. One can clearly see the plasma peak varying on that day between roughly 25 and 90 kHz».

<sup>9</sup> There is a background with a maximum at a frequency of 76 kHz and 1.74 kHz. «The two bottom colored lines refer to [the electrical-domain intensity noise](#) of the Faraday laser lasing on *Rb* 1529 nm transition (red curve) and signal source analyzer (pink curve). The six upper colored lines refer to measured relative intensity noise of the Faraday laser with different optical power».

<sup>10</sup> There is a background with a maximum at a frequency of 76 kHz and 1.74 kHz. «TopWave 266 nm Industrial cw UV Lasers: [Relative intensity noise](#) (RIN)».

<sup>11</sup> There is a background with a maximum at a frequency of 39.9 Hz. «Measured transmission amplitudes from Stanford's single-stage active isolation platform».

<sup>12</sup> There is a background with a maximum at a frequency of 39.9 Hz. «[Phase noise spectrum of the photonically generated 10 GHz Q5](#) microwaves and contributing noise sources».

<sup>13</sup> There is a background with a maximum at a frequency of 0.915 Hz ([Seismic noise](#)).

<sup>14</sup> There is a [background with a maximum at a frequency](#) of 1.74 kHz, 39.9 Hz, 0.915 Hz and 21 MHz. «Free-running relative intensity noise spectrum of various single-frequency lasers».

<sup>15</sup> The toroidal formation around the Earth is by toroidal gravitational waves in which there is an acceleration of elementary particles. [Van Allen Probes](#): Radiation Belt Storm Probe (RBSP) «Two giant donuts of charged particles called the Van Allen Belts surround Earth. (Credit: NASA/T. Benesch, J. Carns) ».

<sup>16</sup> The [granulation of the photosphere diameter of 20-30 thousand km](#) relatively quiet Sun».

<sup>17</sup> Coronal loops on the Sun are coming out of one dark spots and go into other dark spots.

<sup>18</sup> «*Left*: Example of the time-domain method to [remove noise](#) from the earthquake-free vertical data».

<sup>19</sup> Comparison of the spectra of the gravitational waves of the [Virgo interferometer](#) and the spectrum of acoustic vibrations of the [Argentine stilpene](#).

<sup>20</sup> Comparison of the spectra of [gravitational](#) and [electromagnetic natural radiation](#).

<sup>21</sup> «[From Voyager's great distance Earth](#) is a mere point of light, less than the size of a picture element even in the narrow-angle camera. Earth was a crescent only *0.12 pixel* in size.

Coincidentally, Earth lies right in the center of one of the scattered light rays resulting from taking the image so close to the sun. This blown-up image of the Earth was taken through three color filters -- violet, blue and green -- and recombined to produce the color image. The background features in the image are artifacts resulting from the magnification».

<sup>22</sup> «In the [HAARP project](#), when the shock outrage is introduced in the auroral zone of electrojet cycles around the path of the electrojet *2.5 times (2.5 Hz)* to *3 times (3 Hz)* a second until it dissipates. The apparent resonant frequency of the electrojet is determined by its circumference».

<sup>23</sup> October 15, 2007 + [View Video](#) «[The moon Prometheus slowly collides](#) with the diffuse inner edge of Saturn's F ring in this movie sequence of Cassini images. The oblong moon pulls a streamer of material from the ring and leaves behind a dark channel».