

SOME WORDS ABOUT FUNDAMENTAL PROBLEMS OF PHYSICS

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PREFACE

After writing analytical notes on constructive analysis of the fundamental problems of physics, and their posting on the website, the idea appeared to publish them together without processing as they are, in a single book. Such a publication is reasonable and makes sense. The selected notes are written in the same style; they have a common goal reflected in the same their main title. A single view on the general causes of the problems and their solution method unites them. These notes are devoted to the fundamental problems of modern physics with which it cannot cope so far, as well as to the unsubstantiated wrong "solutions" of problems considered to be completed to date in the framework of dominant theories of the Standard Model (SM). As a result of the constructive analysis, for all, without exception, the cases analysed in the notes, radical ways out of this impasse are indicated, and, as examples, concrete solutions are presented.

The fact is that the modern theories of the SM, being abstract-mathematical, are not adequate to physical reality, are virtual, and therefore, erroneous and uncorrectable. They must be completely replaced by physical theories, reflecting the reality. In particular, as an alternative to abstract-mathematical theories of the SM the author proposes the physical theories developed in the framework of the Wave Model (WM), namely, the wave Dynamic Model (DM) of elementary particles and the Shell-Wave Model (SWM) of the atom. The unique solutions and discoveries were obtained in the WM for a relatively short period. A resulting comparative analysis of the theories of two fundamentally different models, the SM and WM, shows extreme efficiency and great potential of the WM and opens up prospects for accepting it by the physical community and the development it in the future. As concerns the theories of the SM, as useless, they very soon will have only of historical value.

The book contains 10 notes, which affect the most basic areas of physics such as: atomic physics, nuclear physics, elementary particle physics, quantum mechanics, quantum chemistry, quantum electrodynamics, quantum chromodynamics, gravitation, cosmology and astrophysics. At the end of the book, in conclusion, a comparative table is presented. From the latter it is clearly seen the principal difference between the two opposed models: the proposed Wave Model and the "modern" Standard Model. The thoughtful reader, penetrating into the essence of the book and familiarized with all the arguments, can sure in the validity of the author's main conclusion on the urgent need for a qualitative change in the methodology of research in theoretical physics. The replacement of the old paradigm in physics, discredited itself, with the new one, in particular, for example, accepted and used by the author of this book at solving by him the fundamental problems of physics, is only a matter of time.

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Part 1

Electron “orbitals”

Although it now goes the second decade of the 21st century but the crisis, in which physics has turned out in the late 19th and early 20th centuries, has not been resolved; and at the turn of 20 - 21 centuries even deepened. A natural question arises: why? The truth of the matter is that, in fact, all efforts of physicists were focused not on cognition of the nature of experimentally detected phenomena, but (in a hurry) on the construction of various abstract theories, the development of abstract mathematical models to describe these phenomena (as a bright example is the Lamb shift), on the accurate adjustment of theoretical results following from these theories and models to experimental data, on the artifice of properties and “fundamental” parameters that do not exist in nature, etc. As a result, it was developed a virtual physics (answering the question: **how?** but does not answer the question: **why?**) where common sense and logic are almost completely absent. Accordingly, there is every reason to state that modern physics is a figment of the individual's imagination, based mostly on schizophrenic logic.

Here I want to draw attention to just one from many other problems unsolvable in the framework of the aforementioned erroneous approach (and, naturally, unsolved therefore): a problem of atomic structure. What are atoms made of, and how? The solution of the latter was and still remains one of the major problems of mankind. Understanding the true structure of matter at micro and macro scales characterizes the level of development of our civilization. In the light of this, a modern picture is, frankly, not cheerful.

It is believed that quantum mechanics (QM) and its successor, quantum electrodynamics (QED), have solved the problem of atomic structure and the problem of the interaction of radiation with matter, but this is misleading. QM (and, therefore, QED) is based on abstract, invented postulates, one of which is the postulate of the so-called Schrödinger equation. The original Schrödinger equation was further developed and, finally, subjected to various modifications (including those that led to the Dirac equation) it became the basis of quantum electrodynamics. An in-depth analysis of the basis of the Schrödinger equation has revealed its logical inconsistency, the complete absence of any common sense, and a number of obvious errors and frauds, coming out of the ordinary. Accordingly, it becomes unclear how such a theory at all could come to light, and it is very strange, how it may flourish until now [1-3]? Whether is so blindly all community of physicists?

Schrödinger equation is absurd in itself, in principle. First, in reality, it does not have the "solutions" which it is credited, and in no way, this equation cannot be treated as wave. What has been called "solutions" is wishful thinking. Outwardly, the initial Schrodinger

equation differs from the classical wave equation only by the wavenumber (the magnitude of the wave vector), but this fundamental distinction has left its imprint on the "solution" of its radial component (in fact, lack of the solution) [1]. Thus, by their form, Schrödinger's and classical wave equations do look like twins, especially because the polar-azimuthal components of both equations and their solutions are the same. However, interpreting of the same polar-azimuthal solutions in both cases differs in principle. But on this circumstance I want to draw special attention.

The wavenumber in the physics of wave processes and, consequently, in wave equations, is the quantity inversely proportional to the wavelength, $k = 2\pi/\lambda$, or directly proportional to frequency, $k = \omega/c$, i.e. it has a strictly defined meaning. In the Schrödinger equation, instead of the wavenumber, there introduced the kinetic energy of an electron in the nucleus of an atom, E , i.e. the wavenumber is a function of distance of the electron from the atomic nucleus, $k = f(r)$:

$$\Delta\hat{\Psi} + k^2\hat{\Psi} = 0 \text{ - Wave equation,} \quad \Delta\hat{\Psi} + f(r)^2\hat{\Psi} = 0 \text{ - Schrödinger's equation}$$

That's the whole difference. But the effect of such a substitution has turned out to be extremely destructive. The wave equation was deprived of any physical meaning after aforementioned Schrödinger's replacement. It is no longer wave in the full sense of the word, although the polar-azimuthal component of the wave equation and its solutions are not changed at the substitution.

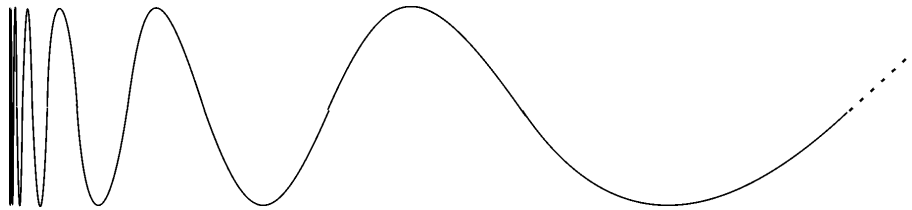
Thus, the main "achievement" of Schrödinger consists in the fact that he picked up and replaced, in the ordinary universal wave equation, the wavenumber with a variable that depends on the distance r in the vicinity of the nucleus inside the atom, because

$$f(r)^2 = \frac{2m}{\hbar^2} \left(W + \frac{e^2}{4\pi\epsilon_0} \frac{1}{r} \right), \quad \text{where} \quad W + \frac{e^2}{4\pi\epsilon_0} \frac{1}{r} = E$$

Let me remind, the wave motion is a **collective** process of transfer of excitation in the space from one particle to another by chain, and this process is completely independent of what is happening inside each individual particle. Schrödinger unfoundedly combined two unrelated processes (phenomena) in one equation. He has distorted thus the wave equation that, naturally, made impossible to get the radial solution without, as it turned out, forced manipulations. Since then the mutilated wave equation, named the Schrödinger equation, became regarded as a basic postulate of quantum mechanics - a new scientific branch which emerged in result in physics. According to the next postulate (from other ones on which the QM is based), any dynamic physical quantity is associated with a linear self-adjoint operator. Thus, there were introduced quantum-mechanical operators, and the Schrödinger equation itself became presented in the operator form, etc. However, a complete introduction of abstract mathematics for presentation of the theoretical concepts in the QM did not affect

the main result of its "solutions" manifested in the appearance of so-called "atomic orbitals", about which I'll talk further. These "solutions" have turned out to be crucial for accepting the quantum mechanical model of the atom.

Think of the absurdity the replacement by Schrodinger the wavenumber with the function. An introduction of the frequency-dependent function, $f(r) = k(r) = 2\pi/\lambda(r)$ (the specific form of the presented above function is taken from [2], see Eq. 3.4), means that the wavelength increases continuously, and its frequency, respectively, decreases from point to point as the wave propagates in intra-atomic space moving away from the atomic nucleus. Period (but not the amplitude) of oscillations varies in a wave so rapidly that even at distance from the nucleus equal to the diameter of the n -th Bohr orbit the wavelength, increasing, achieves infinity (and the frequency comes to zero); i.e. the wave process subsides completely - no oscillations anymore.



However, similar wave processes where a sharp damping is not associated with a decrease in amplitude, but is caused by the continuous change of the oscillation period in the same wave, do not exist. In nature, there are only relatively minor changes in the wavelength (frequency) of a wave beam as it propagates over macroscopic distances. This phenomenon is known due to effects such as the Doppler shift, the cosmological redshift, and etc.

Secondly, the following fundamental error when creating the QM has been and still remains. It is the identification of spherical harmonics, the polar-azimuth functions - solutions of the stationary wave equation (its polar-azimuthal component), with the so-called "electron orbitals" ("clouds"). Such identification is unfounded due to ignorance of the real meaning of these mathematical functions. In fact, spherical functions (harmonics) of the solutions of the wave equation (still regarded by physicists as "real" and "imaginary", being actually both real) indicate the angular (polar-azimuthal) coordinates of nodes and, respectively, the coordinates of antinodes in a standing wave formed in three-dimensional spherical space-field due to interference (superposition) of waves. To understand it physicists must simply look closely guides for math and insight into the meaning of the ready-made solutions of the wave equation, which were well known in Schrodinger's times too. Thus, polar-azimuth functions (spherical harmonics) do have no relation to mystic „electron clouds“. The latter were arbitrarily ascribed to the aforementioned wave formations, spherical harmonics.

In the light of clarifying the nature of the polar-azimuth functions, as absurd it looks the following so-called "hybridization" of the obtained "atomic orbitals": the mathematical

mixing of "real" and "imaginary" components of polar-azimuth functions, i.e. in fact, a mixture of angular coordinates of nodes with angular coordinates of antinodes of standing waves. Hybrid polar-azimuth functions obtained by this way, "atomic and hybrid atomic orbitals" ($s, p_x, p_y, p_z, d_{xy}, d_{x^2-y^2}, d_{xz}, d_{yz}, d_{z^2}, \dots$), were called "**electron configuration of atoms**". But a purely mathematical mixing has no physical meaning. We cannot just pick up and mix anything that is not miscible physically, in principle, by their very nature. For example, it is absurd to imagine a mixing of two energies, potential and kinetic, or two fields, electric and magnetic. Do we get unknown to us new energy and a new field as a result of this mixing? The absurdity of this question is obvious.

We see that instead of studying nature, physicists, using quantum mechanics and quantum electrodynamics, have actually built a non-existent illusory world. But for all that, what about the main goal of physics - cognition of nature?

We can develop this theme further by continuing the list of other absurdities, upon which it rests quantum mechanics (and, accordingly, quantum chemistry). But in order to not overwork the reader, for a beginning, the data presented is quite sufficient and appropriate. Details can be found in the cited literature [1-3] and other articles cited there. Having read these works, the meticulous reader will be convinced in the veracity of conclusions about the impasse to that have landed themselves a modern physics and chemistry, where quantum mechanics, recognized as one of the greatest discoveries of the last century, plays the main role. He also will find there the concrete solutions proposed to exit from the dead end.

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Part 2

Electron “spin”

A very gross error was made by theorists to explain the experimental results obtained by Einstein and de Haas in their measurements of magnetomechanical (gyromagnetic) ratio [1]. From the resulting data it follows that the ratio of the magnetic moment $\mu_{e,\text{exp}}$ of an electron, moving along the Bohr orbit (they relied on the Bohr model of an atom), to its mechanical moment $\hbar = m_e v_0 r_0$ is equal to

$$\frac{\mu_{e,\text{exp}}}{\hbar} = -\frac{e}{m_e c} . \quad (1)$$

This result exceeded twice the expected value, which followed from the calculations made by theorists:

$$\frac{\mu_{e,\text{theor}}}{\hbar} = -\frac{e}{2m_e c} \quad (2)$$

(minus sign indicates that the direction of the moments are opposite).

Clearly in this situation it would be prudent to carefully check the validity of the relevant basic formulas used in the derivation of the theoretical ratio (2). By definition, that modern physics holds still, the calculation of the orbital magnetic moment of an electron in an atom is realized by a simple formula, which determines the magnetic moment of a closed circular loop of electric current,

$$\mu_{orb} = \frac{I}{c} S , \quad (3)$$

where I is an average value of circular current, S is the area of the circuit (orbit), c is the speed of light.

In accordance with the definition of electric current used in electrical engineering, considered as a flow of electric charge ("electron fluid") in a conductor, the calculation of the average value of electric current generated by the orbiting electron was carried out (as proven to be here, poorly thought-out and wrong) by the following formula

$$I = \frac{e}{T_{orb}} , \quad (4)$$

where T_{orb} is the period of electron revolution along the orbit, e is the electron charge. Hence,

$$\mu_{orb,theor} = \frac{I}{c} S = \frac{e}{cT_{orb}} S = \frac{ev_0}{c2\pi r_0} \pi r_0^2 = \frac{v_0}{2c} er_0, \quad (5)$$

that led to the ratio (2) of the moments twice less than the experimentally obtained value (1). It is obvious, one needed to find the error. However, for some reason no one did not put the question, is formula (4) valid or not? This circumstance first had to draw the attention of theorists. The matter is that we are not dealing with a current of "electron fluid" (or "electron gas"), but with a current generated by a single electron charge, moreover, while moving along a closed circuit.

We filled the gap in this matter by revealing shortcomings and finding an answer to the question posed above. Here are our arguments.

1. Let us consider what the average value of current in fact is created by a single (discrete) charge moving along a closed path.

In a general case, the charge transfer of the electron, e , through any cross-section S along any path during the time T is accompanied with disappearance of the charge from one side ($-e$, point A) and appearance on the other side ($+e$, point B) of an arbitrary cross-section, as shown in Fig. 1.

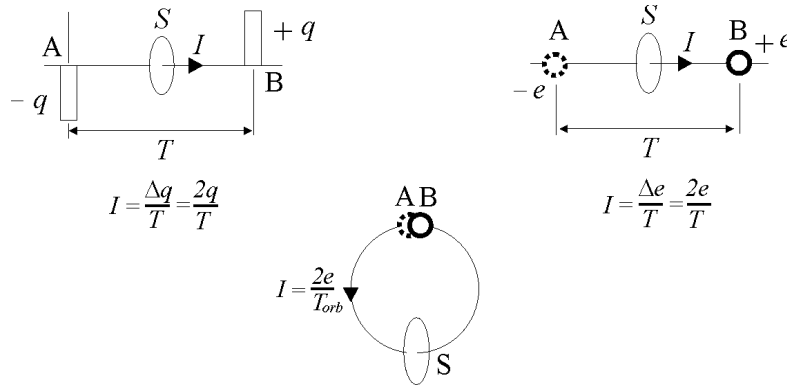


Fig. 1. The charge transfer of the electron, e , through any cross-section S of a conductor.

Let me explain once again. During a period of time T : disappearance of the charge from the left side means REDUCTION of the charge at this side from the value of $+e$ down to 0, i.e. the reduction on the amount of charge $-e$. And appearance of the charge on the right side of the cross-section means GAIN of the charge at this side from the value of 0 up to $+e$, i.e. the gain on the amount of charge $+e$. Thus, during the time T , the complete charge change is $\Delta e = +e - (-e) = 2e$. Hence, an average rate of the charge change (current I) during the time T is

$$I = \frac{\Delta e}{T} = \frac{(+e - (-e))}{T} = \frac{2e}{T} \quad (6)$$

And in the case of a circular orbit, when points A and B coincide, the electron, bearing the charge e , passes through the cross-section S with an average speed

$$I = \frac{2e}{T_{orb}} , \quad (7)$$

where T_{orb} is the period of electron's revolution on a circular orbit.

Additionally, let us come to the derivation (7) by the traditional way, without disturbing the existing logic in the accepted concept of determining the average current. To do this, for more clarity, we deform the orbit compressing it, as shown in Fig. 2. As a result, we obtain something like a closed two-wire line.

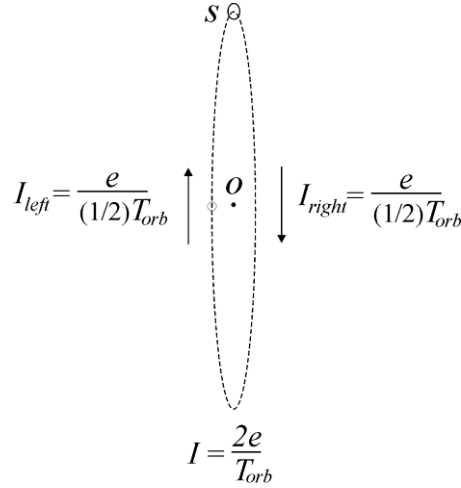


Fig. 2. An average current in a closed two-wire line.

How many times do you think, one orbital electron moving along the closed loop (i.e., during one complete revolution, T_{orb}) and passing in the vicinity of the point "O", first up (the average current in the left half of the trajectory is $I_{left} = e / ((1/2)T_{orb})$) and then down (the average current on the right half of the trajectory is $I_{right} = e / ((1/2)T_{orb})$), creates a transverse (vortical) magnetic field at that point?

As they say "no brainer" that two times: at first moving on the left side and then moving on the right side of the loop near the centre "O". It's like as 2 charges slipped... I wonder, is it? In this case the usual formula obtained from the definition of the average current adopted in physics ($I = q/T$) is not violated. The average value of current on both sides and, therefore, around a whole closed two-wire line is the same and equal to

$$I = I_{left} = I_{right} = 2e / T_{orb}$$

2. Since the electron just like any other elementary particle manifests duality, i.e. exhibit the behaviours of both waves and particles, it is reasonable and necessary without any doubts to derive the formula of the average current for the case of the wave motion of the electron.

a) Let's begin with the one-dimensional problem. From the well-known solution of the wave equation for the string of a length l , fixed at both ends, it follows that only one half-wave of

the fundamental tone is placed at its full length, $l = \frac{\lambda_1}{2}$. If we join the ends of the string together, then we obtain a circle of the length $l = 2\pi r_0$ with one node. As a result, we come to the equality

$$2\pi r_0 = \frac{\lambda_1}{2} = \frac{v_0 T_0}{2}, \quad (8)$$

where v_0 is the wave speed in the string, T_0 is the wave period.

6) In the simplest case of three-dimensional solutions of the wave equation for a spherical field [1], we arrive at the same equation (8): only one half-wave of the fundamental tone is placed on the Bohr orbit, and the electron is in a node of the wave.

Thus (according to (8)), the wave period of the fundamental tone at the wave surface of the radius r_0 is equal to

$$T_0 = \frac{4\pi r_0}{v_0}. \quad (9)$$

An average value of electric current as the harmonic magnitude is determined by the known formulas:

$$I = \frac{2}{iT} \int_0^{T/2} I_m e^{i\omega t} dt = \frac{2}{\pi} I_m \quad \text{or} \quad I = \frac{1}{2\pi i} \int_0^{2\pi} I_m e^{i\varphi/2} d\varphi = \frac{2}{\pi} I_m \quad (10)$$

In the expression (10), the amplitude I_m of the elementary current is

$$I_m = \left(\frac{dq}{dt} \right)_m = \omega_0 e = \frac{2\pi e}{T_0}, \quad (11)$$

where ω_0 is the angular frequency of the fundamental tone of the electron orbit. Thus, substituting (11) into (10), we obtain

$$I = \frac{4e}{T_0}. \quad (12)$$

or, as $T_0 = 2T_{orb}$,

$$I = \frac{2e}{T_{orb}}. \quad (13)$$

Other options to derive an average value of current generated by an individual electron moving in a circular orbit are presented in [1]. They all give the same magnitude defined by the formula (13), but not by (4). The definition of electric current and the relevant problem of electron spin are analyzed in detail in the fundamental book "Atomic Structure of Matter-Space" (2001) [2]. It's quite comprehensive book in which all the questions that just might be are analysed, and their solutions are presented. In particular, a small fragment of the book,

namely paragraphs 9 and 10 of Chapter 9 (from 453 to 494 pages), which examines the concept of current, is available online on the internet in PDF format [3].

Thus, a problem of the average current was solved by the authors of [2], an error in (4) was corrected. The resulting formula for the circular current (13) differs by the multiplier 2 from the erroneous formula (4). Unfortunately, the latter is still remained in physics for the explanation of the Einstein-de Haas measurement data and other phenomena...

Substituting the average value of current (13) into (3), we arrive at the correct formula for the orbital magnetic moment of an electron (logically, physically and mathematically conditioned), which at anybody can no longer call doubts.

$$\mu_{orb} = \frac{I}{c} S = \frac{2e}{cT_{orb}} \pi r_0^2 = \frac{v_0}{c} e r_0. \quad (14)$$

Accordingly, the ratio of the orbital magnetic moment (14) to its mechanical moment (the moment of its orbital momentum, $\hbar = m_e v_0 r_0$), taking into account the sign (the opposite direction of moments), is equal to

$$\frac{\mu_{orb}}{\hbar} = -\frac{v_0 e r_0}{c m_e v_0 r_0} = -\frac{e}{m_e c}. \quad (15)$$

The resulting ratio of the moments, the theoretical derivation of which was given above, coincides with the ratio of the moments (the gyromagnetic ratio) (1) obtained in Einstein-de Haas and Barnett experiments.

CONCLUSION

The true absolute value of the intrinsic magnetic moment of an electron bound in an atom (that have not been considered here) is negligible compared to the relatively huge value ascribed to it at half the orbital magnetic moment (and called the Bohr magneton). What is its precise value and how it was calculated one can find in [4].

We have shown here, hope it was made clear and convincingly enough, that if 100% trust the experimental results, theorists should be first to find an obvious mistake in the formula used by them for the calculation of electric current generated by an individual electron moving on the Bohr orbit, but did not engage in fantasy. The strength of electric current I is the only variable physical quantity (calculated according to its definition) that determines the magnitude of the magnetic moment at constant values of c and S (see Eq. (3)).

In the mathematical formulation of the definition of electric current accepted in physics for the particular case, which is the motion of a single charge along a closed path, one had to be careful and think (for good reason there is a saying: "look before you leap, cut once"). It is an elementary logical task, cope with it and school children and students, but it has never been

put forward for consideration, although this task is fundamentally important and, moreover, good for the development of logical thinking of physicists.

It seems simple, "as the rake", but for some reason, the problem under consideration was not resolved by theorists at that time. Apparently, so necessary revision was not taken into account because of their firm belief in validity and universality of the formula (4). Therefore, to get out of the situation with which they were faced owing to the result (2), theorists preferred to follow the trodden path of their predecessors and put forward the postulate about the allegedly existing in reality an intrinsic mechanical moment of the electron, which was called then an electron spin. Namely to find the missing half in the calculations, resulted in the ratio (2), to fit the latter to the experimental ratio (1), they groundlessly **ascribed** to the electron, in addition to its real fundamental (intrinsic) properties, such as mass and charge, a virtual (mythical) and, therefore, an unreal "fundamental characteristic" property, **spin**. As a consequence, it appeared at once the mythical **electron spin magnetic moment** associated (conjugated) with the mythical spin, the absolute value of which was called the **Bohr magneton**, μ_B :

$$\mu_{spin} \equiv \mu_B = \mu_{orb,theor} = \frac{v_0}{2c} er_0 \quad (16)$$

With the help of a mythical spin magnetic moment, theoreticians "closed the gap" in their calculations of the gyromagnetic ratio (2). Thus, the "lost" (in their calculations) half of the orbital magnetic moment of the electron, bound in an atom, was called by theorists the electron spin magnetic moment. Then this "lost" orbital half (under the name of spin magnetic moment or the Bohr magneton) was fastened to the half of the orbital magnetic moment (5) that they received theoretically:

$$\mu_{e,theor} = \mu_{orb,theor} + \mu_{spin} = \frac{v_0}{2c} er_0 + \frac{v_0}{2c} er_0 = \frac{v_0}{c} er_0 \quad (17)$$

Put together the two halves, actually, of the same orbital magnetic moment, have been named the **total magnetic moment** of an electron in an atom, $\mu_{e,theor}$. As a result of such an obvious and explicit fitting, the complete coincidence with the experimentally obtained gyromagnetic ratio (1) was achieved:

$$\frac{\mu_{e,theor}}{\hbar} = \frac{\mu_{orb,theor} + \mu_{spin}}{\hbar} = \frac{\mu_{e,exp}}{\hbar} = -\frac{e}{m_e c} \quad (18)$$

It was an epoch-making error; it marked the beginning of the present spinmania in physics, which continues to this day. Unfortunately, if to say honest, in result of such an explicit blunder, physics has taken the wrong way. At the present time, modern physics cannot exist without the notion of spin. Apparently, to someone, it was truly necessary to discard the humanity in his cognition of nature to centuries ago, directing physics in a wrong direction to create a virtual reality: driving physics in a dead end, to hinder the development of our

civilization. Consciously or not, but in this kind of virtual (absurd) creations of the 20th century, many eminent theoretical physicists of that time took part...

As was noted, the relatively enormous absolute value of $\hbar/2$ was attributed to electron spin that is comparable with the value of electron's angular orbital moment. With this, it is believed that an existence of the intrinsic mechanical moment, spin, of the electron of such a magnitude was confirmed experimentally. However, where is the direct evidence? Where are experiments to determine the spin **on free electrons**, but not on the electrons which bound to atoms? They are not.

Thus, we see that explaining a series of phenomena observed experimentally, physicists, using the mythical (fabricated, postulated) concepts such as the electron spin, considered here, or like virtual particles of quantum electrodynamics (that will be discussed further in Part 3), draw a distorted picture of reality. In fact, they create virtual, mythical world (science fiction).

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Part 3

Virtual particles

In previous two Parts of short analytical articles I have shown that modern concepts of atomic physics, based on made-up postulates which do not reflect reality, are erroneous. Inadmissibility of using such postulates as the basis for construction of physical theories was convincingly brought to light there. In this (3rd) Part of the articles I touch quantum electrodynamics (QED). Unfortunately, fundamental concepts of QED are also mystic postulates. By this reason, at once one can say, with the full responsibility, that the QED theory is erroneous as well. Nevertheless, oddly enough, QED is still the basic theory of modern physics. Thus, just like quantum mechanics, whose concepts were analysed in Parts 1 and 2, the theory of QED is based on a series of fictional postulates. The central place of them takes the postulate on existence of the so-called virtual particles.

Theorists have introduced such a mystic notion for explaining insignificant, but observable disturbances of electron's motion in the hydrogen, deuterium, and hydrogen-like atoms that become apparent in the characteristic fine-structure of lines found in their optical spectra. The disturbances are manifested in a relative shift (de-degeneracy, "splitting"), called the Lamb shift, of $2S_{1/2}$ and $2P_{1/2}$ quantum levels, where the aforementioned p -state is turned out below the s -state, and also in anomalous magnetic moment of the electron.

Having found these phenomena, the theorists were faced with the deviation from a theory existing to that time, in which the electron g -factor equal to 2 was used. Not analysing thoroughly enough all possible real causes, in order to explain the found phenomena (the Lamb shift and the anomalous magnetic moment of the electron), they began creating a new theory based on mystic notions. Since then, for more than 60 years, with the gradual improvement and increasing accuracy in theoretical derivation of magnitudes for both phenomena, on the basis of the aforementioned erroneous postulates, the modern theory of QED was established and fully developed. What opportunities were missed (ignored) herewith, and which results were reached in QED? We proceed to discuss these questions.

Let us think and ask ourselves. Which influences in principle can be responsible for perturbations of orbital electron motion in the hydrogen atom, and wherewith they are conditioned? Obviously, we should consider and analyze first of all two very obvious possible areas of their origin, internal (inherent) and external. Here they are.

Firstly, an influence of natural processes conditioned by intraatomic dynamics of constituent particles (proton and electron) must be studied. Of course, inherent causes can be regarded as real if only we will consider the proton as a dynamic, elastic, and mobile micro formation being in a continuous state of motion, but not like a rigid static microobject in the form of a

tiny solid nucleus of the hydrogen atom with an enormous density of about $4 \times 10^{14} \text{ g/cm}^3$ (as is believed in modern physics). The same assumption must concern the electrons also, which are still regarded in modern theoretical physics as point-like particles. The supposed intraatomic dynamic processes, if really exist, about that we have no doubt, must be reflected in peculiarity of binding between the constituent particles and, naturally, in electron motion.

Secondly, one should estimate the possibility of influence on electron's orbital motion the environment, including a field of the physical vacuum.

As we see, judging by the course of the development of physical ideas, the first option (intraatomic inherent processes) was not discussed, generally, by theorists. The current model of the atom was not questioned, and no intentions to revise it were arisen, even though the experimentally obtained data clearly showed an inadequacy of the existing model. The hydrogen atom was considered (and is still considered so) as a tightly coupled centrally symmetric system consisting of a stationary proton (nucleus) surrounded by an electron moving within atomic "orbitals" (see Part 1) in obedience to the probabilistic laws of quantum mechanics (or moving along the closed trajectory, an orbit, if we rely on the Bohr model of atoms).

1. Therefore, theorists have focused only on the second of the indicated above options – on a probable external influence from environmental space. And, following the well-trodden path of their predecessors, they have begun to invent by offering abstract postulates (mystic scenarios). According to the hypothesis, adopted with the course of time as basic for a quantum field theory, the interaction of particles and their mutual transformations are realised through the virtual particles generated and absorbed by free particles. It means that any particle continuously emits and absorbs virtual particles of various types. In particular, an electron, bound in the atom, emits and absorbs virtual photons that lead to a change the effective electron mass and an appearance of electron's anomalous magnetic moment. The shift of the aforementioned s-and p-levels is regarded as the effect of interaction between an electron moving along its orbit and virtual particles swarming in the surrounding vacuum.

The process of appearance and disappearance of particles from the vacuum lasts an arbitrarily short time, so that in principle it is not possible to detect these particles by any detector, hence the name - virtual (imaginary, fictitious, ..., in short, unreal) particles. Thus, due to fluctuations of the zero-field of the vacuum caused by continuous generating and absorbing virtual particles, the orbital motion of an electron in an atom is subject to the additional random motion. As a result, according to QED, the main contribution to the Lamb shift, caused by the influence of virtual particles, give the following effects:

1. A change (renormalization) of effective electron mass and charge.
2. Anomalous magnetic moment of the electron.
3. Continuous creating out of the vacuum of virtual short-lived electron–positron pairs and their speedy annihilation (the so-called effect of vacuum polarization).

On the basis of accepted postulates, an elementary mathematical fitting of the theoretical values of electron's anomalous magnetic moment and the Lamb shift to their experimentally obtained values has begun. It continues to this day, with progress in experimental technique and getting more and more accurate numerical data for these quantities. Thus it appeared and fully developed the theory of QED. To what it has come? Let us analyse taking as a particular case the derivation of anomalous magnetic moment of an electron.

The anomalous magnetic moment of the electron is usually expressed for convenience by the so-called anomaly:

$$\alpha_e = \frac{g_e - 2}{2}, \quad (1)$$

where g_e is the electron g -factor (in a semiclassical theory $g = 2$, see Part 2).

How far have advanced the theory of QED, and to what extent of absurdity has reached up the mathematical fitting to the experiment herewith, one can judge by an extremely complex and cumbersome resulting formula for the anomaly (1) derived in the framework of the QED theory. In the completely unfolded form, it is not possible to put this formula, even in a hundred pages of the text, because of the extremely cumbersome mathematical expressions for the coefficients in each of the members of the formula, presented in the form of an expansion in powers of the fine structure constant α . Therefore, only a compact form of the really enormous theoretical formula for the anomaly, $\alpha_e(th)$, without mathematical expressions for the coefficients of the expansion in the formula, but with already calculated (to 2003) numerical values for all them, is demonstrated here:

$$\begin{aligned} \alpha_e(th) = & 0.5 \left(\frac{\alpha}{\pi} \right) - 0.3284789655 \ 79 \dots \left(\frac{\alpha}{\pi} \right)^2 + 1.181241456 \dots \left(\frac{\alpha}{\pi} \right)^3 - \\ & - 1.5098(384) \left(\frac{\alpha}{\pi} \right)^4 + 4.382(19) \times 10^{-12} = 0.0011596521 \ 535(12) \end{aligned} \quad (2)$$

Thus, $\mu_e \neq \mu_B$, because $g_e > g$, or owing to an appearance of «anomaly» α_e (1); namely

$$\mu_e = (1 + \alpha_e) \mu_B \quad (3)$$

Compare with the formula (16) of Part 2, where $\mu_e = \mu_B$.

As I have mentioned already, the expression (2) in a completely unfolded form is extremely complex and cumbersome. Actually, for example, the coefficient 1.5098(384) of the forth

term, at $\left(\frac{\alpha}{\pi} \right)^4$, in the expression (2) (obtained with a big uncertainty in the last three signs, ± 384), is the result of calculation of more than 100 huge 10-dimensional integrals. Therefore, because of the complicated mathematical structure of the coefficients of the terms, a special system of massively-parallel computers of high efficiency (actually, supercomputers) was developed for this purpose. In fact, we are witnessing the skilfully mathematical fitting, which have reached the highest degree of perfection for more than 60

years since the first works of 1947 by H. A. Bethe and T. A. Welton, thanks to strenuous efforts of many experienced theorists from around the world and developing computing means. Incidentally, the last small term in (2) takes into account the contribution of quantum chromodynamics....

You see that theoreticians build, actually, something like the “Tower of Babylon”. Why such an analogy? The reason for this comparison follows from all that was described above. And I will try to confirm the validity of the analogy additionally by showing how simply the problem is solved if we will rely on the common sense and logic.



2. Let us come down from this "tower" to the ground. Consider the first of the aforementioned options (intraatomic inherent processes) most likely responsible for perturbations of orbital motion of an electron in the hydrogen atom, from our point of view. These verisimilar causes by nobody were taken into account heretofore and, hence, never discussed. Obviously, in order to take this option it was necessary primarily to reconsider an internal structure of individual atoms, to answer the natural question, is the atomic model accepted in contemporary physics adequate to reality, whether or not?

If we assume that the source of disturbances to the moving electron, being in an atom in a not excited (isolated from external influences) state, are inherent in the atom its own intra-atomic processes, we must recognize that the atom is the dynamic system vibrating as all in the Universe, rather than a hard static microformation. Hence, the need arises to revise the officially accepted quantum-mechanical (and, in fact, Rutherford-Bohr) atomic model.

Where to start? In our opinion we should start with the definition of the most common properties inherent to any real objects and processes in nature. Acting in this way, we will arrive at the characteristic property of the atom, which could not give rise to any doubts. Then, taking into account this revealed (inherent, universal) property, we can begin building an appropriate model of the atom more adequate to reality.

What is the property that we can accept without any doubts as a real postulate, as a self-evident phenomenon really existing? Look, everything in nature at all levels is in a constant motion. More precisely, everything in the Universe at all levels, including micro-and mega-, is in continuous oscillatory-wave motion. Everything in the Universe is subject to the law of

rhythm. Continuous mutual transformations of fields with opposite properties (e.g., potential field \Leftrightarrow kinetic field) give rise to the wave nature of the World (and are conditioned by the latter). This means that the fields of all objects in nature are wave. Everything in nature exists in a natural harmony. Accordingly, between all fields, including electromagnetic and gravitational, as well as between any of the objects and phenomena, there is a natural harmonic interrelation. And this is no doubt a fundamental property of the world around us. In this case, following the stated above, we must recognize that the properties of objects and processes in nature must obey and be described by the universal (classical) wave equation.

Considering this, on the basis of the postulate of the wave nature of all objects and phenomena in Universe, solving the universal (classical) wave equation, we have arrived at the Wave Model (fundamentally differing from the Standard Model of modern physics), on the basis of which the new theories: a wave Dynamic Model of elementary particles (DM) [1] and Shell-Nodal (or, in other words, Shell-Wave) atomic model [2], were developed. Based on the new theories, the problem on the anomalous magnetic moment of the electron [3, 4] and the Lamb shift [4, 5], discussed in this article, were solved relatively simple and logically impeccable.

According to DM, the centers of mass of a hydrogen atom as a whole, as well as a proton and an electron separately, and their wave shells are subject to constant wave influence, caused by the wave nature of the structure and behaviour of elementary particles. Therefore, they are constantly fluctuating with a certain frequency and amplitude, in a state of equilibrium also. Perturbing the orbital motion of electrons on the fundamental frequency of the wave exchange, they produce the natural (background) oscillations of the electron in a hydrogen atom at this frequency.

Natural (incessant) intra-atomic vibrations disturb (superimposed on) electron's orbital motion, resulting in the formation of a zero-level spectrum – the spectrum of a background radiation. It turned out that the line of the background radiation at the maximum corresponds to the temperature 2.7 K. The difference in the energies of the nearest terms of the background spectrum corresponds exactly in value to the 1S and 2S Lamb shifts.

This fact indicates at the natural bond between the Lamb shift and the background spectrum, uncovering thus the origin of the Lamb shift and additionally confirming the correctness of the theoretical derivation of the background spectrum. These discoveries were possible due to aforementioned new theories, which were fully developed with taking into account the wave nature of all objects and phenomena in nature.

The anomalous magnetic moment is easily explained in DM on the basis of the wave notions (without involvement of virtual particles of QED); the formula of the moment is derived relatively simple and logically noncontradictory [3, 4]. Here is its unfolded detailed form:

$$\mu_e(th) = \frac{e\upsilon_0}{c} \left[r_0 + \left(\frac{c}{\omega_e} + \frac{r_0}{b'_{0,1}} \right) \sqrt{\frac{2Rh}{m_0c}} + r_e \frac{y_{0,1} + y'_{0,1}}{2y_{0,1}y'_{0,1}} \sqrt{\frac{2Rh_e}{m_0c}} \right], \quad (4)$$

where $b'_{0,1}$, $y_{0,1}$, $y'_{0,1}$ are roots of Bessel functions (radial solutions of the wave equation); R is the Rydberg constant; r_0 is the Bohr radius; r_e is the theoretical radius of the wave shell of the electron; ω_e is the fundamental frequency of atomic and subatomic levels; h_e is the orbital action of the electron (analogous to the Planck constant h), conditioned by its rotation around own center of mass with the Bohr speed υ_0 ; e is the elementary quantum of mass exchange (electron “charge”, dimensionality $g \times s^{-1}$); m_0 is the associated mass of the proton; c is the basis speed of the wave exchange at the atomic and subatomic levels, equal to the speed of light in vacuum. (r_e , ω_e , h_e , e , m_0 , and c are unknown earlier parameters originated from DM).

Eq. (4) takes into account: the oscillations of the hydrogen atom as a whole in a spherical field of exchange, oscillations of its wave spherical shell together with an orbital electron, oscillations of the center of mass of the hydrogen atom, oscillations of the center of mass of the electron as a whole relative to the center of mass of the hydrogen atom. All of these oscillations are superimposed (modulate) the orbital motion of the electron and as a result are manifested in the form of the phenomena of the “anomalous” magnetic moment and the Lamb shift. All the details of the physical meaning of each term in Eq. (4) and its derivation can be found in [1, 3-5].

Note that in Eq. (4), there are no integrals, and there is a clear understanding of the physical meaning of all terms in it. “Anomalous” magnetic moment is derived simply and logically in the framework of a new approach that we applied to solving the problem, and, as a result, the moment is easily calculated. Resulting data have the same high accuracy, which has been reached in QED for many decades that took for the mathematical derivation of Eq. (2), owing to enormous efforts of many groups of theorists. Moreover, Eq. (4) is easily calculated using the **calculator** that is impossible to apply for the calculations of “anomaly” by Eq. (2). Remind that for calculations of extremely awkward expression (2), derived in QED on the basis of abstract (imaginary, unreal) postulates, resulted in appearing a several hundred of the huge ten-dimensional integrals, and, hence, in order to calculate the electron’s “anomalous” magnetic moment (3), one needs **supercomputers**.

Thus, we see that the postulates of the postulates of strife. The Standard Model of modern physics is based mainly on abstract (unrealistic) postulates. The Wave Model that we have developed is based on the postulates reflecting reality. Hence, the corresponding striking results were obtained, as clearly shown in the examples considered in two previous (1st and 2nd) Parts and in this 3rd Part of the articles. A comparison of both theoretical approaches is not in favour of those accepted in modern physics that dominate currently.

Here is a well-known statement of Richard Feynman. *“The theory of quantum electrodynamics describes Nature as absurd from the point of view of common sense. And it agrees fully with experiment. So I hope you accept Nature as She is — absurd”* [6].

He was right in part. Actually, QED *“describes Nature as absurd from the point of view of common sense”*. Everybody will agree with this completely. But I hope nobody can agree with Feynman’s last statement. It is stupidly to *“accept Nature as She is — absurd”* only because Nature is described by QED so absurdly. His second statement that *“it agrees fully with experiment”* nothing speaks about efficiency and truthfulness of the QED theory, etc. As once was noted [7], *“the correspondence of any theory with experiments done so far does not quite mean that the given theory is true and uniquely possible. Moreover, the possibilities of modern mathematics are so impressive that it can represent any abstract absurdity as a profound theory (or its development), and fit that to any experiment”*.

How an agreement with experiment is achieved in QED, with what efforts, you have convinced on an example of the derivation by QED of $\mu_e(th)$ that led to enormous Eq. (2). Compare the latter with elegant Eq. (4) obtained by the Wave Model. Accordingly, the opposite option is applied, namely **QED is absurd**, but not Nature. It seems obvious, because we must tend not only to describing experiments at any cost, but along with this endeavour to cognize Nature. For this purpose abstract-mathematical theories like QED are not valid in principle. This is why primordial problems of physics, such as the nature of electric charges and the origin of mass of elementary particles, magnetic moments of nucleons (proton and neutron), and etc., are not solved in the Standard Model including QED. To the point, these problems are naturally solved in the framework of the Wave Model.

Do we need a virtual physics (and, in fact, science fiction)? Is it time to change the paradigm in physics? I think the answer to these questions is clear to all. According to this, we need to pull the physics out of the impasse in which it resides.

A reliance on the real postulate on the wave nature of all phenomena and objects in the Universe has led us to unique results. The dynamic model of elementary particles [1] and shell-nodal (shell-wave) model of the atom [2] were developed. On their basis, we have come to the discovery according to which the three phenomena considered above have a common source (hydrogen atoms) of their origin and a single mechanism responsible for their appearance (wave nature). All these phenomena are caused by the wave nature of elementary particles, constituent of the atoms. Let us remind once again, in the end of this article, these phenomena. Here they are:

- (1) The "anomalous" magnetic moment of an electron.
- (2) The background radiation of hydrogen atoms with a black body spectrum corresponding to the temperature of 2.7 K (erroneously ascribed to a mystic "relic" radiation, allegedly remaining after the hypothetical "Big Bang").

- (3) The Lamb shift, which is a difference between adjacent energy levels in a spectrum of microwave background radiation of hydrogen atoms.

So, whether you want to continue building the "Tower of Babel" of virtual particles?

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Part 4

Atomic nucleus

I think that many of those who have read three previous Parts of the notes were shocked by conclusions reached by the author. However, the worst is still to come; this is nothing compared with what is to come. Undoubtedly, I will again upset the readers if say it frankly that there is no solid nucleus in an atom. Everyone knows that according to modern physics almost all mass of an atom is concentrated in its superdense nucleus, a tiny spherical volume with a radius of an order 10^{-13} cm , surrounded by electrons. Our studies conducted in last years have shown that it is a myth, like the fact that the average density of nuclei is a huge amount of about $4 \times 10^{14} \text{ g / cm}^3$. Thus, the nuclear model of the atom is wrong.

But how so, you can ask, so much progress has been made in atomic and nuclear physics, as every knows, resulted in the use of atomic (nuclear) energy, both in civilian and military areas, etc., and all thanks to the physicists – specialists in atomic and nuclear physics! An answer is simple: it's all experimental achievements, an engineering use of the discovered phenomenon of radioactivity. The similar enormous advances were achieved owing to use of the discovery of electricity, at all despite the fact that nobody so far knows, what the electric charge is, and what is an electron. An introduction of a unit of electric charge, Coulomb, in the SI system (made to get rid of fractional units that exist in the CGS system) did nothing add to the understanding of its nature [1]. We can name the unit of charge as we want, whether Peter or Bob, but still the name will remain only a fig leaf covering the gap in the knowledge of its true dimension. Actually, in the objective units of matter, space and time (g, cm, s), the dimension of the charge has not changed with introduction of SI and still remains absurd, in essence, as expressed in fractional units of gram and centimeter ($\text{g}^{1/2} \text{cm}^{3/2} \text{s}^{-1}$). Indeed, what are \sqrt{g} and $\sqrt{\text{cm}^3}$? No one can explain, because such mathematical constructs do not exist in nature as physical objects.

As before, following Rutherford, the charge is treated in modern physics as "distributed" uniformly (or nonuniformly) on a surface of particles. But in the Universe there is only a matter in the form of fields and particles that are in constant motion in the broadest sense of the word. So what is this something that is "distributed" (as usually written in scientific papers on physics), called the charge? Is it unknown form of matter or the same matter of which all things around us are made? Or perhaps nothing is "distributed"? Official physics, on the basis of mainstream theories, cannot answer to these questions. Resting upon new fundamentals of physics that we have developed for the last 2 decades, this problem has

been solved by us. Our answer to the above questions one can find, for example, in [2]. But let us turn back to the origin of the modern view on the structure of the atom and its nucleus.

The concept of a single tiny nucleus, in which the whole mass of the atom is concentrated, came from Rutherford. He found in his experiments on alpha particles scattering a relatively small number of backscattering acts, and ascribed this phenomenon to the reflection of a falling particle, under the central impact, from the positively charged region (the nucleus) where the majority of the mass of the atom, as he assumed, was concentrated. Other possible options to explain the phenomenon of backscattering he did not consider.

Having taken as a result the nuclear model of the atom for a basis, Rutherford and his followers were forced to admit that in this case nucleons, protons and neutrons, being inside the nucleus, must have dimensions not exceeding a size of the nucleus itself, i.e., they must have a radius of the same order, 10^{-13} cm , or less. The size of the electron is known to be generally ignored by theoreticians; they consider it in their works as a point-like particle. As a result, the development of atomic and nuclear physics has gone on way to develop the ideas put forward by Rutherford; and in this way physics continues to move now. In-depth analysis shows, however, that Rutherford's interpretation of the experiments on scattering of α - and β -particles (1911) that led to a modern nuclear model of the atom was not convincing. Moreover, it was not an only possible one. What was overlooked by Rutherford and his followers in their reasoning while treating the experimental data?

First, the most important of the shortcomings was the concentration of their efforts exclusively on one of the possible models of atomic structure. Namely, the atom was considered only as a spherical (and, hence, one-center) microobject with a nucleus in the center. Although, it is not implied from Rutherford's experiments that the atom has only one scattering center [3].

As it turned out, in fact, the atoms remind of molecules consisting of the paired nucleons. The latter are in nodes of atomic spherical wave shells, according to the shell-nodal (or shell-wave) structure of the atoms [4]. Various atoms differ from each other by the different number of the nodes and unique for each atom the structure (configuration) of their external spherical shells, in which these external nodes are located. Molecular-like atoms of the shell-nodal atomic model have the multinodal or multicentric structure. Each pair of nucleons in one node is bound by strong bonds (called also as "nuclear") with neighbouring pairs of nucleons of neighbouring nodes in the same atom [5]. Therefore, the collision of α -particle from an alpha radiation beam, falling on the metal foil, "head-on" with one of the nucleons of one from all nucleon nodes of the atom, is equivalent to the collision of α -particle with the whole mass of the atom. Note that in Rutherford's experiments a natural source of α -radiation has been used. It is characterized by relatively low energy of alpha-particles compared with the binding energy of nucleons in the atom.

Second, the following question should be thoroughly discussed also: what is the mechanism of the process itself of scattering at collisions, the more that elementary particles show duality, behave as particles and as waves? And according to this, why the scattering volume must be incredibly dense and hard? Unfortunately, the aforementioned questions were not put and, hence, were not considered. To all appearances, a purely mechanical approach to atomic structure was dominated at that time.

From our studies it follows that a very tiny scattering volume, accepted by Rutherford for a compact superdense atomic nucleus, is a diminutive central region of the volume of intranucleon space, "swept" by the oscillating center of the mass of the nucleon. The latter is strongly bound with other nucleons in the atom which behave themselves identically. Frequency of the oscillations turned out to be equal to $\omega_e = 1.869 \times 10^{18} \text{ s}^{-1}$. Other new revealed parameters are the following. The size (radius) of the proton is $r_p = 0.5284 \times 10^{-8} \text{ cm}$, that is slightly less than the Bohr radius. The radius of the electron is $r_e = 0.417 \times 10^{-9} \text{ cm}$, that is about 10 times smaller than the radius of nucleons. The mass of the particles has a wave associated character, and the mass density is only 3 g / cm^3 .

The new results presented above were obtained on the basis of rigorous solutions of the wave equation. Their validity is fully confirmed by all course of the development of new theories [4]. As one of the last direct evidence of the validity of such fundamental findings, one can serve the experiments carried out on monatomic layers of graphite - graphene. A two-dimensional hexagonal crystal lattice of carbon atoms in graphene is an ideal material for the verification of validity of the shell-wave (or shell-nodal) internal structure of the carbon atom and, consequently, all atoms of the periodic table [6]. But first things first.

An existing quantum mechanical (QM) model of the atom in full sense is abstract and mathematical. No one abstractionist till now dared to draw at least any image of an atom in full agreement with the QM concepts. If, for example, one images that the size of this page of the A4 format is assumed to be coinciding with the dimension of the atom, then its nucleus should be 100,000 times smaller, i.e., an order of $1 \text{ }\mu\text{m}$. But such a point in the middle of this page will invisible to the naked eye. And further, how can depict the electrons, which in accordance with the QM do not move along closed trajectories, but obeying the probabilistic laws they move somehow (undefined how) within the space bounded by the mythical electron orbitals (see Part 1) corresponding to the so-called electron shells. For example, where and how on this clean sheet around an invisible center (nucleus) one can paint all 28 electrons of the nickel atom in full compliance with the so-called electron configuration of the atom. This problem is unsolvable. And it is because we are not dealing with the physical, but with an abstract, mathematical (QM) model. The latter was developed first of all in order to somehow describe experimental results obtained from the study of emission and absorption spectra of excited atoms, leaving aside (and then forgetting) the main aim - cognition of the nature of matter, how it is arranged at the atomic level.

Because of its absolute abstractiveness, the QM atomic model is extremely flawed; hence, the possibilities of such a model are limited. In general, it cannot be even regarded as a model of the atom, in the full sense of the word, since the necessary and sufficient conditions of integrity of elementary conceptions about the atom are absent in it. In particular, that is a very important point; an existence of atomic isotopes found experimentally for all atoms does not follow, at all, from the QM atomic model. This model, which deals mainly with the description of an electron structure of atoms, does not say anything about features and an internal structure of a central part of the atom, where its main mass is concentrated, i.e., no information about its nucleus is there. This part of the atom is considered separately in another branch of physics, nuclear physics. With this, there is no single model of the nuclear structure. Hence, to describe the diversity of properties of atoms, continuously found experimentally, the various hypotheses on the structure of its nucleus are put forward up to this day. The most famous of them are the drop model of the nucleus (proposed in 1936 by Niels Bohr); the shell model (proposed in the 30th years of the 20th century); the generalized model of the Bohr-Mottelson; the cluster model of the nucleus, the model of nucleon associations; the optical nuclear model; the superfluid nuclear model, a statistical model of the nucleus, etc.

The modern theory of atomic structure is abstract and imperfect in such a high extent, that none of the sober-minded physicists does not doubt in the need as soon as possible to replace the existing abstract mathematical model of the atom with a clear physical model. The new atomic model must be based on postulates that reflect reality, the real regularities in nature.

On the basis of the Dynamic Model of elementary particles (DM) [2], that revealed the nature of electric charge and the origin of mass, and the Shell-Wave (or Shell-Nodal) atomic model (SWM) [4], the theory of scattering by a substance of particles and waves incident on it has received its new resolution [3]. In accordance with the DM, a center of the mass of the nucleon, which is considered as a wave spherical pulsating microformation in space, performs the radial oscillations with amplitude of the order $1.4 \times 10^{-13} \text{ cm}$ and frequency of $1.869 \times 10^{18} \text{ s}^{-1}$. This leads to the formation of a dynamic spherical volume with a radius equal in magnitude to the amplitude of these oscillations. Just this dynamic volume was found in scattering experiments by Rutherford and was perceived mistakenly for a superdense nucleus of the atom. According to the DM, the nucleon mass has a wave nature and is associate. The scattering volume ("nucleus") of any nucleon in an atom is at the same time the scattering volume ("nucleus") of the atom as a whole, since all nucleons in the molecular-like atom (according to the SWM) are linked by strong bonds. Therefore, a collision with one of the nucleons is equivalent to the collision with all nucleons of an atom, i.e., with the atom as a whole.

A new view on the atomic structure naturally affects on our concepts lying in the fundamentals of chemistry. Indeed, the first analysis conducted in the framework of the

SWM has shown that the main role in the formation of the geometric structure (spatial shape) of all molecules composed of atoms belongs to nucleons rather than electrons as is commonly believed until now. Electrons are responsible only for the strength of these bonds, but not for the direction. A concept of hybridization of atomic orbitals accepted in modern physics and chemistry (see Part 1) has turned out to be erroneous as well.

An apogee in studying substance was a creation of Large Hadron Collider (LHC), built primarily in order to find a mythical particle, the Higgs boson, and hence to make ends meet in respective speculations of QED theorists in the field of the so-called electroweak interaction. The Higgs boson as believed is responsible for the origin of the mass of elementary particles. Make no doubt, the Higgs boson will be "found" as up till now all that was needed for the validation of all theories put forward by theorists was "found" without fail. And then all media together, in chorus, will loudly report about this as about a great discovery. Just as they have hammered into the innocent people heads (and still do it) a validity of the mythical "Big Bang" hypothesis; so that the latter is perceived by "zombie" not as a myth, but dogmatically (like religious dogmas), as a matter of course, actually happened in the past fact; and they almost reached this goal.

Actually, as follows from our studies, the rest mass, as such, of elementary particles does not exist. The mass of the particles has an associate wave character [2, 7]. Therefore, there is no need to seek not existing mythic Higgs bosons. As a result one can save the giant funds consumable on the maintenance of the LHC. In this connection it makes sense analyzing thoroughly enough the results presented in this article and in References. The validation of them (about that we have no doubt) will confirm the uselessness of further use of the LHC. The latter might be remade so that its circular torus could serve for people, for example, as a transport tunnel. Is the Game worth the candle?

Thus, figuratively speaking, the 4th Part of the article has led us to the "Tower of Babylon" over unfinished stump of which a unique toroidal crown in the form of the LHC of about 27 km long was found suspended there. That's really, indeed, there is no limit of human imagination, as well as to a boundless blind faith of politicians in any advertised ("credible") scientific authority and their "projects".

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Part 5

The nature of gravity

In this Part of the notes I will tell, like in previous Parts as briefly as possible, about a universal phenomenon of gravity, to influence of which each one of us is subject all the time, but unfortunately, which is still not comprehensible. Our bodies are adapted to an existence in the Earth's gravitational field and we must ultimately understand the cause of attraction. You know how much speculations about gravitation were made till now. Therefore, in order not to be repeated, I present only our vision of the problem resolved by us in the framework of the Dynamic Model (DM) of elementary particles [1, 2]. About the latter it has been already mentioned in previous Parts of the notes. The DM essentially differs by its fundamental notions from the basic theories of the Standard Model (SM) of modern physics.

Therefore, under realisation of our approach to the solution of unsolved problems of physics, including the gravity problem, we use about a dozen of new physical notions and respective parameters hitherto unknown for official physics, but which form the basis of the DM, and also use some till now unknown formulas of laws applicable in the DM.

Currently the gravitational interaction is described, in part, by Newton's theory of "universal gravitation", but in a general case, by the general theory of relativity, and, in the so-called quantum limit, by quantum theory of gravity till unfinished.

However, it should be stressed that, in the first place, none of these theories can explain the nature of gravity; they are all focused only on the description of experimental facts related to gravity. Newton wrote in his commentary (General Scholium, 1713) to the 2nd edition of his Principia (translation of 1999 from Latin): *"I have not as yet been able to discover the reason for these properties of gravity from phenomena, and I do not feign hypotheses"* (*'hypotheses non fingo'*, in Latin).

Second, everything in nature is interrelated and is in natural harmony. Therefore, if a theory is correct, the aforementioned harmony and interrelation must be reflected in the description by a given theory of various fundamental interactions as well. This means that the description should be single, universal for all types of the interactions. However, all attempts undertaken by official physics to construct a unified theory of physics were ended in failure despite the enormous efforts of many groups of theoreticians. In particular, modern physics in no way can find the relation between gravitational interaction described by the theory of general relativity and the remaining three types of fundamental interactions, which modern physics distinguishes presently (strong, electromagnetic and weak).

This suggests an unambiguous conclusion that the main reason for the failure of official physics is the inadequacy of its fundamental theories in the framework of the Standard Model (SM), including the theory of general relativity, reality.

Theorists in their search for a unified theory stubbornly adhere to the SM. They are trying to improve it somehow (for example, using different versions of string theories and their derivatives) without changing the fundamental concepts of the SM, but it does not bring the desired result [3]. Facing the difficulties they nevertheless do not want to see and hear about other approaches that go beyond the SM. They are afraid to overstep the framework of solutions accepted currently in the official theoretical physics to the problems of gravity and a unified theory. As a result, gravity is still the official dogma of science, one of a series of inexplicable phenomena.

Let's get back to basics and begin, as they say, "dance from the stove." What we do know from experience?

- (I) Newton's law of universal gravitation (1686) and similar, in form,
- (II) Coulomb's law for interacting point electric charges (1785-1788):

$$F = G \frac{m_1 m_2}{r^2}, \quad F = k \frac{q_1 q_2}{r^2}. \quad (1)$$

The proportionality factor in Newton's formula, called the gravitational constant, $G = 6.67384(80) \times 10^{-8} \text{ cm}^3 \text{ g}^{-1} \text{ s}^{-2}$, is the factor obtained from the experience. Whereas the magnitude and dimensionality of the proportionality factor, k , in Coulomb's law are unknown. In the objective system of units, CGS (cm , g , s), the factor k was accepted arbitrarily for a unit, $k = 1$, which led to the absurd dimensionality of the charge q (see Part 4).

Identical functional dependence – the subordination of the gravitational and electrostatic interactions to the inverse square law – led us to believe that both of the laws, apparently, are particular cases of a general inverse square law, which must describe both these interactions from a single point of view. In order to find its form, obviously, it was necessary to examine all 4 vague notions (parameters) in both Newton's and Coulomb's formulas (1), namely, we need to establish the following.

- 1) What is the mass m , what is its nature?
- 2) What is the charge q , what is its true nature and, hence, the correct dimensionality expressed by integer powers of objective units (cm , g , and s)?
- 3) From which parameters the gravitational constant G depends?
- 4) From which parameters the proportionality factor k in Coulomb's law depends, and what are its absolute value and dimensionality?
- 5) How do the parameters, m and q , interrelate?
- 6) How do the parameters, G and k , interrelate?

Official physics, unfortunately, cannot answer these questions. In the framework of the accepted theories of modern physics, these questions are unsolvable, and therefore, remain as a white spot that hinders the development of physics.

Recognition of the wave nature of the Universe, all phenomena and objects in it, and therefore, reliance on the universal (classical) wave equation led us to the Dynamic Model of elementary particles (DM) [1, 2] and the Shell-Wave Model of the atom (SWM) [4]. On the basis of these models the answers to all 5 questions mentioned above were obtained by natural way. Moreover, as in a domino effect, like a chain reaction, relatively simple and logically consistent solutions were found for other phenomena, which to this day were incorrectly (or not convincingly) interpreted in modern physics. I would remind that the matter is about the phenomena that are not adequately described by modern theories built on the basis of fictional abstract postulates and virtual parameters [5].

So, here are the answers obtained from the DM to the questions above:

1) The mass m of elementary particles has a wave associated character. The rest mass of the particles does not exist.

2) The electric, magnetic and gravitational charges are the charges of mass exchange. That means that the charges determine the rate of the wave mass exchange (interaction); their dimensionality is $g \times s^{-1}$. At the level of gravitational exchange (interaction), we deal with the gravitational charge, and denote it (for distinction) as q_g . At the atomic and subatomic levels, the "electric" and "magnetic" charges are denoted, respectively, as q_e and q_m .

3) The gravitational constant G relates to the fundamental frequency of elementary particles at the mega-level, ω_g , by the relation:

$$\omega_g = \sqrt{4\pi\varepsilon_0 G}, \quad (2)$$

where $\varepsilon_0 = 1 g \times cm^{-3}$ is the absolute density unit. This frequency determines the gravitational interaction of particles. Since, as follows from experience, $G = 6.67384(80) \times 10^{-8} cm^3 g^{-1} s^{-2}$, hence, the fundamental frequency of the gravitational field and gravitational interaction is

$$\omega_g = 9.158082264 \times 10^{-4} s^{-1}.$$

4) The proportionality factor in Coulomb's law is equal in absolute magnitude to $1/4\pi$, and its dimensionality is as for the inverse density,

$$k = \frac{1}{4\pi\varepsilon_0} cm^3 \times g^{-1}, \quad (3)$$

5) The parameters, m and q , respectively, in Newton's and Coulomb's laws (1), interrelate as follows:

a) at the gravitational level, by the relation,

$$\omega_g = q_g / m; \quad (4)$$

6) at the atomic and subatomic levels, similarly,

$$\omega_e = q_e / m, \quad (5)$$

where

$$\omega_e = e / m_e = 1.869162559 \times 10^{18} \text{ s}^{-1} \quad (6)$$

is the fundamental frequency of the atomic and subatomic levels,

$$e = m_e \omega_e = 1.702691627 \times 10^{-9} \text{ g} \cdot \text{s}^{-1} \quad (7)$$

is an elementary quantum of the rate of mass exchange (interaction) – an electron “charge”, m_e is the associated electron mass.

6) The parameters G and k , as seen from (2) and (3), are related by

$$G = k \omega_g^2 \quad (8)$$

The Universal Law of Exchange (interaction) originating from the DM, which describes three types of fundamental interactions: strong, electromagnetic and gravitational, has the following form:

$$F = \omega_x^2 \frac{(Z_1 m_x)(Z_2 m_x)}{4\pi \varepsilon_0 r^2}, \quad (12)$$

where Z_1 and Z_2 are relative masses of interacting objects, m_x is the associated mass of elementary particles – basic constituents of the atom (an electron, m_e , or a nucleon, m_n), $\varepsilon_0 = 1 \text{ g} \times \text{cm}^{-3}$ is the absolute density unit, ω_x is one of the fundamental frequencies (either ω_e or ω_g).

Coulomb's law that describes the electrical attraction or repulsion between two charged point objects and Newton's law of universal gravity are particular cases of the Universal Law of Exchange (12) [6]. Here is an explicit form of the both laws:

$$F_{elec} = \omega_e^2 \frac{(Z_1 m_e)(Z_2 m_e)}{4\pi \varepsilon_0 r^2}, \quad (13)$$

$$F_{grav} = \omega_g^2 \frac{(Z_1 m_n)(Z_2 m_n)}{4\pi \varepsilon_0 r^2}. \quad (14)$$

On the language of the wave exchange, these laws describe, respectively, the exchange (interaction) at the level of "electric" wave field (13) (molecular interaction) on the basis of

an electron with the associated mass m_e and the exchange ("electric") charge $e = m_e \omega_e$; and exchange (interaction) at the level of the gravitational wave field (14) on the basis of the graviton-nucleon with the associated mass m_n and the exchange gravitational charge $q_g = m_n \omega_g$.

In the particular case of the description of the strong interaction (exchange) [7], the Universal Law of Exchange (12) takes the form

$$F_{strong} = \omega_e^2 \frac{(Z_1 m_n)(Z_2 m_n)}{4\pi \epsilon_0 r^2}, \quad (15)$$

Conclusion. According to the DM, elementary particles are both micro and mega pulsating objects of the Universe at the same time, i.e. they are unique dynamic wave formations limited by their wave spherical shells. This means that they are extremely small and infinitely large in size at the same time. Their effective mass has associated (affiliated) wave nature, and therefore, they have no rest mass. Such particles pulsate in 2 fundamental frequencies simultaneously, ω_e and ω_g . Obeying the Law of Universal Exchange (12), their exchange interaction (gravitational, electromagnetic, and strong) with an ambient field and other particles is realised at these frequencies.

The first fundamental (innate) pulsation frequency of particles, the ultimately high frequency, $\omega_e = 1.869162559 \times 10^{18} \text{ s}^{-1}$, is responsible for their electromagnetic and strong interactions. This frequency determines, in particular, the ordering in the arrangement of the interacting atoms (which are the wave formations in accordance with DM) in crystals with an average pitch, an internodal distance (a lattice parameter), of about $3.2 \times 10^{-8} \text{ cm}$, that is equal in accuracy to the wave diameter, $D_{\lambda_e} = 2\lambda_e$, since the wave radius is equal to

$$\lambda_e = c / \omega_e = 1.603886492 \times 10^{-8} \text{ cm}. \quad (16)$$

The second fundamental (innate) pulsation frequency of elementary particles, the extremely low frequency, $\omega_g = 9.158082264 \times 10^{-4} \text{ s}^{-1}$, is responsible for their gravitational interaction. For confirmation of the reality of pulsations of the particles with the frequency of ω_g and their interaction at this frequency, one can serve the mean radii of the orbits of the planets and their satellites [3, 6] derived theoretically for the first time in physics due to the new theory (the DM), which turned out capable of doing this. The correlation between the calculated data and the data of astronomical observations is quite satisfactory. At a distance from the Sun, in an average, within a gravitational wave radius,

$$\lambda_g = \frac{c}{\omega_g} = 3.274 \times 10^{13} \text{ cm} = 327.4 \times 10^6 \text{ km}, \quad (17)$$

the asteroid belt is located. The gravitational radius is the boundary separating the oscillatory and wave zones of particles, so that it is a transition region, where the big planets could not be formed.

Thus, based on the Dynamic Model, we have come to the unified theory that describes the three fundamental interactions (see equation (12)): strong, electromagnetic, and gravitational.

At the end, I present the following formulation of the gravitational interaction, which was offered at the 19th International Conference on General Relativity and Gravitation in Mexico City (2010) [8]:

Gravitational interaction of bodies is a result of the wave exchange of all elementary particles, constituents of the bodies, individually at the fundamental frequency
 $\omega_g = 9.158082264 \times 10^{-4} \text{ s}^{-1}$ *inherent in every particle.*

P.S. Without violating the style taken in the notes (beginning from Part 1), I could not resist and decided to add at the end of this Part the following my reflections. Modern official physical schools (research laboratories), led by well-known (credible) scientists, remind closed religious sects that do not let in outsiders-freethinkers to themselves: those who, instead of preaching the same dogma, invites members of the sect to abandon of their dogmas, and to open their doors to new fresh ideas that are beyond an accepted paradigm.

Obviously, this is an abnormally developing system in the science of nature, physics – a system with negative feedback; and it may not exist long, a new era comes. Therefore, official physics must, finally, have the courage to recognize openly about its inability, in principle, ever to resolve the unsolved problems over which it beats by using the SM quite long and unsuccessfully. This situation has long been recognised by many, every feels intuit it. No matter how will correct and improve the SM. Inevitably, this will not give any positive result because at the foundation of the SM is a hopeless dead-end paradigm (see also, e.g., Part 1-4 of these notes). Hence, there is only one way out of the stagnation - a change of the basic postulates, or paradigms, in modern physics.

And on my mind, it would be appropriate and democratically to declare, for example, an open international competition (assuming the participation of all physicists without exception) on the best alternative generalized theory for the replacement of the failed SM. What can you say in regard to this idea?

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Part 6

Planetary orbits

One of the unsolved mysteries of modern physics and astrophysics is still the nature of the existing order in an arrangement of the orbits of planets at certain mean distances from the Sun. Newton's law of universal gravitation and Kepler's laws even though give us interrelation between the size of planetary orbits and their periods, but do not allow to calculate these orbits. The Standard Model is also helpless here, as in many other cases. Therefore, so far, distances of the planets from the Sun (average radii of the orbits) are calculated by a simple empirical formula proposed by J. D. Titius 245 years ago, in 1766, and further popularized by J. E. Bode, in his works of 1772. The formula is called in their honour the Titius – Bode Law (sometimes just Bode's Law). In one version of the writing the law, the average radii of the orbits (in astronomical units) are subordinate to the formula

$$R_i = \frac{D_i + 4}{10}, \quad (1)$$

where $D_{-1} = 0$, $D_i = 3 \times 2^i$, $i \geq 0$.

The values, calculated by this formula, correlate to the astronomical data within the spread of data, but not for all the planets. For example, on the calculated orbit for $i = 3$ there is an asteroid belt instead of a planet. Why? It is unknown. The orbits of Neptune and Pluto also fall out of the calculations performed by this empirical formula.

And most importantly, the Titius-Bode empirical law has no theoretical justification, i.e., a conceptual framework for the derivation of the formula is missing. There is only a trivial verbal explanation, actually, a statement of a self-evident fact. According to the latter, in the early stage of the formation of the Solar System, the regular structure was forming from alternating regions, in which may or may not stable orbits exist, according to the so-called rule of orbital resonances (a certain ratio of the radii of the neighbouring orbits).

In this Part of the article I give the first theoretical explanation of the order in an arrangement of the stationary orbits, reveal causes of the phenomenon, which turned out to be possible on the basis of theories within the Wave Model (WM): the Dynamic Model of elementary particles (DM) [1, 2] and the Shell-Wave Model of atoms (SWM) [3].

One of the results obtained in the DM is a discovery of the fundamental frequency of an ultimately low value,

$$\omega_g = 9.158082264 \times 10^{-4} \text{ s}^{-1}, \quad (2)$$

which is characteristic for the wave field of elementary particles. As it turned out, on this frequency it is realised their gravitational exchange (interaction). In accordance with the

postulate, upon which the DM rests, all processes and objects in the Universe have a wave nature and, therefore, subordinate to the universal (classical) wave equation,

$$\Delta\hat{\Psi} - \frac{1}{c^2} \frac{\partial^2 \hat{\Psi}}{\partial t^2} = 0. \quad (3)$$

A solution [3] of the radial component of this equation and the discovery [1] of the gravitational frequency ω_g (2) led us to the discovery of the spectrum of wave gravitational shells (will be shown below). This spectrum allowed understanding, as was mentioned in Part 5, the reason for the location of the planetary orbits within regions around well-defined distances from the star, as well as the location of the orbits of planetary satellites.

This is an extremely important theoretical result [4 - 6] for the first time obtained in physics in the framework of the WM. So I decided to bring it to the attention of the readers by this publication, provided in a series of short notes (Parts) devoted to the fundamental problems of physics.

The gravitational frequency (see Part 5) determines the gravitational radius of elementary particles, which is also the elementary radial gravitational wave

$$\tilde{\lambda}_g = \frac{c}{\omega_g} = 327.4 \times 10^{11} \text{ m} = 327.4 \text{ Mkm}. \quad (4)$$

The wave shell of the gravitational radius (4) of a particle in stellar systems, which in turn are spherical objects of mega space (atoms of mega world), separates the oscillating region of a spherical field-space of a star and its wave region.

We on the Earth are inside a giant gravitational wave and, therefore, perceive the gravitational wave field as stationary. As follows from the Universal Law of Exchange (see Eqs. (12) and (14) in Part 5), the power of gravitational exchange (the "force" of gravity) of individual particles,

$$F_{grav} = \omega_g^2 \frac{(Z_1 m_n)(Z_2 m_n)}{4\pi \epsilon_0 r^2}, \quad (5)$$

is negligible. But a huge number of particles (e.g., the Sun consists approximately of 10^{57} nucleons) compensates for this negligible amount, and in sum, leads to a very significant effect – the gravitational attraction.

In accordance with the solutions of the wave equation (3), the gravitational wave radius (4) of elementary particles determines the radii of their wave equilibrium spherical shells by the following equation:

$$r = \tilde{\lambda}_g z_{m,n} = 327.4 \times 10^6 \times z_{m,n} \text{ km}; \quad (6)$$

where $z_{m,n}$ are solutions of the wave equation (3) (roots, zeros, of Bessel functions) [7].

This is simple but at the same time a fundamental relationship and it has a deep physical sense. Namely it reflects the wave nature of objects and their interaction at the mega (gravitational) level. Eq. (6) includes only two parameters. One of them, the roots of Bessel functions, $z_{m,n}$, is the result of solving the wave equation (3), to be more precise, its radial component. The second parameter, the wave gravitational radius of elementary particles, λ_g , corresponding to the extremely low frequency of their intrinsic pulsations, ω_g , is the result of solutions obtained in a theory of the DM.

The solution (6) is realized in the first approximation in a spectrum of the Keplerian shells-orbits, assuming that the gravitational shells are spherical and, therefore, the orbits are circular (see Table 1). Under the conditions of interplanetary gravitational interaction (perturbation), the planets cannot move strictly along circular orbits, to which they naturally aspire constantly as to equilibrium. Mutual perturbations eventually have turned the circular orbits in elliptic. However, because of relatively small eccentricities, the orbits of the planets can be considered in the first approximation (for analysis) as a circular.

Table 1

A gravitational spectrum of *H*-atomic wave spherical shells

| s | $z_{m,n} = j_{0,s}$ | r, Mkm | Planets* |
|-----|---------------------|----------|------------------|
| 1 | 2.4048 | 787.3 | Jupiter (778.57) |
| 2 | 5.5201 | 1807.3 | Saturn (1433.45) |
| 3 | 8.6537 | 2833.2 | Uranus (2876.68) |
| 4 | 11.7915 | 3860.5 | |
| 5 | 14.9309 | 4888.4 | Neptune (4503.4) |
| 6 | 18.0711 | 5916.5 | Pluto (5906.5) |

*) Planets located in relative proximity to the spherical shells. In brackets there are semi-major axes of elliptical orbits of the planets.

The elliptic orbits of Saturn and Neptune are closer to circular of spherical shells, corresponding to the roots of the extremes of Bessel functions [7], $z_{m,n} = a'_{0,2} = 4.49341$ and $z_{m,n} = a'_{0,5} = 14.0662$: $r = 1471.1 Mkm$ and $r = 4605.3 Mkm$, respectively.

From formula (6) the following important, in a practical meaning, relation originates:

$$r_s = r_1 \frac{z_{m,s}}{z_{m,1}} \quad (7)$$

In this expression there is not the characteristic fundamental frequency of the gravitational field, ω_g , which, of course, was changing during the historical period of the formation of the Universe. If we take, as the basic, a gravitational wave shell of the Sun, e.g., on which is an orbit of the planet Mercury, we arrive at the gravitational spectrum, conditioned by the solutions of the Bessel functions of the first order (Table 2).

A transient region, between oscillatory and wave, limited by the wave gravitational radius, $\lambda_g = 327.4 \text{ Mkm}$, is presented by the asteroid belt around the Sun (the orbital radius of the belt is in average within 329.12 - 538.56 Mkm). In the center of the field of asteroids, there is the only dwarf planet, 1 Ceres. No large planets are there, since in the formation of the Solar System, the transient region was a place of the most intense motion.

Table 2

A gravitational spectrum of wave spherical shells of elementary particles

| s | $z_{m,n} = j_{1,s}$ | r_s, Mkm | Planets |
|-----|---------------------|-------------------|-------------------------------|
| 1 | 3.831706 | 57.91 | Mercury |
| 2 | 7.015587 | 106.03 (108.2) | Venus |
| 3 | 10.17347 | 153.76 (149.6) | Earth |
| 4 | 13.32369 | 201.36 (204.5) | Toro |
| 5 | 16.47063 | 248.93 (227.9) | Mars |
| 6 | 19.61586 | 296.46 | Asteroids |
| 7 | 22.76008 | 339.45 | Asteroids |
| 8 | 25.90367 | 391.49 | Asteroids |
| 9 | 29.04683 | 438.96 | 413.77 (1 Ceres) Asteroids |
| 10 | 32.18968 | 486.49 | Asteroids |
| 11 | 35.33231 | 533.99 | Asteroids |
| 12 | 38.47476 | 581.48 | Asteroids |
| 13 | 41.61709 | 628.97 | 1 asteroid |
| 14 | 44.75932 | 676.46 | |
| 15 | 47.90146 | 723.95 | |
| 16 | 51.04354 | 771.44 (778.57) | Jupiter |
| ... | | | |
| 30 | 95.02923 | 1436.2 (1433.45) | Saturn |

Semi-major axes of elliptical orbits of the planets are in brackets. For a small planet Toro, in brackets, an average distance from the Sun is indicated.

In addition, in Tables 3, 4 and 5, there are shown the spectra, $r_s(j_{1,s})$ and $r_s(y_{1,s})$, of the wave gravitational shells of Jupiter, Saturn and Uranus. They were obtained from the relations,

$$r_s(j_{1,s}) = r_1 \frac{j_{1,s}}{j_{1,1}} \quad \text{и} \quad r_s(y_{1,s}) = r_1 \frac{y_{1,s}}{j_{1,1}}, \quad (8)$$

originated from Eq. (7), where $j_{1,s}$ and $y_{1,s}$ are roots of Bessel functions [7]; $\langle r_s \rangle$ are semi-major axes of orbits (a) of planetary satellites known from the astronomic observational data.

Table 3

A spectrum of wave gravitational shells of Jupiter; r_s *kkm*.

| s | $r_s (j_{1,s})$ | $r_s (y_{1,s})$ | $\langle r_s \rangle$ (experimental); semi-major axes, a |
|-----|-----------------|-----------------|--|
| 1 | 71.492 | | |
| 2 | 130.9 | 101.3 | 129.0 (Adrastea), 128 (Metis) |
| 3 | 189.8 | 160.38 | 181.4 (Amalthea) |
| 4 | 248.6 | 219.2 | 221.9 (Thebe) |
| 7 | 424.7 | 395.3 | 421.8 (Io) |
| 11 | 659.2 | 629.9 | 671.1 (Europa) |
| 18 | 1069.6 | 1040.3 | 1070.4 (Ganymede) |
| 32 | 1890.29 | 1860.98 | 1882.7 (Callisto) |

$r_1=71.492$ *kkm* is an equatorial radius of Jupiter

Table 4

A spectrum of wave gravitational shells of Saturn; r_s *kkm*.

| s | $r_s (j_{1,s})$ | $r_s (y_{1,s})$ | $\langle r_s \rangle$ (experimental); semi-major axes, a |
|-----|-----------------|-----------------|--|
| 1 | 60.268 | | |
| 2 | 110.346 | 85.40 | 74.5-92.0 (Ring C) 92.0 - 117.5 (Ring B) |
| 3 | 160.0 | 135.20 | 137.67 (Atlas), 139.38 (Prometheus) 133.58 (Pan), 136.5 (Daphnis) 122.2-136.8 (Ring A) 140.210 (Ring F) 165.8 - 173.8 (Ring G) |
| 4 | 209.56 | 184.8 | 185.539 (Minas) |
| 5 | 259.06 | 234.3 | 238.037 (Enceladus) |
| 6 | 308.53 | 283.8 | 294.67 (Tethys) 294,71 (Telesto, Calypso) |
| 7 | 357.99 | 333.26 | 180.0 - 480.0 (Ring E) |
| 8 | 407.43 | 382.71 | 377.42 (Dione, Helene) 377.2 (Polydeuces) |
| ... | ... | ... | ... |
| 11 | 555.73 | 531.02 | 527.04 (Rhea) |
| 25 | 1247,61 | 1222.9 | 1221.865 (Titan) |
| 30 | 1494.69 | 1469.98 | 1500.934 (Hyperion) |

$r_1=60.268$ *kkm* is an equatorial radius of Saturn. For rings, the distances to the center of Saturn are indicated.

Table 5A spectrum of wave gravitational shells of Uranus; r_s *kkm*.

| s | $r_s (j_{1,s})$ | $r_s (y_{1,s})$ | $\langle r_s \rangle$ (experimental); semi-major axes, a |
|-----|-----------------|-----------------|--|
| 1 | 25.559 | | |
| 2 | 46.8 | 36.2 | 49.8 (Cardelia) |
| 3 | 67.85 | 57.34 | 59.2 (Bianka), 66.1 (Portia) 69.9 (Rosalind) |
| 4 | 88.87 | 78.37 | 86.0 (Puck), 76.42 (Perdita) 74.39 (Cupid) |
| 5 | 109.86 | 99.36 | 97.736 (Mab) |
| 6 | 130.84 | 120.36 | 129.9 (Miranda) |
| 9 | 193.75 | 183.27 | 190.9 (Ariel) |
| 13 | 277.6 | 267.12 | 266.0 (Umbriel) |
| 21 | 445.27 | 434.79 | 436.3 (Titania) |
| 28 | 591.97 | 581.5 | 583.5 (Oberon) |

 $r_1=25.559$ *kkm* is an equatorial radius of Uranus

The correlation between the shown above results of theoretically derived gravitational wave shells of the Sun and observed experimentally semi-major axes of elliptical orbits of its planets, as well as the correlation between gravitational wave shells of the planets derived theoretically and semi-major axes of their satellites taken from the astronomical data, is quite satisfactory.

It should be noted the similarity of the spectrum of gravitational wave shells of elementary particles (6) and, hence, planetary and satellite orbits in our Solar System with the derived theoretically spectrum of wave shells of atomic and subatomic levels of exchange (e.g., with optical spectra). The difference is in their different, in scale, characteristic frequencies, ω_g and ω_e , related to the mega (gravitational) level and the atomic and subatomic levels, respectively. Please, compare

$$\omega_g = 9.158082264 \times 10^{-4} s^{-1} \quad \text{and} \quad \omega_e = 1.869162559 \times 10^{18} s^{-1}.$$

Elementary particles, in particular, nucleons (protons and neutrons), being extremely small and infinitely large at the same time, in full agreement with the DM (see Part 5), representing thus both micro and mega world simultaneously, are described at both levels by the same wave equation (3). The solutions for micro and mega levels of the Universe are similar in many ways. For example, the equation for the radii of the wave shells at the atomic and subatomic levels

$$r = \tilde{\lambda}_e z_{m,n}, \quad (9)$$

has the same form as Eq. (6) for the radii of the wave shells of the gravitational level. Only one difference is: in (6) there is the wave radius $\tilde{\lambda}_g$, and in (9) $\tilde{\lambda}_e$. This is not surprising, since the exchange interaction of the particles at both levels of the Universe, to which they belong at the same time, is subject to the Universal Law of Exchange (see Eq. (12) in Part 5).

Conclusion

The mysteries of an existing order in an arrangement of the orbits of the planets at certain average distances from the Sun, as well as the orbits of satellites of these planets, are unravelled. As it turned out, the planets and their satellites, mutually influencing each other, move along the orbits formed in discrete regions of wave space in full conformance with the derived spectrum (6) of gravitational wave spherical shells of the particles, from which the Sun and planets of our Solar System are made up.

A theoretical basis for the derivation of the spectrum (6) is the wave approach. Herewith, one should be distinguished once again the following two independent sources in the framework of the WM that led to the spectrum.

(a) The solutions within a theory of the DM, which led to the discoveries of the wave nature of elementary particles and the wave nature of their exchange (fundamental interactions) at all levels of the Universe, including gravitational with the characteristic frequency of the gravitational exchange, $\omega_g = 9.158082264 \times 10^{-4} s^{-1}$.

(b) The radial solutions of the universal (classical) wave equation (3), expressed by the roots of Bessel functions.

Thus, the Wave Model, including theories of the DM and SWM, confirming once again its advantage in comparison with the Standard Model accepted in modern physics, this time in ability to explain the nature of gravity and the phenomena caused by it, can be considered as a real alternative to the latter.

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Part 7

Cosmic microwave background

The next of the important shortcomings of modern physics, to which I would like to turn attention of article readers, is a lack of convincing arguments and, hence, groundlessness of linking the origin of the cosmic microwave background (CMB) radiation to the mystic “Big Bang”.

In 2006 two researchers from the U.S. (John Mather and George Smoot) were awarded the Nobel Prize in Physics. They were the initiators of the project and led a large team of researchers and engineers having implemented the unique project on measuring the CMB radiation. The measurements showed that its spectrum is characterized by a relatively high degree of isotropy (up 0.01%) and almost perfectly matches the spectrum of a blackbody radiation with the temperature of around 2.73 K.

For the first time this radiation was found by radio physicists in 1965. At the same time astrophysicists-theorists, adhering to G. A. Gamow's hypothesis of 1946, and developing it, felt certain to an existence of the CMB radiation in this region of the spectrum because this followed from their favourite hypothesis. Therefore, without thinking twice, they at once unhesitatingly took his hypothesis as the basis for explaining the found radiation. Since then the fantastic hypothesis came to the fore of astrophysics. In accordance with the modern standard cosmological model, the CMB is considered as a residual thermal radiation of continuously expanding and, hence, cooling cosmic space (across the Universe). This is going on allegedly after the hypothetical “Big Bang” of the so-called cosmological 'singularity', a region characterized by infinite density, temperature and curvature; but saying simply, out of nothing!

The “Big Bang”, as is believed resulted in the birth of the Universe, happened (according to the latest estimates) approximately 13.7 billion years ago. An extravagant idea of the Big Bang has received wide publicity. At the present time a bad manner is considered even to question the reality of the hypothetical event allegedly happened in the above mentioned time in the far past. Brainwashing by the media proved so successful that the word “hypothesis” has almost disappeared from circulation. And the majority of innocent people, including children, pupils and students, took for granted (as dogma) that myth.

In the last century theoretical physicists were guided by a strange logic (in Part 1 it has been called the schizophrenic logic, “schizologic”). As soon as experimenters discovered a new phenomenon, theorists immediately put forward fantastic ideas (by the way, this approach is still preserved) instead of calmly study the nature of the phenomenon. As a result, they left so much a mess and have complicated all to such a degree (see, e.g., Parts 1 - 6 of these

notes) that new generations of open-minded physicists would be long examine debris left after them, to clean physics from these.

Sources of electromagnetic radiation in a wide spectral band of frequencies, including optical and microwave, are excited atoms. Among them, following the logic and common sense, without imagination, it was necessary to seek the cause of the CMB radiation. Unfortunately, theorists, confusing physics with science fiction, taking over a dead-end abstract method of virtual physics from their predecessors, continued the construction of the virtual world.

After analyzing the faults of the past and trying to fill the gap arising as a result in physics, and following the logic of common sense, we have gone through the search for truth, excluding myths and fairy-tale scenarios. In this 7th Part of the notes, I will tell readers about the solution revealing, in our opinion, the true origin of the CMB radiation.

So in the case of the CMB we deal with objectively existing radiation in cosmic space, which is equilibrium and almost isotropic, whose wavelength in maximum is about $\lambda = 0.1 \text{ cm}$. This value lies within the maximum of the spectral density of the equilibrium blackbody radiation corresponding to the absolute temperature of about 2.7 K [1].

Assuming that a source of this radiation are likely to be excited atoms, let us ask, which of the elements of the periodic table can actually be considered responsible for the observed microwave radiation in space? No one, apparently, will be surprised that we have chosen hydrogen as the most likely source of the microwave background radiation. Why? Hydrogen is the most abundant element in the Universe (about 92%), being the main constituent of stars and interstellar gas. Therefore, our assumption that hydrogen emits and absorbs not only in optical, but also in the microwave region of the spectrum and, hence, is responsible for the CMB radiation, had a common sense.

We know quite a lot about the emission and absorption spectra of hydrogen, but probably not everything, so our assumption seemed logical and plausible. Hydrogen is the most studied element, however, about its possible radiation in the microwave region of the spectrum has not been even a hint in the literature of physics. Looking ahead one must say that hydrogen, considering by us as an elementary electronic system of the atomic scale, "noises" (like any electronic device on the threshold of sensitivity) while being in the unexcited equilibrium state. But it makes a "noise" in its own way, continuously emitting and absorbing electromagnetic waves of the microwave frequency range. The fact that nobody still did know about it should not be surprising. Do not forget, at the present stage of the development of our civilization, far imperfect, natural sciences, including physics, are still at the beginning stage of the infinite way to knowing nature.

Results of the study of the CMB radiation have given a large impulse for a comprehensive verification of the idea on that hydrogen - the most common element of space - is its only source. In the first stage it was necessary to try to find a single universal formula of the spectra of the hydrogen atom, which implies all its spectral lines currently known from

observations. However, such a problem (like many others, as mentioned in the previous six Parts of this article) could not and cannot be solved in principle in the framework of modern abstract-mathematical theories such as quantum mechanics and elementary particles physics, and in general, by the fitting method as it is done in modern theories of the Standard Model. The solution of the above problem requires a qualitatively another level of the relevant theories and the knowledge of the physical (not abstract mathematical) structure of the atom and its constituent elementary particles, as far as possible close to the truth.

Therefore, we have constructed a new physical theory on the basis of the real postulate. According to which all phenomena and objects in the Universe have a wave nature (with this fact most physicists must agree) and, consequently, their behaviour must obey the universal wave equation (see Part 6, Eq. (3)).

As a result, relying on the solution [2] of the universal (classical) wave equation and the wave Dynamic Model of elementary particles (DM) [3], as well as on the Shell-Wave Model of the atom (SWM) [4], we found that elementary classes of optical spectra in the general case are determined by the Universal Formula of Energy Transitions. Here is its general form:

$$\frac{1}{\lambda} = R \left(\frac{|\hat{e}_p(z_{p,m})|^2 z_{p,1}^2}{z_{p,m}^2} - \frac{|\hat{e}_q(z_{q,n})|^2 z_{q,1}^2}{z_{q,n}^2} \right), \quad (1)$$

where

$$\hat{e}_p(z_{p,s}) = \sqrt{\frac{\pi z_{p,s}}{2}} (J_p(z_{p,s}) \pm i Y_p(z_{p,s})); \quad (1a)$$

$z_{p,m}, z_{q,n}, \dots$ are roots (zeros) of the Bessel functions, $J_p(z_{p,s})$ and $Y_p(z_{p,s})$, i.e., the right solutions of the radial component of the wave equation; R is the Rydberg constant.

As particular cases, the various classes of spectra follow from Eq. (1). For example, for $p=q=0$, zeros of the Bessel functions $J_{0+\frac{1}{2}}(z_{0,s})$ are equal to $z_{0,s} = j_{\frac{1}{2},s} = s\pi$. Hence, at such solutions (roots), we have

$$|\hat{e}_0(z_{0,s})|^2 = 1. \quad (2)$$

Under this condition, Eq. (1) is transformed into the well-known elementary spectral formula of the hydrogen atom

$$\frac{1}{\lambda} = R \left(\frac{1}{m^2} - \frac{1}{n^2} \right). \quad (3)$$

From the universal formula (1) it also follows the low-frequency spectrum generated by the zero (background) wave perturbation [5, 6]:

$$\frac{1}{\lambda} = R \left(\frac{1}{n^2} - \frac{1}{(n + \delta n)^2} \right), \quad (4)$$

where

$$\delta n = \sqrt{\frac{2Rh}{m_0 c}} \cdot \frac{e_p(z_{p,s})}{Z_{p,s}} - \beta_n \frac{r_e^2}{r_0^2} \sqrt{\frac{2Rh_e}{m_0 c}} \cdot \frac{e_m(z_{m,n})}{Z_{m,n}} \quad (4a)$$

is the relative measure, $\delta n = \frac{\delta r}{r_0}$, of the background perturbation δr of the orbital (Bohr)

radius r_0 at the zero level of exchange. The remaining parameters are: r_e is the theoretical radius of the wave spherical shell of an electron; m_0 is the associated mass of a proton; c is the basis speed of the wave exchange at the atomic and subatomic levels, equal to the speed of light in vacuum; $h_e = 2\pi m_e v_0 r_e$ is the orbital action of an electron (analogous to the Planck constant h) caused by its rotation along own center of the mass with the Bohr speed v_0 ; β is the constant factor ($\beta \geq 1$, depends on the type of the transition, see Tables 1 and 2 below). It should be noted that r_e , h_e , m_0 , and c (just its meaning) are unknown earlier physical parameters originated from the DM.

For $p = m = 0$ the zero of the second kinetic wave shell is $z_{0,2} = y_{0,2} = 3.95767842$. Substituting the values of all above parameters into (4), we obtain that the most probable perturbation of the steady state ($n = 1$) of the hydrogen atom at the zero level of exchange (interaction) causes the equilibrium radiation of the wavelength

$$\lambda = 0.106315 \text{ cm} \quad (5)$$

The zero level of the wave exchange (interaction) with environment is not perceived visually and integrally characterized by the absolute temperature of the zero exchange. It exists as a standard energetic medium in the Universe. Actually, the wave (5) is within an extremum of the spectral density of the equilibrium cosmic microwave background. An absolute temperature of the zero level radiation with this wavelength is

$$T = \frac{0.290(\text{cm} \times K)}{\lambda} = 2.72774 \text{ K} \quad (6)$$

The resulting value is fully consistent with the temperature of the so-called "relict" background radiation measured by NASA's Cosmic Background Explorer satellite (COBE) (and also by other apparatuses) to four significant digits ($2.728 \pm 0.002 \text{ K}$) [1]. Accordingly, the almost complete coincidence of both values indicates that the measured cosmic microwave background is not a "relict" (direct proofs of this will never be), but rather it is a natural background formed by the equilibrium zero (at a noise level) emission of hydrogen atoms distributed in the cosmic space.

The microwave background spectrum of hydrogen atoms has the form of the Planck distribution (subject to Planck's law of blackbody radiation). We have considered this feature of the spectrum in [2, 5].

For the sake of completeness of the relevant information, the data calculated by the formula (4) are presented below in Tables 1 and 2 (taken from the author's work [6]).

Table 1. Terms, $1/\lambda$, of the background spectrum (4) of the hydrogen atom; $n = 1$ [6].

| s | $Z_{p,s}$ | $Z_{m,n}$ | β_n | $1/\lambda, cm^{-1}$ Eq. (4) | λ, cm | T, K | T_{exp}, K [1] |
|-----|------------|--------------|-----------------------|------------------------------|-----------------|----------------|----------------------|
| 1 | $y_{0,1}$ | $y'_{0,1}$ | $\beta_1=1.0$ | 41.751724 | 0.023951 | 12.10805 | |
| 2 | $y_{0,2}$ | $y'_{0,1}$ | $\beta_1=1.0$ | 9.40602023 | 0.106315 | 2.72774 | 2.728 ± 0.002 |
| | $j'_{0,2}$ | $j'_{1/2,1}$ | $\beta_1=1.203068949$ | 9.67863723 | 0.103320 | 2.80680 | |
| 3 | $y_{0,3}$ | $y'_{0,1}$ | $\beta_1=1.0$ | 5.240486 | 0.190822 | 1.51974 | |
| | $j'_{0,3}$ | $j'_{1/2,1}$ | $\beta_1=1.203068949$ | 5.255841 | 0.190265 | 1.52419 | |

Таблица 2. Terms, $1/\lambda$, of the background spectrum (4) of the hydrogen atom; $n = 2$ [6].

| s | $Z_{p,s}$ | $Z_{m,n}$ | β_n | $1/\lambda, cm^{-1}$ Eq. (4) | λ, cm | T, K |
|-----|------------|--------------|-----------------------|------------------------------|-----------------|---------|
| 1 | $y_{0,1}$ | $y'_{0,1}$ | $\beta_2=1.0$ | 5.219748 | 0.191580 | 1.5137 |
| 2 | $y_{0,2}$ | $y'_{0,1}$ | $\beta_2=1.0$ | 1.1758681 | 0.850436 | 0.3410 |
| | $j'_{0,2}$ | $j'_{1/2,1}$ | $\beta_2=1.018671584$ | 1.211154 | 0.825659 | 0.3512 |
| 3 | $y_{0,3}$ | $y'_{0,1}$ | $\beta_2=1.0$ | 0.6550701 | 1.526554 | 0.18997 |
| | $j'_{0,3}$ | $j'_{1/2,1}$ | $\beta_2=1.018671584$ | 0.6582849 | 1.519099 | 0.1909 |

The results presented here, along with others not mentioned above the unique data, indicate that the source of the microwave background radiation detected in space really is hydrogen - the most abundant element in the Universe, the basic element of the stars and interstellar gas.

The anisotropy of the CMB in different directions in the sky, observed experimentally, consists of the small temperature fluctuations ($\pm 0.00335 K$) in the distribution of the temperature background corresponding to the blackbody radiation. Obviously, they are associated with fluctuations in the distribution of hydrogen in space, correlating with the heterogeneity of the distribution of matter in it.

Thus, the Dynamic Model of elementary particles and the Shell-Wave Model of the atom led us to the discovery of the spectrum of the microwave background radiation of hydrogen atoms (4). Now this discovery is among the most important facts disproving the "Big Bang" hypothesis [7].

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Part 8

The neutron magnetic moment

According to the theory of quantum electrodynamics (QED), the neutron, as a neutral particle, should not have a magnetic moment. However, experience shows that it is not so. The neutron has a magnetic moment; its value (data of 2006) is of 1.46 times less than the magnetic moment of the proton and opposite in sign (direction),

$$\mu_p = 1.410606662(37) \cdot 10^{-26} \text{ J} \cdot \text{T}^{-1}, \quad \mu_n = -0.96623641(23) \cdot 10^{-26} \text{ J} \cdot \text{T}^{-1}. \quad (1)$$

It was a surprise to physicists. An origin of the magnetic moment of the neutron was/is not clear; therefore this moment has been called "anomalous". Since the QED theory has proved incapable to resolving the problem, attempts for its solution were/are undertaken in quantum chromodynamics (QCD). According to the QCD the anomalous magnetic moment of the neutron (and proton) occurs due to hypothetical particles, quarks, allegedly constituents of nucleons. Fractional charges are ascribed to these mystic particles in the QCD. Besides, for explaining the origin of magnetic moments of nucleons, the QCD uses the concept of "virtual particles" adopted from the QED. Fallacy of this notion has been discussed in Part 3 of these notes.

The proton and neutron are considered in the QCD as consisting of 3 quarks of two kinds, up and down ($p = uud$ and $n = ddu$), and 3 massive photons called gluons. According to the QCD, the strong interaction of hadrons (protons and neutrons belong to this class of elementary particles) is due to their mutual transformation. Namely, the neutron, emitting a negative virtual π -meson, transforms for a time in the proton. So that, the neutron magnetic moment is seen as the result of charge redistribution due to appearance and disappearance of the negative-charged virtual π -mesons. The latter are regarded as a specific kind of the pair of quark-antiquark. Similarly, the proton virtually "dissociates" at the certain time into a neutron and a positive-charged virtual π -meson, and the "anomaly" of its magnetic moment is a result of the charge redistribution as well. Thus, in accordance with the QCD, the charge redistribution of protons and neutrons, continuously occurring in time, generates the magnetic moments of the nucleons (as well as their quadrupole moments).

A modern trend in attempts to describe magnetic moments of nucleons is the use of three-quark model of nucleons with the *up*, *down*, and *strange* quarks ... However, we will not go here into the wilds of this theory, the logical end of the construction of which is not seen. Despite numerous attempts by QED and QCD to explain the magnetic moment of the

nucleons, the problem remains open. Physicists seek new ways for the less complex solutions. To the point, I would like to recall the readers that the solution of the problem on the origin of magnetic moments of nucleons is exceptionally important, because, in essence, with its solution, as a consequence, it is solved the fundamental problem of physics on the structure of nucleons. Therefore now, bound principally to the quark model of nucleons and having no advancements in solving the above problem, QCD theorists are trying at least to adjust by different ways the structure of nucleons to coordinate it to the ratio of the magnetic moments of the neutron and proton, μ_n / μ_p , known from experience (1).

As for the calculation of absolute values of the magnetic moments with a reasonable accuracy, this problem is not solved in the framework of the QCD. And, in general, in our opinion, the problem is unsolvable in principle in the QCD.

Why do theorists still cannot derive the magnetic moments of nucleons (proton and neutron)? In my opinion, the answer is simple: because their theories are not adequate to the physical reality, as virtual ones in essence. For this reason, in particular, a complete theory of strong interactions cannot be built as well. As clearly demonstrated in the previous 7 Parts of this article, all difficulties in solving the fundamental problems of physics are due to the abstract mathematical essence of the modern theories limited by the framework of the Standard Model (SM). A lack of knowledge about the structure of elementary particles as possible close to reality, i.e., ignorance of their physical structure, is abnormal state in physics. As a result of the abstract mathematical essence of the SM, it is ignorance of the origin of the mass and the nature of charge of elementary particles, as well as a lack of awareness about other real fundamental parameters inherent in the atomic and subatomic levels of the Universe. The abstract mathematical essence of modern theories makes it impossible in principle to solve the problem of the magnetic moments of nucleons without arbitrary abstract speculations and adjusting.

It should be noted that the problem of the mass and charge of elementary particles has been solved some time ago beyond the SM. But the saddest thing in this case is that this fact, though known and not denied, but, unfortunately, still is not loudly recognized. It is persistently overlooked by the official physics, as if the solution has not been found yet. The reason of silence about these discoveries is that the above mentioned solution was found not in the framework of generally accepted mainstream theories, but on the basis of an alternative theory, moreover, semiclassical. As everyone knows, a slighting relation of scholars in the official physics is characteristic to such theories. Ignoring the unique solutions, paying no heed to them, suppression of the achievements (which are at the level of scientific discoveries) of scientists who is not working in leading scientific schools, and not related to these, unfortunately, is a flawed standing practice in official physics. As a result, the abstract mathematical adjustment is still the main method of modern theoretical physics used for the accomplishment of a correspondence of its theories to the experiment.

From the preceding 1-7 Parts of the notes, it follows that at the transition from abstract mathematical theories of the SM to physical ones, in particular, to the theories of the Wave

Model (WM), at once the simple logically consistent solutions are found for all cases without exception. For example, such a solution was achieved in the case when we have dealt with the "anomalous" magnetic moment, referred to in Part 3. In this Part of the notes, we will demonstrate the validity of the WM again, in this case on an example of the derivation, on its basis, the magnetic moment of the neutron [1].

The true structure of the neutron is covered by a profound mystery. But one of the main features, well-established from experience, is that free neutrons are unstable and decompose on the average of approximately during 885.7 s into a proton and an electron, and that the mass of the neutron is a combination thereof. It is assumed that during the lifetime, the β -decay of free neutrons occurs following the scheme: $n \rightarrow p + e^- + \tilde{\nu}_e$. But there is no experimental evidence that this process produces an antineutrino. It is impossible to register such a hypothetical event. Therefore, the above scheme of the β -decay of free neutrons is inconclusive. There are alternative schemes. For example, it is believed that the true mass of a neutron is different from the currently accepted and that a free neutron during its lifetime initially absorbs a neutrino, and only then decomposes following the scheme: $n + \nu \rightarrow p + e^-$ [2] ... But let's not go into the details of the β -decay of the neutron, it is not so important here. The main thing for us is an initial condition for our solution of the problem on the neutron magnetic moment, that is, that the neutron is a binary proton-electron system.

Based on the postulate on the wave nature of the Universe, of all processes and objects in it, we came to the wave theory of elementary particles called the Dynamic Model (DM) [3, 4]. In accordance with the DM, the nucleons, a neutron and a proton, as well as any other fundamental particle, are dynamic wave microformations, reminiscent of wave resonance structures caused by the interference of waves in a three-dimensional spherical space.

With use of the DM theory, we have solved in recent years a number of the problems of modern physics, including a problem of the magnetic moments of nucleons. In the case of the neutron, in accordance with the DM, we deal with a coupled wave system. And all peculiarities of the wave motion of the system as a whole and its components separately have to be taken into account that was realised in our works [1].

The incessant wave motion and, accordingly, the unceasing wave exchange causes oscillations of the wave spherical shells and a center of the mass of the particles, including electrons and nucleons, with the amplitude defined by the equation

$$A_s = A \frac{\hat{e}_l(kr)}{kr}, \quad (1)$$

where

$$\hat{e}_l(kr) = \sqrt{\pi kr/2} (J_{l+1/2}(kr) \pm iY_{l+1/2}(kr)); \quad (1a)$$

$J_{l+1/2}(kr)$ and $Y_{l+1/2}(kr)$ are the Bessel functions; k is the wave number; $z_{p,s} = kr$ are roots (zeros and extremes) of the Bessel functions [5].

From Eq. (1) it follows, in particular, that a nucleon, being a dynamic wave microformation, as a wave node of the standing spherical waves, oscillates, as a whole, with the amplitude

$$r_m = \tilde{\lambda}_e \sqrt{\frac{2Rh}{m_0 c}}, \quad (2)$$

where

$$\tilde{\lambda}_e = \frac{c}{\omega_e} \quad (2a)$$

is the fundamental wave radius, corresponding to the fundamental frequency ω_e of the atomic and subatomic levels; R is the Rydberg constant; h is the Planck constant; m_0 is the associated mass of a proton; c is the basis speed of the wave exchange at the atomic and subatomic levels equal to the speed of light in vacuum.

Small perturbations of the amplitude (2) are primarily due to the fact that the wave spherical shell simultaneously oscillates with respect to the center of the mass of a nucleon. These small deviations, defined by (1), are

$$\delta r_1 = \frac{r_0}{z_{0,s}} \sqrt{\frac{2Rh}{m_0 c}}, \quad (3)$$

where r_0 is the radius of the wave shell of a nucleon equal to the Bohr radius. The deviations with the amplitude (3), superimposed on the deviations with the amplitude (2), change (modulate) the amplitude of the oscillatory motion of a nucleon.

In addition, in the case of the neutron, we should take into account the perturbations of the next order of smallness related to the oscillations of the center of the mass of the electron, as a whole, relative to the center of the mass of the neutron,

$$\delta r_2 = \frac{r_e}{z_{0,s}} \sqrt{\frac{2Rh_e}{m_0 c}}. \quad (4)$$

Here $h_e = 2\pi m_e v_0 r_e$ is the proper action of the electron (analogous to the Planck action $h = 2\pi m_e v_0 r_0$) under the condition that the limiting oscillatory speed of the wave shell of the electron is equal to the Bohr speed v_0 ; r_e is the radius of the wave spherical shell of the electron, calculated in the DM; m_e is the associated mass of the electron.

Thus, we have all main constituents of oscillatory displacements caused by perturbations inherent in the neutron considered as a coupled proton-electron wave microsystem. Now for further consideration one needs to recall some basic definitions. The wave motion of an elementary particle, as a central object of the field, generates an elementary longitudinal (electric) moment caused by the displacement r ,

$$p_E = qr, \quad (5)$$

and corresponding to it the transversal (magnetic) moment,

$$\mu = \frac{v}{c} q r. \quad (6)$$

Here $q = m\omega_e$ is the exchange charge of a particle of the associated mass m , v is the oscillatory speed of its wave shell. The absolute value of the exchange charge of an electron represents a minimal quantum of the rate of exchange, $e = m_e\omega_e$. In the case of a free neutron, regarded as a coupled proton-electron wave system being in an excited state (in contrast to the hydrogen atom), the exchange of a spherical wave field of a proton and a transversal wave field of an electron is unstable and mutually balanced only for a short period of the neutron lifetime.

Therefore, the magnetic moment of a free neutron is measured during its lifetime, when the neutron is in a metastable very excited (threshold with respect to its decay) energy state. For this reason, we choose for the calculation one of the roots (zeros) of Bessel functions corresponding to the higher wave radial shells characteristic for excited states. We selected the value of the root $z_{0,s} = y_{0,12} = 35.34645231$ [5], corresponding to the solution of the radial component of the wave equation for one of the higher kinetic wave shells of the neutron. We also assume that $v = v_0$, and the exchange is realized by the elementary quanta of exchange e , i.e., the exchange charge $q = e$ (in absolute value).

Using the above parameters and taking into account all 3 components of the displacement r (Eqs. (2) - (4)), we arrive at the following theoretical formula in an expanded form that allowed us to perform the precise calculation of the neutron magnetic moment μ (6):

$$\mu_n(th) = \frac{ev_0}{c} \left[\left(\lambda_e + \frac{r_0}{y_{0,12}} \right) \sqrt{\frac{2Rh}{m_0c}} + \frac{r_e}{j_{0,12}} \sqrt{\frac{2Rh_e}{m_0c}} \right]. \quad (7)$$

After substituting the numerical values of all above parameters into (7) (all the data and details of the calculation are given in [1]), with due account the sign of the exchange charge, we obtain

$$\mu_n(th) = -0.96623513 \times 10^{-26} \text{ J} \cdot \text{T}^{-1}. \quad (8)$$

This value with high accuracy coincides with the recommended (CODATA, 2006) value of the neutron magnetic moment:

$$\mu_{n,CODATA} = -0.96623641(23) \times 10^{-26} \text{ J} \cdot \text{T}^{-1} \quad (9)$$

Thus, the next fundamental problem, unsolvable in the Standard Model, was solved in the framework of the Wave Model. From this fact it follows that we must recognize the validity of the DM theory on which basis this and other solutions were implemented. The

corresponding solution performed with use of the DM for the proton magnetic moment will be discussed further in 9th Part of the article.

As has been mentioned at the beginning, the solution of the problem on the origin of the magnetic moments of nucleons solves in principle the major fundamental problem of physics on the structure of nucleons. In this regard, our arguments in favour of the wave nature of elementary particles, including nucleons, and hence, in favour of the wave nature of atoms, have obtained the firm proof to their validity. And as an important consequence, the conclusion drawn in Part 3 about erroneousess of the modern nuclear model of atoms is confirmed as well.

The rigorous theoretical derivation of the neutron magnetic moment presented here, performed for the first time in physics, testifies once again to the fact that we have chosen a conceptually correct and logically consistent way to solving the fundamental problems of physics, unsolvable in principle in the framework of abstract mathematical theories of the Standard Model.

Various aspects of the semiclassical wave approach, which were not touched upon here, one can find in previous 1-7 Parts of the notes and in the references.

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Part 9

The proton magnetic moment

In this Part of the notes I will describe briefly, as it was done in the previous eight Parts, only about major aspects of the derivation of the proton magnetic moment accentuating attention on the logic and meaning of certain actions undertaken in this case. All the details of the derivations are contained in the paper [1] available online on the Internet. The indicated paper is a continuation of the work devoted to the theoretical derivations of the magnetic moments of an electron [2, 3] and a neutron [4], and the derivation of the Lamb shift [5], performed in the framework of the Wave Model (WM) by a theory of the Dynamic Model (DM) of elementary particles [3, 6]. The material presented here is closely related with the previous Part 8; therefore one should familiar with its contents before to begin reading this Part.

The charges and their behaviour are responsible for the magnetic properties of elementary particles. But what solution on the magnetic moments of the particles can be expected from the theories of the Standard Model (SM) dominated currently in physics, which do not know the nature of the charges, what is the charge? The same ignorance relates to the origin of the mass of the particles. The mass and the charge are the main parameters of elementary particles of which all the physical bodies consist; they are the primary fundamental concepts of physics. These parameters are, unfortunately, an unfathomable mystery, *terra incognita*, for modern physics with its SM.

Therefore, all the attempts of physicists in the framework of the SM, by means of quantum electrodynamics (QED) and quantum chromodynamics (QCD), in fact, blindly, to explain the "anomalous" magnetic moments of nucleons caused by the charges, on the nature of which they know nothing, are nonsensical and, of course, doomed to failure. Please, read in this regard Part 3, in which it was shown what efforts were required to QED theorists to fit to the experiment the "anomalous" magnetic moment of an electron that they "derived" at last for more than half a century with the high accuracy, about what they are so proud today.

About the shortcomings of the SM every physicist knows, but the official physics is not going to abandon it, trying all the time to somehow improve this model. However, the embellishment of the rotten foundation and patching holes in it aggravates the stalemate and stagnation in theoretical physics in even more extent. In construction, for example, no one would do so, but would to pull down the old foundation (or leaving it to rot on further) and all the forces would give up on building a new one.

Currently, there appear works in which the realistic approach is dominated. This approach is connected with a return to clear physical images and ideas inherent in classical physics. The

classical approach was arbitrarily and hastily neglected beginning from the last century, for the sake of the quantum theory appearing in that time. A thorough analysis of the foundations of physics [7] showed that the possibilities of classical physics are still far from exhausted. As a result of the analysis, in the framework of the wave approach (the WM), the wave theory of elementary particles (the DM) [3, 6] was developed. Its solutions proved to be very effective, as evidenced, in particular, by the results presented in all previous Parts of this analytical paper.

Thus, the derivation of the proton magnetic moment is impossible without the knowledge of the true nature of charges. Therefore, let me first to present in this regard some necessary notions and definitions related to the discovery (in the DM) the origin of the mass and the nature of charges.

In accordance with the DM, the rest mass of elementary particles does not exist, and the mass, that we take for granted, it turns out, has the *associated wave nature*, and is a measure of exchange (interaction). The concept of "exchange" instead of "interaction" is one of the fundamental concepts of the DM. Two types of exchange, as two opposite sides of the interaction between the particles and the surrounding field, are distinguished: *longitudinal* and *transversal*. *Longitudinal exchange* is characteristic for spherical fields of particles in rest and motion. *Transversal exchange* is inherent in cylindrical fields of moving particles.

Intensity (rate) of the wave mass exchange determines the *exchange charges*. Their dimensionality is $g \times s^{-1}$. Exchange charges are responsible for the electric and magnetic properties of particles. Thus, the so-called "electric" and "magnetic" charges inherently relate to the wave exchange of particles; therefore the charges are called the "exchange" ones. According to the DM, there are two types of exchange charges corresponding to two types of exchange: *longitudinal* ("electric") exchange charges and *transversal* ("magnetic") exchange charges. The transversal charge arises when moving particles. Thus, so far unsolved mystery of the nature of the charges ("electric" and "magnetic") revealed, finally, in the DM.

Now, after such a necessary introduction, we can proceed directly to the derivation of the proton magnetic moment. For this, we should first to remind some features of the neutron because in both (proton and neutron) cases, we use the same approach and, hence, the same equations. With this, some fragments of the solutions are valid for both.

The neutron is considered in the DM as a coupled proton-electron wave system, and as a whole it is an electrically neutral microformation. In a free state (see Part 8), the neutron is unstable. Due to the exchange charges, longitudinal and transversal, the continuous equilibrium wave exchange (interaction) between the longitudinal and transversal fields of constituent particles of the neutron (proton and electron) is implemented in it. The longitudinal positive exchange charge of the basis (proton) and the transversal negative exchange charge of the electron moving in the system cancel each other. Consequently, being a neutral particle, the neutron as a whole does not generate in its motion the

transversal exchange charge. But as in the case of a hydrogen atom, a negative exchange charge of the electron causes the negative magnetic moment of the neutron.

A free proton has the longitudinal (“electric”) exchange charge equal in magnitude to the elementary (minimal) quantum of the rate of mass exchange. The longitudinal exchange charge of the proton is not compensated, in contrast to the neutron; and, therefore, in its motion the proton generates additionally the transverse charge, which together with its not compensated longitudinal charge is responsible for the magnetic properties. Both the wave exchanges and the corresponding exchange charges, longitudinal and transversal, are responsible for the existence of the magnetic moment of the proton.

Thus, the total exchange charge of the proton, q , is determined by the positive not compensated exchange charge, $+e$, and the additional, associated, transversal exchange charge, Δe_p :

$$q = +e + \Delta e_p. \quad (1)$$

The derivation of the proton magnetic moment repeats the derivation of the neutron magnetic moment [4] up to the stage related to the contribution caused by the electron; therefore, there is no need to repeat it here. Taking into account Eq. (1) and two first terms of Eq. (7) (from Part 8) related to the neutron magnetic moment, which are valid for the proton, we obtain the following theoretical formula for the total magnetic moment $\mu_p(th)$ of the proton:

$$\mu_p(th) = \frac{(e + \Delta e_p) \upsilon_0}{c} \left(\tilde{\lambda}_e + \frac{r_0}{z_{0,s}} \right) \sqrt{\frac{2Rh}{m_0 c}}. \quad (2)$$

The values of all the parameters in the formula (2) are known, except of Δe_p , and are provided in Part 8. The transversal charge, Δe_p , is unknown so far for modern physics the physical parameter, its nature is considered in detail in [1, 7]. The transversal exchange is directly related to the longitudinal exchange. Both above exchanges are fundamental concepts of the DM, they reflect the true regularities of nature.

The exchange charge in the DM, as a measure of the rate of mass exchange (interaction), is the product of the associated mass m and fundamental frequency ω_e of the exchange at the subatomic and atomic levels ($\omega_e = 1.869162534 \times 10^{18} \text{ s}^{-1}$):

$$q = \frac{dm}{dt} = m\omega_e, \quad (3)$$

Hence, the transversal exchange charge Δe_p is defined by the following equality,

$$\Delta e_p = \Delta m_p \omega_e, \quad (4)$$

where Δm_p is the additional associated (transversal) mass of the proton. It is calculated, according to the DM, by the following formula

$$\Delta m_p = \frac{4\pi r_0^2 l \varepsilon_0}{1 + 4k_e^2 r_0^2}, \quad (5)$$

where

$$l = \frac{e}{2\pi r_0 c \varepsilon_0} = 1.708182574 \cdot 10^{-12} \text{ cm} \quad (5a)$$

is the length of an elementary (minimal) part of the cylindrical surface of the cylindrical (transversal) field around a trajectory of the moving proton, corresponding to an elementary transversal magnetic charge-flow at the level of the Bohr radius, and at the speed of exchange equal to c ; $e = 1.702691582 \cdot 10^{-9} \text{ g} \cdot \text{s}^{-1}$ is the charge of exchange of the proton with environment equal, in absolute value, to the electron exchange charge (i.e., to the elementary quantum of the rate of mass exchange); r_0 is the Bohr radius; $\varepsilon_0 = 1 \text{ g} \cdot \text{cm}^{-3}$ is the absolute unit density; $k_e = \omega_e / c$ is the fundamental wave number.

Calculations by the formulas (4) and (5) give the following values for the associated additional (transverse) mass, Δm_p , and the associated extra (transversal) exchange charge of the proton, Δe_p :

$$\Delta m_p = \frac{4\pi r_0^2 l \varepsilon_0}{1 + 4k_e^2 r_0^2} = 4.187602162 \cdot 10^{-28} \text{ g}, \quad m_0 = 1.672621637(83) \cdot 10^{-24} \text{ g} \quad (6)$$

$$\Delta e_p = \Delta m_p \omega_e = 7.827309069 \cdot 10^{-10} \text{ g} \cdot \text{s}^{-1}, \quad e = 1.702691582 \cdot 10^{-9} \text{ g} \cdot \text{s}^{-1} \quad (7)$$

For comparison, to the right, there are shown the associated (longitudinal) mass of the proton, m_0 , and the value of the elementary exchange charge, $+e$. Thus, the total exchange charge of the proton wave shell with the surrounding space is

$$q = e + \Delta e_p = 2.485422489 \cdot 10^{-9} \text{ g} \cdot \text{s}^{-1}. \quad (8)$$

We now can return to the formula (2). Similarly as in the case of theoretical derivation of the neutron magnetic moment, we choose solutions of Bessel functions near the 12th wave shell. Because of greater uncertainty we take the average of two adjacent roots of $z_{0,s}$: $a'_{0,11} = 32.95638904$, equal to the extremum of the 11th potential wave spherical shell, and $y_{0,12} = 35.34645231$, equal to the zero of the 12th kinetic wave shell [8]. Under these conditions Eq. (2) takes the following detailed form:

$$\mu_p(th) = \frac{(e + \Delta e_p) \upsilon_0}{c} \left(\tilde{\lambda}_e + r_0 \frac{(a'_{0,11} + y_{0,12})}{2(a'_{0,11} y_{0,12})} \right) \sqrt{\frac{2Rh}{m_0 c}}, \quad (9)$$

where $\upsilon_0 = \alpha c = 2.187691254 \cdot 10^8 \text{ cm} \cdot \text{s}^{-1}$ (α is the fine-structure constant [9]). After substituting the numerical values we obtain:

$$\begin{aligned} \mu_p(th) &= (1.397094734 + 0.0135137738) \times 10^{-26} \text{ J} \cdot \text{T}^{-1} = \\ &= 1.410608508 \times 10^{-26} \text{ J} \cdot \text{T}^{-1} \end{aligned} \quad (10)$$

The experimental value (recommended by CODATA in 2006) is:

$$\mu_{p,CODATA} = 1.410606662(37) \cdot 10^{-26} \text{ J} \cdot \text{T}^{-1} \quad (11)$$

We see a fairly high accuracy (up to the 5th decimal) of coincidence of the calculated value (10) and the averaged experimental value (11) for the proton magnetic moment. The absolute agreement between two variables (theoretical and experimental), up to the last decimal places, one can easily achieve by introducing an empirical coefficient $1/\beta$ for the second term in (9). Such an action is quite acceptable, since by this way we can adjust the possible uncertainty which could naturally arise from the averaging of weight contributions of each of the two roots of the Bessel functions in (9) (corresponding to the chosen wave shells).

Assuming $\beta = 1.000136546$, we get the absolute coincidence of the calculated and experimental values of the proton magnetic moment:

$$\mu_p(th) = \frac{(e + \Delta e_p) \upsilon_0}{c} \left(\tilde{\lambda}_e + r_0 \frac{1}{\beta} \frac{(a'_{0,11} + y_{0,12})}{2(a'_{0,11} y_{0,12})} \right) \sqrt{\frac{2Rh}{m_0 c}} = 1.410606662 \times 10^{-26} \text{ J} \cdot \text{T}^{-1}. \quad (12)$$

Thus, for the first time in physics, the theoretical derivation of the proton magnetic moment has been realised, similarly as for the neutron (see Part 8), moreover, with absolute accuracy and without the involvement of virtual concepts of the QED and QCD theories. This proven to be possible theoretically owing to the Dynamic Model - a new physical theory - the wave theory of elementary particles that takes into account the wave structure and behaviour of elementary particles.

The accurate derivation of the proton magnetic moment in the DM, impossible in the framework of the SM, confirms once again the advantage of the wave approach developed by the author. There proved the reality of the fundamental discoveries made in the DM, such as: (a) the wave associated nature of the mass of elementary particles, and (b) the wave nature of the exchange charges ("electric" and "magnetic"), and (c) the values of the fundamental frequencies at which the exchange (interaction) with other particles and the environment occurs at subatomic and atomic, and gravitational levels. The charges, regarded

in physics as “electric” and “magnetic”, represent the rate (intensity, power) of the wave mass exchange, longitudinal and transversal, respectively, that is reflected in their true dimensionality of $g \times s^{-1}$.

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Part 10

The fundamental period-quantum of the Decimal Code of the Universe

Adhering to the dialectical philosophy and dialectical logic, we consider the Universe as the Material-Ideal System. Accordingly, in such a system must be not only material, physical laws, but also the laws of an ideal facet of the Universe, ideal laws [1-3]. We call them the Laws of the Second Kind, thereby distinguishing them from ordinary physical (material) laws, which we attribute to the Laws of the First Kind.

In this Part we discuss one of the fundamental phenomena existing in the Universe, unknown up till now to "modern" physics, related to the aforementioned Second Kind Laws, to which, as we assume, all physical phenomena are subject. This is the fundamental law of nature, that we discovered, related to one of the ideal fields (in opposite to physical) of the Universe, namely, to the dialectical numerical field [1]. Numerical fields, including a binary dialectical numerical field, are typical ideal fields of the Universe.

Physics uses the absolute, reference, time t , which represents an ideal mathematical time of an imaginary absolute uniform motion. It is defined by the formula

$$t = \frac{l}{v}. \quad (1)$$

The real (physical) time as a measure of pure rest-motion is determined by the similar way as it is done for the reference time (1) [4]. However, the displacement in the numerator of the formula of the physical time must be a complex wave function, which reflects the dual potential-kinetic nature of the movement. Take for example the wave function

$$\hat{\Psi} = \hat{R}(r)\Theta(\theta)\hat{\Phi}(\varphi)\hat{T}(t) = \hat{\phi}(r, \theta, \varphi)\hat{T}(t). \quad (2)$$

It satisfies the universal wave equation

$$\Delta\hat{\Psi} - \frac{1}{c^2} \frac{\partial^2 \hat{\Psi}}{\partial t^2} = 0. \quad (3)$$

This equation contains a wealth of information about the structure and behaviour of physical objects that have a wave nature, and about physical processes occurring in them in space and time [3]. In form and content, Eq. (3) is the mathematical expression of the inseparable bond of the fields of material space with an ideal field of the physical time. The time function $\hat{T}(t)$ (its simplest form is $\hat{T}(t) = e^{\pm i\omega t}$) expresses, with use of the variable t of absolute mathematical time, the physical periodical time field.

Thus, the physical time of harmonic oscillations \hat{t} is defined as the ratio of the potential-kinetic displacement $\hat{\Psi}$ to the modulus of the potential-kinetic speed v :

$$\hat{t}(t) = \frac{\hat{\Psi}}{v} = \frac{ae^{i\omega t}}{\omega a} = t_e e^{i\omega t} = t_e (\cos \omega t + i \sin \omega t), \quad (4)$$

where

$$t_e = \frac{1}{\omega} = \frac{T}{2\pi} \quad (5)$$

is the modulus of the potential-kinetic time. The time period is $T = 2\pi t_e$. The modulus of the potential-kinetic time t_e represents the radius of a time circumference T . All details about the binary numerical field of dialectical physics can be found, in particular, in [5-7] available online on the Internet.

When $t_e = 1$, we come to a unit (absolute) time radius. Hence, when the basis of numbers is the number e , i.e., the base of natural logarithms, the absolute time period T , corresponding to the unit time radius t_e , is $T = 2\pi$. In this case Eq. (4) takes the form,

$$\hat{t}(t) = \hat{1}_e(t) = e^{i\omega t} = \cos \omega t + i \sin \omega t. \quad (6)$$

The lower index indicates the unit base e , in which all parameters are presented (usually it is omitted). Thus, we have a time circle $T_e = 2\pi$ with a time radius (vector) of the unit length, $t_e = 1$, uniformly rotating with the absolute time angular velocity $\omega_e = 1$.

The above presented absolute parameters of time (t_e , T_e , and ω_e) are zero-dimensional measures, so they are universal, common to all minds on any planetary system in the Universe (regardless of the time measurement methods taken there).

An appearance of the concept of time is equally and inevitable everywhere in the Universe. It is connected with the circular motion of the planets in stellar systems and, consequently, due to cyclic processes in them resulting in the fully-formed proper biological rhythm of their reasonable creatures. Let us remember in this regard the first sundials of our distant ancestors.

In the transition from the base of natural logarithms e to an arbitrary basis B (e.g., octal or decimal, etc.), the absolute radius of the unit time is saved, that is, $t_B = t_e = 1$ and (see (6))

$\hat{1}_B(t) = B^{i\omega_B t}$, in the basis B , is equal to $\hat{1}_e(t) = e^{i\omega t}$ in the basis e . Thus, at any basis B , we have

$$\hat{1}_B(t) = \hat{1}_e(t) \quad \text{and} \quad B^{i\omega_B t} = e^{i\omega t}, \quad (7)$$

where ω_B is the absolute time angular velocity in an arbitrary basis B . The following elementary mathematical relations are valid for Eq. (7):

$$i\omega_B t \ln B = i\omega t, \quad \text{or} \quad \frac{i\omega_B t}{\log_B e} = i\omega t. \quad (8)$$



Considering (6) - (8), the rotation of the unit time vector (6) in an arbitrary basis B takes the following general form:

$$\hat{1}_B(t) = e^{\frac{i\omega_B t}{\log_B e}} = \cos\left(\frac{\omega_B t}{\log_B e}\right) + i \sin\left(\frac{\omega_B t}{\log_B e}\right). \quad (9)$$

For the decimal basis, $B = 10$, we arrive at the following expression:

$$\hat{1}_B(t) = 10^{i\omega_{10} t} = e^{\frac{i\omega_{10} t}{\lg e}} = \cos\left(\frac{\omega_{10} t}{\lg e}\right) + i \sin\left(\frac{\omega_{10} t}{\lg e}\right). \quad (10)$$

Here ω_{10} is the absolute time angular velocity in the decimal basis.

The period T of the exponential function (6), $e^{i\omega t} = \cos \omega t + i \sin \omega t$, is equal to 2π , i.e.,

$$T_e = \omega_e t = 2\pi.$$

The period of the exponential function $e^{\frac{i\omega_{10} t}{\lg e}}$ (10) (as any exponential function) is equal to 2π as well, i.e.,

$$T_e = \frac{\omega_{10} t}{\lg e} = \frac{T_{10}}{\lg e} = 2\pi.$$

Hence, the unit time circles in the two bases, 10 and $e=2.71828\dots$, are related by the following equalities,

$$T_{10} = \omega_{10} t = T_e \lg e \quad \text{or} \quad T_{10} = \omega_{10} t = 2\pi \lg e$$

Thus (denoting T_{10} by the symbol Δ), we obtain the following *absolute period of the absolute time at the decimal basis*

$$\Delta = 2\pi \lg e = 2.7287527... \quad (11)$$

This quantity represents the *fundamental period-quantum of an ideal field of the decimal numeric basis*.

The dominant number system on the Earth is the decimal numeration. The emergence of this system was not accidental. As it turned out, the decimal basis underlies the cosmic processes. In particular, it determines the stability of oscillatory (wave) motion of the Earth in the Solar System and the Earth-Moon system. Let us show this. If one takes as a unit of time one day, the period of a rotation of the Moon around the Earth of 27.3 days is tenfold of the absolute time period of the decimal base, 10Δ . And the time wave radius of Moon's orbit,

$$\tilde{\lambda}_{Moon} = \frac{\langle r_{Earth-Moon} \rangle}{v} \approx 4.34 \text{ days}, \quad (12)$$

is tenfold of the absolute time radius $\lg e = 0.43429448...$. Here $\langle r_{Earth-Moon} \rangle = 384.467 \text{ kkm}$ is an average distance between the centers of the Earth and Moon, $v = 1.023 \text{ km} \times \text{s}^{-1}$ is an average speed of the orbital motion of the Moon. If one takes 10 Earth days for a unit of time, then the period of revolution and the time radius of the Moon's orbit will be equal, respectively, to the numerical values of Δ and $\lg e$. Thus, we can say that the Earth-Moon system is in resonance with the period-quantum Δ of the Decimal Code of the Universe, and therefore such a system is stable.

The time angular speed of the proper time wave field of the Earth, corresponding to the sidereal day: 23 hours, 56 minutes, 4 seconds is equal to $\omega_{Earth} = 7.2939 \times 10^{-5} \text{ s}^{-1}$. From this it follows that the time radial wave of the Earth's rotation around its axis is multiple of half the fundamental period-quantum, $\frac{1}{2}\Delta$, of an ideal field of the decimal numerical basis:

$$\tilde{\lambda}_{Earth} = \frac{1}{\omega_{Earth}} \approx 1.37 \times 10^4 \text{ s}. \quad (13)$$

The frequency of rotation of the Earth around the Sun is also in harmony with the absolute period-quantum (11):

$$v = \frac{1}{T} = \frac{1}{365.26} \approx 2.74 \times 10^{-3} \text{ days}^{-1}. \quad (14)$$

Let's look at the Universal harmony from the other side. From the Dynamic Model (DM) [9, 10] it follows that the gravitational field is wave [11, 12], and its fundamental frequency (see Part 5) is equal to

$$\omega_g = 9.158082264 \times 10^{-4} \text{ s}^{-1}. \quad (15)$$

The gravitational frequency (15) defines the *radial* time wave-period,

$$T_g = \frac{2\pi}{\omega_g} = 0.686080898 \times 10^4 \text{ s} . \quad (16)$$

Only one half wave of the fundamental tone is placed on an orbit with a single node. Hence, the following, in value, *azimuthal* time wave of the fundamental tone corresponds to the radial wave period (16),

$$T_{azimuth} = 4\pi T_g = 8.621546841 \times 10^4 \text{ s} . \quad (17)$$

This value almost coincides with the sidereal day of

$$23 \text{ hours}, 56 \text{ min}, 4 \text{ s} = 8.6164 \times 10^4 \text{ s} . \quad (18)$$

The time wave, $T_{azimuth} = 4\pi T_g$, repeats the structure of the spatial wave of the fundamental tone on the Bohr orbit of the hydrogen atom, $\lambda = 4\pi r_0$.

The above relations show that the Earth is in harmonic resonance coupling with both the fundamental period-quantum Δ of an ideal field of the decimal numerical basis and the fundamental frequency of the gravitational field ω_g . Like the electron in the Bohr orbit in the hydrogen atom is in harmonic resonance coupling with the period-quantum Δ and the fundamental frequency of the atomic and subatomic levels ω_e .

Thus, the Earth is fundamentally different from other planets occupying a special place in the Solar System. Like the hydrogen atom is different from other elements in the periodic table.

Our analysis showed that at the heart of the ancient spectrum of measures of various nations at the dawn of our civilization lies the fundamental period-quantum Δ of an ideal field of the decimal numerical basis (11). This subject was described in detail in [1-3, 6]. The decimal system penetrated into the life on the Earth independently and everywhere under the influence of cosmos. With the development of our civilization to the present day, a lot has changed; with this the new measures have emerged and old ones were changing. However, some of them related to the fundamental period-quantum have survived to this day almost unchanged. I cite here below only a few examples from the recent past and the present time, demonstrating the relationship of various measures with the fundamental period-quantum $\Delta = 2.72875 \dots$ of an ideal numerical field. Here they are.

Ancient Roman ounce = 27.2875 g

A measure of tea (UK), bag of tea (cybik, from Russian "цыбик") = 27.2 kg

Foot for tin (UK) = 27.216 cm

A measure of flax yarn (UK), lea = 274.31 m

A measure for wheat (U.S., UK), board pound = 27,216 kg

A measure for potatoes (U.S.), board pound = 27.216 kg

Barrel of rice (U.S.) = 272.2 kg

A measure in weighing silk in Russia (14-17 cc), ansyr = 545.28 g (272.64 × 2)

Thaler Milan coin (1556-1598), filippo = 27.5 g
 Bale of paper (U.S.) = 136.0 kg (272.0 : 2)
 Bale of cotton (U.S.) = 170.0 kg (the golden section of 272.875...)
 Bulgarian sartorial arshin = 68 cm (272.0 : 4)
 Net weight of 2.5 pounds explosive charges M5A1 (U.S.) in a box = 27,216 kg
 Barrel of mineral oil (U.S.) \approx 136.4 kg (272.8 : 2)
 Barrel for the measurement of cranberries (U.S.) = 2.71 bushels

Interesting evidence, which has come down to us from prehistoric times, is contained in the document written in French of about hundred and fifty years ago, with which the members of Rushel Blavo's expedition in Burma [13, p. 105] were lucky to meet. Here is a fragment of the text (translated from Russian).

«...An entrance to the cave represents a small cutout of an arcuate shape on the east side of the hill. Immediately after the entrance, literally at a depth of five meters, there is a very spacious hall with a relatively small lake located at its center, and on the opposite wall with respect to the entrance, on the other side of the lake, there is a heathen temple; along the entire wall lined up strictly in line 9 (nine) of mineral columns of equal height (54 cm) and the same diameter (27 cm at its base and 17 cm at the top). ...columns were not liable to exposure by mechanical tools, showing a pattern of durability... After that, the cave was blown up, so the hill where the cave was located was completely destroyed».... "In those few years of French occupation in the nineteenth century, this cave was blocked and completely destroyed. Why? The French wanted to nullify the native beliefs of the Burmese, and the cave just such fundamental beliefs has cultivated. Since ancient times, rites of worship of spirits, in the reality of which no one could doubt, were accomplished in it...».

Ordained monks from nearby monasteries were told that in the cave, which was completely destroyed by the French about 150 years ago, "was an ancient temple, left over from atlanteans" [13, p. 175]. Please, pay attention to the numbers 9, 54, 27, and 17, which are multiple to Δ (11): the number 9, (27:3), is related to identical columns of a mineral in the form of a truncated cone of the height 54 cm, (27×2), and the diameter of 27 cm from the bottom and 17 cm on top. The number 17 is multiple to $\sim \frac{5}{8} \Delta$, that is, a golden section of the fundamental period-quantum.

Conclusion

The Universe is a single *material-ideal wave system*, where the material and ideal components of the system are inseparable, interacting and influencing each other. Therefore, regardless of the will and consciousness of people, *ideal fields* (like an ideal field

of the decimal numerical basis) naturally exert influence upon the physical fields and the wave structure of *material* objects. This is evident everywhere, and in particular, as we have found, in the spectrum of measures and the numerical values of fundamental physical constants (the latter will be shown in an Appendix).

Thus, everything in the Universe is in natural harmony and at all levels is strictly subordinated to a certain rhythm. Owing to this, the frequency spectrum of oscillatory (wave) processes in nature correlates with the fundamental period-quantum Δ of an ideal field of the decimal numerical basis.

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CONCLUSION

COMPARATIVE TABLE

of two physical models:

WAVE and STANDARD

Physical theories of the **Wave Model** (WM), including the **Dynamic Model** (DM) of elementary particles (DM) and the **Shell-Wave Model** of the atom (SWM), originally introduced in 1996 by L. G. Kreidik and G. P. Shpenkov in the book "*Alternative Picture of the World*", proved to be the key to solving many problems in physics.

A postulate on the wave nature of the Universe is in the basis of the WM. The elementary particles are considered as dynamic micro-objects, namely, as the spherical wave micro formations pulsating at certain frequencies – extremely high and extremely low simultaneously. Wave exchange at these frequencies determines all types of fundamental interactions. The nature of the mass and charge of elementary particles was revealed, and other fundamentally important discoveries were made. The results exceeded all expectations. Based on these data the WM can be rightfully considered as a viable alternative to abstract mathematical theories of the Standard Model (SM), dominant at the present time in physics.

Details on the WM can be found in the references to each of the 10 parts of the notes, as well as at the end of the **Table** below that compares the features of two models, **Standard** and **Wave**. Comparative table illustrates the undeniable advantages of the WM, in what could easily sure everyone looking at it.

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| | | |
|---|---|---|
| | <p>Advantages of the theories of the Wave Model (WM):</p> <p>The Dynamic Model (DM) of elementary particles and Shell-Wave Model (SWM) of atoms, solutions of the wave equation</p> $\Delta\hat{\Psi} - \frac{1}{c^2} \frac{\partial^2 \hat{\Psi}}{\partial t^2} = 0$ <p>What does it follow from the DM?</p> | <p>Comments on capability of the Standard Model (SM)</p> <p>including</p> <p>Schrödinger's QM, Dirac's QED, and QCD,</p> <p>with respect to enumerated points at issue</p> |
| 1 | <p>The origin of mass</p> <p>The mass has the field associated character:</p> $m = \frac{4\pi\epsilon_0 r^3}{1 + k_e^2 r^2} ; \text{ where } \epsilon_0 = 1 \text{ g} \cdot \text{cm}^{-3}, k_e = \omega_e / c \text{ (see \# 5)}.$ <p>The rest mass does not exist</p> | Unknown |
| 2 | <p>The nature of electric charges.</p> <p>The charge is the rate of mass exchange:</p> $Q = dm / dt$ | Unknown |
| 3 | <p>The relation between the mass and charge:</p> $Q = m\omega_e$ | Unknown |
| 4 | <p>The objective central ("electric") charge of an electron:</p> $e = 1.70269155 \cdot 10^{-9} \text{ g} \cdot \text{s}^{-1}$ <p>Electron is an elementary quantum of the rate of mass exchange</p> | <p>Incorrect dimensionality and value:</p> $e = 1.602176462 \cdot 10^{-19} \text{ C (SI)},$ <p>where $1C = \frac{c_r}{10} \frac{1}{\sqrt{10^9}} \text{ kg}^{1/2} \text{ m}^{3/2} \text{ s}^{-1},$</p> $c_r = 2.99792458 \cdot 10^{10} \text{ or in the CGSE system}$ $e = 4.803204197 \cdot 10^{-10} \text{ CGSE}_q \text{ (g}^{1/2} \cdot \text{cm}^{3/2} \cdot \text{s}^{-1}\text{)}$ |

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| 5 | <p>The fundamental frequency of the subatomic and atomic levels:</p> $\omega_e = e / m_e = 1.869162559 \cdot 10^{18} \text{ s}^{-1}$ | Unknown |
| 6 | <p>Static fields do not exist in Nature</p> <p>“Electrostatic” fields are, actually, exofrequency fields of the fundamental frequency ω_e (see # 5)</p> | Unknown |
| 7 | <p>The objective transversal (“magnetic”) charge of an electron on the Bohr orbit:</p> $e_H = \frac{v_0}{c} e$ | Unknown |
| 8 | <p>The fundamental wave radius:</p> $\lambda_e = c / \omega_e = 1.603886492 \cdot 10^{-8} \text{ cm}$ | Unknown |
| 9 | <p>The ratio of electron’s orbital magnetic moment, to its orbital moment of momentum,</p> $\mu_{e,orb} = e v_0 r_0 / c ,$ $\hbar = m_e v_0 r_0 :$ $\frac{\mu_{e,orb}}{\hbar} = \frac{e}{m_e c} = \frac{1}{\lambda_e} = k_e$ | <p>Incorrect value</p> $\frac{\mu_{e,orb}}{\hbar} = \frac{e}{2 m_e c}$ |
| 10 | <p>The magnetic moment of an electron:</p> $\mu_e = \frac{v_0}{c} e (r_0 + \delta r_0) = -1855.877359 \cdot 10^{-26} \text{ J} \cdot T^{-1} ;$ $v_0 = 2.187691263 \cdot 10^8 \text{ cm} \cdot \text{s}^{-1} \text{ is the Bohr speed}$ | <p>Incorrect value</p> $\mu_e = (1 + \alpha_e) \frac{e \hbar}{2 m_e c} =$ $= -928.476410(80) \cdot 10^{-26} \text{ J} \cdot T^{-1}$ |

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| 11 | <p>The proper magnetic moment of an electron (electron “spin” magnetic moment):</p> $\mu_s = \frac{r_e}{Z_{p,q}} \sqrt{\frac{2Rh_e}{m_0 c}} = -5.50792 \cdot 10^{-29} \text{ J} \cdot T^{-1}$ | <p>Incorrect value</p> $\mu_s = \mu_B = \frac{e\hbar}{2m_e c} = -927.400947(80) \cdot 10^{-26} \text{ J} \cdot T^{-1}$ |
| 12 | <p>The radius of an electron shell (electron’s radius):</p> $r_e = \sqrt{\frac{m_e}{4\pi\epsilon_0}} = 4.17052597 \cdot 10^{-10} \text{ cm};$ $\epsilon_0 = 1 \text{ g} \cdot \text{cm}^{-3}, \quad m_e = 9.10938253 \cdot 10^{-28} \text{ g}$ | <p>Unknown Considered as a point like particle. Classical electron radius is</p> $r'_e = \left(\frac{\nu_0}{c} \right)^2 r_0 = 2.817940325 \cdot 10^{-13} \text{ cm}$ |
| 13 | <p>The radius of a proton shell (proton’s radius):</p> $r_p = 0.528421703 \cdot 10^{-8} \text{ cm}$ <p>(calculated from the formula of mass, see # 1)</p> | <p>Unknown</p> <p>Proton rms charge radius is</p> $r_p = 0.8750(68) \cdot 10^{-13} \text{ cm}$ |
| 14 | <p>The fundamental frequency of the gravity field:</p> $\omega_g = \sqrt{4\pi\epsilon_0 G} = 9.158082264 \cdot 10^{-4} \text{ s}^{-1};$ $G = 6.6742 \cdot 10^{-8} \text{ g}^{-1} \cdot \text{cm}^3 \cdot \text{s}^{-2}, \quad \epsilon_0 = 1 \text{ g} \cdot \text{cm}^{-3}$ | <p>Unknown</p> |

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| 15 | <p><i>The fundamental wave radius of the gravity field:</i></p> $\lambda_g = c / \omega_g = 327.4 Mkm$ | <i>Unknown</i> |
| 16 | <p><i>The gravitational spectrum of nucleon wave shells:</i></p> $r = \lambda_g Z_{m,n};$ <p>$Z_{m,n}$ are roots of Bessel functions</p> | <i>Unknown</i> |
| 17 | <p><i>The background spectrum of the hydrogen atom:</i></p> $\frac{1}{\lambda} = R \left(\frac{1}{n^2} - \frac{1}{(n + \delta n)^2} \right); \quad \delta n = \delta r / r_0$ | <i>Unknown</i> |
| 18 | <p><i>The nature of the Lamb shift:</i></p> <p>the shift is precisely equal to the frequency gaps between the nearest spectral terms of the background spectrum (see # 17)</p> | <i>An erroneous concept</i> based on an influence of the invented (non-existed) virtual particles |
| 19 | <p><i>The precise derivation of binding energy</i> in atoms <i>without use</i> of the relation</p> $\Delta E = \Delta m \cdot c^2$ | <i>Unable</i> |
| 20 | <p><i>The physical meaning of the speed</i> of light c in the relation</p> $E_0 = m_0 c^2;$ <p>m_0 is the associated mass of a particle (see # 1). Speed of light c is the basis wave speed of exchange of matter-space-time at the subatomic level.</p> | <i>Unknown</i> m_0 is the “ r_{res} ” mass. |

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| 21 | <p><i>Internal spatial structure of atoms,</i> <i>i. e., the disposition of nucleons in atoms (The latter defines the structural variety at the molecular level in Nature: “genetic code”)</i></p> | The fixed (strictly geometrical) disposition of nucleons is Unknown |
| 22 | <p><i>The g-lepton structure of nucleons:</i> Proton and Neutron are similar in g-lepton structure to isotopes $^{28}_{14}\text{Si}$ and $^{29}_{14}\text{Si}$, respectively, according to Shell-Nodal Atomic Model $(m_g = 68.22 m_e)$</p> | Quark structure (does not similar to crystal) |
| 23 | <p><i>Crystal structure of solids,</i> including forbidden by mathematical laws of crystallography</p> | Unable |
| 24 | <p><i>The structure of all isotopes and their relative masses</i> (including limiting masses: minimal and maximal for every isotope)</p> | Unable |
| 25 | <p><i>The nature of Mendeleyev’s Periodic Law:</i> the similarity of nodal structure of external atomic nucleon shells.</p> | Different explanation: electron structure of atoms |
| 26 | <p><i>The fine structure constant physical meaning:</i> the scale correlation between basis and superstructure of wave (between oscillatory and wave processes in waves)</p> | Unknown |
| 27 | <p><i>The unified description</i> of electromagnetic, gravitational, and strong (nuclear) interactions</p> | Unable |

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| 28 | <p>The nature of the spherical harmonics of wave and Schrodinger equations</p> <p>The spherical harmonics define polar-azimuthal coordinates of nodes and antinodes of standing spherical waves</p> | <p>Unknown</p> <p>As a result, an introduction in quantum mechanics of the conceptually unfounded notion of hybridization of atomic orbitals</p> |
| 29 | <p>The nature of integer and fractional quantization in quantum Hall effect</p> <p>The nature of quantization in the Hall conductance (the resistance quantum) is naturally uncovered as an internal feature of atomic structures considered as wave formations, without accounting an influence of external magnetic fields.</p> <p>The deduced spectrum of fundamental resistances</p> $R_e = \frac{h}{e^2} \frac{m}{n}$ | <p>Fitting theory in the spirit of the virtual particles of quantum electrodynamics</p> <p>Modern explanation is based on an imaginary quantum-mechanical fluid of a hypothetical new form and on a many body wave function. It predicts that the elementary excitations involve pseudo-particle charge carriers with charges that are fractions of the electronic charge.</p> |
| 30 | <p>Precise derivation of the neutron magnetic moment</p> $\mu_n(th) = \frac{e v_0}{c} \left[\left(\tilde{\lambda}_e + \frac{r_0}{y_{0,12}} \right) \sqrt{\frac{2R\hbar}{m_0 c}} + \frac{r_e}{j_{0,12}} \sqrt{\frac{2R\hbar_e}{m_0 c}} \right]$ $\mu_n(th) = -0.96623513 \cdot 10^{-26} J \cdot T^{-1}$ | <p>Unable</p> |
| 31 | <p>Precise derivation of the proton magnetic moment</p> $\mu_p(th) = \frac{(e + \Delta e_p) v_0}{c} \left(\tilde{\lambda}_e + r_0 \frac{1}{\beta} \frac{(a'_{0,11} + y_{0,12})}{2(a'_{0,11} y_{0,12})} \right) \sqrt{\frac{2R\hbar}{m_0 c}}$ $\mu_p(th) = 1.410606662 \cdot 10^{-26} J \cdot T^{-1}$ | <p>Unable</p> |

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| 32 | <p>Objective (true) dimensionalities of physical quantities in integer powers of units of matter (g), space (cm), and time (s):</p> <p>Electric charge, $[q] = [m]/[t] = g \cdot s^{-1}$</p> <p>Electric current, $[I] = [q]/[t] = g \cdot s^{-2}$</p> <p>Circulation, $[\Gamma] = [I]/[c] = g \cdot cm^{-1} \cdot s^{-1}$</p> <p>Electric field strength, $[E] = [F]/[q] = cm \cdot s^{-1}$</p> <p>Magnetic field strength, $[B] = [F]/[q] = cm \cdot s^{-1}$</p> <p>Electric field momentum density, $[D] = [\epsilon_0][E] = g \cdot cm^{-2} \cdot s^{-1}$</p> <p>Magnetic field momentum density, $[H] = [\epsilon_0][B] = g \cdot cm^{-2} \cdot s^{-1}$</p> <p>Potential, $[U] = [F][I]/[q] = cm^2 \cdot s^{-1}$</p> <p>Resistance, $[R] = [U]/[I] = g^{-1} \cdot cm^2 \cdot s$</p> <p>Conductance, $[G] = [R]^{-1} = g \cdot cm^{-2} \cdot s^{-1}$</p> <p>Resistivity, $[\rho] = [R][l] = g^{-1} \cdot cm^3 \cdot s$</p> <p>Conductivity, $[\sigma] = [\rho]^{-1} = g \cdot cm^{-3} \cdot s^{-1}$</p> <p>Inductance, $[L] = [U][t]/[I] = g^{-1} \cdot cm^2 \cdot s^2$</p> <p>Other physical quantities of electromagnetism contained electric charge, current, and their derivatives with corrected dimensionalities.</p> | <p>Incorrect dimensionalities (subjective, phenomenological)</p> <p>Accepted in contemporary physics, the dimensionalities of physical quantities of electromagnetism, based on the erroneous dimensionalities of electric charge, current, and their derivatives, are erroneous</p> |
| 33 | <p>The Fundamental Period of the Decimal Code of the Universe</p> <p>$\Delta = 2\pi g_e = 2.7287527 \dots$</p> | <p>Unknown</p> |

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Supplement

FUNDAMENTAL PERIOD-QUANTUM OF THE DECIMAL CODE OF THE UNIVERSE AND FUNDAMENTAL PHYSICAL CONSTANTS

The last 10th Part of the notes was devoted to the dialectical numerical field - one of the ideal fields of the Material-Ideal Universe. In conclusion to this Part it was noted, in particular, that there is a relationship between the Fundamental Period-Quantum of the Decimal Code of the Universe and the spectrum of values of fundamental physical constants.

This is a very important regularity that we found. Here, in the Supplement, I will show with specific examples the reality of this harmonic interrelation. The depth of the latter is determined by the degree of deviations of the numerical values of the given fundamental physical constants from the nearest numerical values multiple to the fundamental period-quantum. The deviation indicates the degree of coherence (resonance) of measures of measurement of matter, space and time, accepted on the Earth, with the absolute period-quantum of the decimal code of the Universe and, consequently, testifies the degree of fundamentality and accuracy of values of various physical constants.

Dimensionalities of all physical constants are appropriate to represent in objective units of *matter, space* and *time*: *g, cm, and s* [1, 2]. This representation allows us to constantly see the physical meaning of all the dimensional quantities, to understand with what we are dealing and makes it easy, knowing the dimensionalities, to solve a number of problems, to find and correct possible errors. We follow this principle in all our works and this paper is no exception. Recall in this connection, as a bright example, the unit of electric charge *coulomb* accepted in the "modern" physics.

For the subjective name of the dimensionality of the unit of charge, *coulomb*, intricate transformations are hiding, which were performed in that time with the CGS system of units, mainly in order to get rid of the fractional exponents in dimensionalities of physical quantities, containing the units of matter (g) and space (cm). These transformations, which led eventually to the SI units, covered with thick fog all metrology in electromagnetism, and "closed" thus the problem of fractional dimensionalities in the system of units, and hence, the problem on the nature of charges, without solving these problems essentially (for example, in the CGSE_q system, there is $e = 4.803204197 \cdot 10^{-10} \text{ g}^{1/2} \cdot \text{cm}^{3/2} \cdot \text{s}^{-1}$; but in SI, we

have $e = 1.602176462 \cdot 10^{-19} \text{ C}$). Thus, in result of the CGS-into-SI transformations, instead of $g^{1/2} \cdot cm^{3/2} \cdot s^{-1}$ we have obtained C (coulomb), whose dimensionality, as it turned out after our thorough analysis, has the same fractional exponents in multiple objective units (kg, m, s), $kg^{1/2} \cdot m^{3/2} \cdot s^{-1}$ (see [3, 4]). Therefore, the "modern" physics still does not know what a charge is.

The Fundamental Period-Quantum of the Decimal Code of the Universe

$$\Delta = 2\pi \lg e = 2,728752708... \quad (1)$$

The golden section of the fundamental period-quantum (FPQ), $\Delta_{goldenratio}$, is

$$\Delta_{goldenratio} = \frac{1}{\phi} \Delta = 1.6999631245 \approx 1.70, \quad (2)$$

where $\phi = 1.6180339887...$ is the golden section (or the golden ratio, or the golden mean), the irrational number.

The FPQ (1) determines the spectrum of absolute measures expressed by the formula

$$M = 2^k \times 3^l \times 5^m \times 7^n \Delta \quad (3)$$

where k, l, m, n are the set of integers $Z = \{..., -2, -1, 0, 1, 2, ...\}$.

For comparison with the absolute FPQ it is necessary and sufficient to take into account for all parameters only their cardinal (absolute) numerical values. The decimal order, depending on the specific dimensionalities of the unit, it does not matter in this case.

1. An elementary quantum of the rate of mass exchange, the exchange charge of an electron («electric» charge of an electron)

$$e = 1.70269155 \times 10^{-9} g \cdot s^{-1} \quad (4)$$

The cardinal numerical value of the exchange charge e is almost identical to the value of

$$2^{-3} \times 5^1 \Delta = 1.705470443. \quad (5)$$

This magnitude is approximately equal to the golden section (2) of the FPQ,

$$\Delta_{goldenratio} = 1.6999631245.$$

Thus, the following equality is valid:

$$e \approx \Delta_{goldenratio} \quad (6)$$

An equality of the cardinal number of the electron's "charge" (the elementary quantum of the rate of mass exchange) to the golden section of the FPQ shows the harmonic resonance relation of the "charge" with the FPQ, and is evidence to the true fundamentality of the given physical parameter. Obviously, the absolute coincidence of all cardinal numbers up to the last decimal places is possible only in case of absolute agreement on 100% of the units of mass (*gram*) and time (*second*), that are in the dimensionality of the elementary quantum of the rate of mass exchange ($g \times s^{-1}$), with the absolute FPQ. From this it is clear in which direction one needs to carry out research in metrology for the proper selection and increasing accuracy of the standards for the units of mass and time: these standards should be in resonance with the FPQ, Δ . Thus, ideally, their cardinal numerical values must be multiple to the FPQ with the absolute precision.

2. The associated mass of an electron

$$m_e = 9.10938253 \times 10^{-28} \text{ g} \quad (7)$$

The cardinal numerical value of the mass (ignoring the decimal order) is close to the value

$$3^{-1} \Delta = 9.09584236 \times 10^{-1},$$

i.e., with sufficient accuracy it is multiple to Δ ,

$$m_e \approx 3^{-1} \Delta \quad (8)$$

3. The associated mass of nucleons (proton and neutron)

$$m_p = 1.67262131 \times 10^{-24} \text{ g} \quad m_n = 1.67492728 \times 10^{-24} \text{ g} \quad (9)$$

The cardinal numerical value of the associated mass of the nucleons is close to the value multiple to the golden section of the FPQ, $\Delta_{goldenratio}$:

$$3^1 \times 5^{-1} \Delta = 1.637251625 \quad \text{and} \quad \Delta_{goldenratio} = 1.6999631245$$

Thus,

$$m_{nucleons} \approx 3^1 \times 5^{-1} \Delta \quad \text{or} \quad m_{nucleons} \approx \Delta_{goldenratio} \quad (10)$$

4. The fundamental frequency of exchange (interaction) of elementary particles at the atomic and subatomic levels of the Universe

$$\omega_e = e/m_e = 1.869162559 \times 10^{18} \text{ s}^{-1} \quad (11)$$

The angular frequency is inversely proportional to the period, $\omega = 2\pi/T$. In the decimal basis, the period $T = \Delta = 2\pi \lg e$. Hence, the absolute wave fundamental quantum of the angular frequency in the decimal basis is

$$\omega_{\Delta} = \frac{2\pi}{\Delta} = \frac{1}{\lg e} = \frac{1}{0.434294481} = 2.302585093 \quad (12)$$

The fundamental angular frequency in the decimal basis must be a multiple of this absolute quantum in accordance with the equality

$$\omega = 2^k \times 3^l \times 5^m \omega_{\Delta}. \quad (13)$$

The cardinal numerical value of the fundamental frequency of exchange ω_e (equal 1.869162559) is a multiple of the absolute quantum of the fundamental frequency ω_{Δ} , because the value,

$$2^2 \times 5^{-1} \omega_{\Delta} = 2^2 \times 5^{-1} \frac{2\pi}{\Delta} = 1.842068074,$$

almost coincides with ω_e . The value, multiple to Δ , is also close to the numerical value of ω_e , but in a relatively less extent:

$$2 \times 3^{-1} \Delta = 1.819168472$$

Thus, we can write the following equality,

$$\omega_e \approx 2^2 \times 5^{-1} \omega_{\Delta} \quad (14)$$

5. The fundamental gravitational frequency of exchange (interaction) of elementary particles

$$\omega_g = \sqrt{4\pi\varepsilon_0 G} = 9.157835 \times 10^{-4} \text{ s}^{-1}; \quad (15)$$

where $G = 6.67384(80) \times 10^{-8} \text{ g}^{-1} \cdot \text{cm}^3 \cdot \text{s}^{-2}$ is the gravitational constant (the CODATA data of 2010), $\varepsilon_0 = 1 \text{ g} \cdot \text{cm}^{-3}$ is the absolute unit density. The magnitude of the gravitational frequency ω_g is determined by the formula (15), so the reliability of its value depends on the accuracy with which the value G is determined experimentally. The cardinal number of (15) is, approximately, four-multiple to the absolute quantum of the fundamental frequency $\omega_{\Delta} = \frac{2\pi}{\Delta} = \frac{1}{\lg e}$,

$$2^2 \omega_{\Delta} = 2^2 \frac{1}{\lg e} = 9.210340372,$$

and also is multiple to the value

$$2^1 \times 3^{-1} \times 5^1 \Delta = 9.09584236.$$

Thus, ignoring the decimal order, the following equalities are valid,

$$\omega_g \approx 2^2 \omega_\Delta \quad \text{and} \quad \omega_g \approx 3^{-1} \Delta \quad (16)$$

6. The basis (innate) speed of the wave exchange of elementary particles at the atomic and subatomic levels (equal to the speed of light in vacuum)

$$c \approx 2.99792458 \times 10^{10} \text{ cm} \times s^{-1}. \quad (17)$$

The numerical value, ten times the value $3^{-2} \Delta = 0.303194745$, coincides with relatively high accuracy with the cardinal number of the speed c . Therefore, ignoring the decimal order depending on the specific dimensions of the units, the following equality is valid for cardinal numbers,

$$c \approx 3^{-2} \Delta \quad (18)$$

7. The fundamental wave radius of elementary particles at the atomic and subatomic levels

$$\tilde{\lambda}_e = c / \omega_e = 1.603886492 \times 10^{-8} \text{ cm} \quad (19)$$

The absolute fundamental wave radius-quantum is

$$\tilde{\lambda}_\Delta = \frac{\Delta}{2\pi} = \lg e \quad (20)$$

This follows from comparison of the formulas,

$$\lambda = 2\pi\tilde{\lambda} \quad \text{and} \quad \Delta = 2\pi \lg e \quad (21)$$

Thus, if the wave radius $\tilde{\lambda}_e$ is fundamental, it must be multiple to $\lg e$ in accordance with the equality

$$\tilde{\lambda} = 2^k \times 3^l \times 5^m \tilde{\lambda}_\Delta.$$

Actually, the value

$$2^1 \times 3^2 \times 5^{-1} \tilde{\lambda}_\Delta = 1.563460135$$

is, approximately, equal to the cardinal number of the fundamental wave radius $\tilde{\lambda}_e$. The value of

$$3^1 \times 5^{-1} \Delta = 1.637251625$$

is also close to the cardinal number of the wave radius (19). Therefore, we can write that

$$\tilde{\lambda}_e \approx 2^1 \times 3^2 \times 5^{-1} \tilde{\lambda}_\Delta \quad \text{and} \quad \tilde{\lambda}_e \approx 3^1 \times 5^{-1} \Delta \quad (22)$$

8. The fundamental wave radius of elementary particles at the mega (gravitational) level

$$\tilde{\lambda}_g = c / \omega_g = 3.27352877 \times 10^{13} \text{ cm} . \quad (23)$$

With high precision $\tilde{\lambda}_g$ is multiple to the absolute FPQ, Δ , and in a less extent, to $\tilde{\lambda}_\Delta$. Indeed,

$$2^1 \times 3^1 \times 5^{-1} \Delta = 3.27450325 \quad \text{and} \quad 2^2 \times 3^2 \times 5^{-1} \tilde{\lambda}_\Delta = 3.12692027 .$$

Therefore,

$$\tilde{\lambda}_g \approx 2^1 \times 3^1 \times 5^{-1} \Delta \quad (24)$$

9. The speed of an electron on the first Bohr orbit

$$v_0 = 2.187691263 \cdot 10^8 \text{ cm} \cdot \text{s}^{-1} \quad (25)$$

The value of

$$2^2 \times 5^{-1} \Delta = 2.183002166$$

almost coincides with the cardinal number of the Bohr speed. Thus, the Bohr speed is the fundamental physical parameter [5]. The cardinal number of the speed (25) is multiple to the FPQ of the Decimal Code of the Universe,

$$v_0 \approx 2^2 \times 5^{-1} \Delta . \quad (26)$$

10. The radius of the first Bohr orbit

$$r_0 = 0.5291772108 \times 10^{-8} \text{ cm} \quad (27)$$

The value of

$$2^1 \times 3^1 \times 5^{-1} \tilde{\lambda}_\Delta = 0.521153378 ,$$

multiple to the absolute fundamental wave radius-quantum $\tilde{\lambda}_\Delta = \lg e$ (20), almost coincides with the cardinal number of the Bohr radius. Hence,

$$r_0 \approx 2^1 \times 3^1 \times 5^{-1} \tilde{\lambda}_\Delta , \quad (28)$$

i.e., the Bohr radius, like all presented above fundamental parameters-constants, is in the correlation (resonance) with the Decimal Code of the Universe.

11. The fundamental ratio (constant) alpha, reflecting the scale correlation of the basis and superstructure of waves (the “fine-structure constant”)

$$\alpha = v_0 / c = 7.2973525376 \times 10^{-3} . \quad (29)$$

Here v_0 is the limiting, or threshold, *oscillatory speed* in any point of a wave process (the parameter of the superstructure of a wave); c is the basis speed of a wave, i.e., the speed of propagation of oscillations (perturbation of medium). At the level of an electromagnetic field, the threshold speed of oscillations is equal the first Bohr speed, i.e., the speed of an electron on the stationary (first) Bohr orbit, $v_0 = 2.187691263 \cdot 10^8 \text{ cm} \cdot \text{s}^{-1}$.

The *basis speed* c of a wave is the fundamental speed of wave exchange at the atomic and subatomic levels of the Universe. It is equal to the speed of light in vacuum. Thus, the constant alpha (29) reflects the fundamental relationship existed between two conjugate characteristic speeds, oscillatory and wave, inherent in wave processes at any levels of the Universe [5]. The value of

$$2 \times 3^3 \times 5^1 \Delta = 7.367632312$$

almost coincides with the cardinal number of the constant α . Accordingly, the following equality is valid

$$\alpha \approx 2 \times 3^3 \times 5^1 \Delta. \quad (30)$$

12. The gravitational exchange charge of a neutron (fundamental graviton)

$$q_{ng} = m_n \omega_g = 1.53392 \times 10^{-27} \text{ g} \cdot \text{s}^{-1}. \quad (31)$$

Here $m_n = 1.674927211(84) \times 10^{-24} \text{ g}$ is the associated mass of a neutron. The value of

$$3^{-2} \times 5^1 \Delta = 1.515973727$$

with sufficient accuracy coincides with the cardinal number of the gravitational exchange charge of a neutron q_{ng} , therefore,

$$q_{ng} \approx 3^{-2} \times 5^1 \Delta. \quad (32)$$

The fact of the multiplicity to the FPQ evidences about the fundamentality of the gravitational exchange charge of a neutron. The same conclusion can be drawn with respect to the gravitational exchange charge of a proton, as the masses of both nucleons up to the second decimal place match.

13. The fundamental quantum of resistance

$$R_e = h / e^2 = 2.285514295 \times 10^{-9} \text{ g}^{-1} \cdot \text{cm}^2 \cdot \text{s} \quad (33)$$

$$2^{-1} \times 3^{-1} \times 5^1 \Delta = 2.27396059$$

$$R_e \approx 2^{-1} \times 3^{-1} \times 5^1 \Delta \quad (34)$$

14. The fundamental quantum of specific electron resistance

$$\rho_e = 1 / \varepsilon_0 \omega_e = 5.349991157 \times 10^{-19} \text{ g}^{-1} \cdot \text{cm}^3 \cdot \text{s} \quad (35)$$

$$2^{-1} \times 3^{-2} \times 5^1 \times 7^1 \Delta = 5.305908043$$

$$\rho_e \approx 2^{-1} \times 3^{-2} \times 5^1 \times 7^1 \Delta \quad (36)$$

15. The fundamental quantum of specific proton resistance

$$\rho_p = \pi \tilde{\lambda}_e^3 / e = 7.612634088 \times 10^{-15} g^{-1} \cdot cm^3 \cdot s \quad (37)$$

$$2^1 \times 5^{-1} \times 7^1 \Delta = 7.640507582$$

$$\rho_p \approx 2^1 \times 5^{-1} \times 7^1 \Delta \quad (38)$$

16. The electron total magnetic moment

$$\mu_e = \frac{v_0}{c} e(r_0 + \delta r_0) = -6.578913944 \times 10^{-20} g \cdot cm \cdot s^{-1} \quad (39)$$

$$2^2 \times 3^1 \times 5^{-1} \Delta = 6.549006499$$

$$\mu_e \approx 2^2 \times 3^1 \times 5^{-1} \Delta \quad (40)$$

17. The electron proper („spin”) magnetic moment

$$\mu_s = \frac{r_e}{z_{p,q}} \sqrt{\frac{2Rh_e}{m_0 c}} = -1.952506803 \times 10^{-25} g \cdot cm \cdot s^{-1} \quad (41)$$

$$5^1 \times 7^{-1} \Delta = 1.949109077$$

$$\mu_s \approx 5^1 \times 7^{-1} \Delta \quad (42)$$

18. The radius of electron spherical wave shell (electron radius)

$$r_e = \sqrt{\frac{m_e}{4\pi\epsilon_0}} = 4.17052597 \cdot 10^{-10} cm \quad (43)$$

$$2^{-1} \times 3^1 \Delta = 4.093129062$$

$$r_e \approx 2^{-1} \times 3^1 \Delta \quad (44)$$

19. The radius of proton spherical wave shell (proton radius)

$$r_p = 0.528421703 \times 10^{-8} cm \quad (45)$$

$$2^1 \times 3^1 \times 5^{-1} \tilde{\lambda}_\Delta = 0.521153378$$

$$r_p \approx 2^1 \times 3^1 \times 5^{-1} \tilde{\lambda}_\Delta \quad (46)$$

20. The magnetic flux quantum

$$\Phi_0 = ch / 2e = 5.833251078 \times 10^{-8} cm^3 \cdot s^{-1} \quad (47)$$

$$3^1 \times 5^1 \times 7^{-1} \Delta = 5.847327231$$

$$\Phi_0 \approx 3^1 \times 5^1 \times 7^{-1} \Delta \quad (48)$$

21. The conductance quantum

$$G_0 = 2e^2 / h = 8.750765017 \times 10^8 \text{ g} \cdot \text{cm}^{-2} \cdot \text{s}^{-1} \quad (49)$$

$$2^4 \times 5^{-1} \Delta = 8.732008666$$

$$G_0 \approx 2^4 \times 5^{-1} \Delta \quad (50)$$

22. The «gravitational constant»

$$G = \frac{\omega_g^2}{4\pi \varepsilon_0} = 6.6742 \times 10^{-8} \text{ g}^{-1} \cdot \text{cm}^3 \cdot \text{s}^{-2} \quad (51)$$

where $\omega_g = 9.158082264 \times 10^{-4} \text{ s}^{-1}$ is the fundamental frequency of the gravitational wave field, $\varepsilon_0 = 1 \text{ g} \cdot \text{cm}^{-3}$ is the absolute density unit.

The nature of the gravitational constant, which is revealed by the formula (51), was not known till now to "modern" physics [6, 7]. For the first time it was revealed in the framework of the Dynamic Model of elementary particles [8]. This formula implies that the "gravitational constant", in the full sense of this expression, is no fundamental constant, because it is the combination of the truly fundamental physical constant ω_g , i.e., the fundamental frequency of the gravitational field, and ε_0 . Since the cardinal number of the fundamental gravitational frequency ω_g (16) is multiple to the absolute quantum of the fundamental frequency ω_Δ ,

$$\omega_g \approx 2^2 \omega_\Delta = 2^2 \frac{1}{\lg e}, \quad (52)$$

the cardinal numerical value of the gravitational constant G must be multiple to $2^2 \omega_\Delta$ squared divided by 4π (in accordance with the formula (51) that is actually:

$$G \approx \frac{2^4}{4\pi} \omega_\Delta^2 = 6.750586336. \quad (53)$$

Conclusion

In the last 10th Part of the notes it was shown that motion of the Earth and its satellite, the Moon, in the Solar System are in harmonic bond with the FPQ of the Universe, as well as with the ancient measures of the mass, length, and time. Presented here, in the Supplement, the data demonstrated a relationship of the most important (known and unknown to

"modern" physics) fundamental physical constants with the FPQ. All this indicates that the Decimal Code "works" like a tuning fork that sets the rhythm, to which all processes in the Universe are subjected, both material and ideal, in the animate and inanimate nature.

Incidentally, the average heart rate of an adult as well as the frequency of its breathing is in resonance with the Decimal Code of the Universe. Indeed, it is considered normal if the pulse is about 68 beats per minute, and it is the value (its cardinal number) multiple to one-quarter of the fundamental period-quantum, $(\frac{1}{4})\Delta = 68.22 \times 10^{-2}$. An adult at rest makes an average of 14 breaths per minute, and it is a multiple of half the fundamental period-quantum, $(\frac{1}{2})\Delta = 13.644 \times 10^{-1}$. Thus, it is disclosed the action of one of the most important laws of an ideal component of the Material-Ideal World (called the laws of the second kind) – the Law of the Decimal Code of the Universe.

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