Interrelation of Values of Base Units and Fundamental Constants with the Fundamental Quantum of Measures

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Abstract. Interrelation between the fundamental period-quantum of the dialectical binumerical wave field of decimal base and the base units of matter, space, and time (the gram, the centimeter, and the second) is considered. Fundamental constants of physics (such as the electron mass and charge, the gravitational wave radius and period, etc.) are examined on the consistency with the universal formula of measures, which are directly connected with the fundamental period-quantum. The last and the universal spectrum of measures are considered as manifestation of the Decimal Base Law.

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1. Introduction

Dialectics considers the World as the material-ideal formation and as a contradictory wave system of Quality and Quantity with an infinite series of intersecting material-ideal states, one of which is presented by Reason at the Earth.

The Universe generates in consciousness of human beings a triad of base qualitative measures of matter, space, and time, which are presented by *the gram* (*g*), *the centimeter* (*cm*), and *the second* (*s*). It would seem that it is possible to accept, as a reference triad, any units of mass, length, and time, but as we will show below, namely the above mentioned unit measures *have the fundamental "magic" feature*, being the *ideal quanta of perception of the Universe*. They are closely related to the dialectical binumerical field (Paper 3).

2. A dialectical binumerical wave field

The dialectical binumerical wave field, developed first in works [1, 2], is one of the elementary levels of the ideal facet of the Universe.

Any binumber $\hat{Z} = a + ib$ of this field (see Paper 3) with any basis *B* can write as

$$\hat{Z} = a + ib = re^{i\varphi} = r(\cos\varphi + i\sin\varphi)\,, \qquad (2.1)$$

where $i\varphi = \ln B \cdot i\psi$, and $i\psi = \mathrm{ad}_B(Z)$.

At that, a period-quantum of binumber $\hat{Z}$ is

$$\Delta = \frac{2\pi}{\ln B}\,. \qquad (2.2)$$

Hence, φ–parameter is the number of units of negation of superstructure, a phase of the binumber at basis *e*.

Every concrete value of superstructure of a variable binumber $\hat{Z} = B^{\alpha+\beta i}$ with basis *B* determines an instantaneous value of the binumber, therefore, when two binumbers are compared it should be to distinguish a differential (instantaneous) equality and an integral equality over the all the domain of values of superstructure.

Two binumbers $\hat{Z}_1 = a_1 + ib_1 = \exp_e(\ln r_1 + i\varphi_1)$

and $\hat{Z}_2 = a_2 + ib_2 = \exp_e(\ln r_2 + i\varphi_2)$,

reduced to the general basis *e*, are differentially equal if

$$r_1 = r_2 \quad \text{and} \quad ad_e(\hat{Z}_1) - ad_e(\hat{Z}_2) = 2\pi m i\,, \qquad (2.3)$$

where $m = \pm 1, \pm 2, ..., \pm n$ and $n \in N$, and integrally equal if

$$r_1 = r_2 \quad \text{and} \quad ad_e(\hat{Z}_1) = ad_e(\hat{Z}_2)\,. \qquad (2.4)$$

Strictly speaking, differential and integral equalities are relative equalities if initial bases are different. An absolute (total) equality takes place under the condition when bases and superstructures are equal:

$$B_1 = B_2, \qquad ad_{B_1}(\hat{Z}_1) = ad_{B_2}(\hat{Z}_2). \qquad (2.5)$$

Evidently, at an absolute and relative equality of binumbers $\hat{Z}_1$ and $\hat{Z}_2$,

$$a_1 = a_2, \qquad b_1 = b_2. \qquad (2.6)$$

Relations between components *Yes* and *No* of binumber $\hat{Z}$, we express on a phase plane of numbers *Yes-No* (Fig. 2.3a, Paper 3), where *x*-axis is the axis of affirmation and *y*-axis is the axis of negation. In this plane, a quantitative module *r* is characterized by the direction, defined by the polar phase angle α. The phase angle $\alpha \in [0,2\pi)$ and the phase φ are related by the equality

$$\varphi = \alpha + 2\pi m, \qquad (2.7)$$

where m is an integer.

Phase geometry of binumber $\hat{Z}$, expressing quantitative relations between its components, we describe by a binumber $\hat{z}$ of the following kind:

$$\hat{z} = a + bi = re^{i\alpha} = r(\cos\alpha + i\sin\alpha). \qquad (2.8)$$

If $m \neq 0$ then binumbers $\hat{z}$ and $\hat{Z}$ are equal differentially, but not integrally.

When the phase plane coincides with a physical plane of harmonic oscillations and direction of motion is perpendicular to the plane of oscillations, geometry of a binumber with $\mathrm{ad}_e(\hat{Z}) = \ln r + i\omega t$ coincides with the real oscillatory wave (Fig. 2.3b, Paper 3) in the physical space:

$$\hat{Z} = a + bi = e^{\ln r + i\omega t} = re^{i\omega t} = r(\cos\omega t + i\sin\omega t). \qquad (2.9)$$

In this sense, the binumber $\hat{Z}$ is a binumber-biwave, which belongs to the numerical wave bifield of numbers *Yes-No* of a various structure.

The harmonic oscillatory wave (2.9) is inseparable from the wave propagated in the physical space. The simplest numerical biwave-beam has the following structure

$$\hat{Z} = a + bi = re^{i(\omega t - ks)} = r(\cos(\omega t - ks) + i\sin(\omega t - ks)), \qquad (2.10)$$

where $k = \dfrac{2\pi}{\lambda} = \dfrac{1}{\lambda\!\!\!^{-}}$ is the wave number along the beam *s* in some space.

If we introduce a bimodule of the number-wave (2.10), according to the equality $\hat{r} = re^{-iks}$, then the numerical biwave takes the simple form

$$\hat{Z} = \hat{r}e^{i\omega t} = \hat{r}(\cos\omega t + i\sin\omega t), \qquad (2.11)$$

This biwave represents the elementary numerical biwave with basis *e* which defines its fundamental period of 2π units.

The numerical biwave $\hat{Z}$ with basis *B* and superstructure

$$\mathrm{ad}_B(\hat{Z}) = ad_B(r) + i\frac{t}{e_t} = \log_B r + i\tau,$$

where r is the module of number $\hat{Z}$, e_t is the unit of *t*-parameter, and

τ is the relative measure of superstructure (the phase of the number at basis *B*),

has the following form

$$\hat{Z} = r\exp_B\left(i\frac{t}{e_t}\right) = r(\cos(ad_e(B)\frac{t}{e_t}) + i\sin(ad_e(B)\frac{t}{e_t})). \qquad (2.12)$$

or

$$\hat{Z} = rB^{i\omega t} = re^{\ln B\cdot i\omega t} = r(\cos(\ln B\cdot\omega t) + i\sin(\ln B\cdot\omega t)), \qquad (2.13)$$

where $\omega = 1/e_t$.

The numerical biwave of basis *B* is characterized by the relative Δ and the absolute Δ_t periods (Fig. 2.1), defined by the condition of periodicity $\ln B\cdot\omega t = 2\pi m$ (here, *m* is an integer):

$$\Delta = \frac{2\pi}{ad_e(B)} = 2\pi ad_B(e) = 2\pi\log_B e, \qquad (2.14)$$

$$\Delta_t = \frac{2\pi}{\omega} ad_B(e) = 2\pi ad_B(e)\cdot e_t = 2\pi \log_B e \cdot e_t, \qquad (2.15)$$

These periods depend uniquely on value of basis *B*. At that, the polar phase angle α and the phase τ of binumber with basis *B* are coupled by the equality

$$\tau = (\alpha + 2\pi m)\log_B e. \qquad (2.16)$$

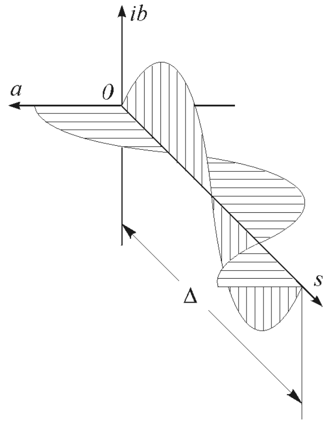

Fig. 2.1. A graph of a space numerical biwave-beam $\hat{Z}$.

The local wave (2.13) can generate a space biwave-beam of basis *B*

$$\hat{Z} = rB^{i(\omega t - ks)} = r(\cos(ad_e(B)(\omega t - ks)) + i\sin(ad_e(B)(\omega t - ks))), \qquad (2.17)$$

or

$$\hat{Z} = re^{\ln B\cdot i(\omega t - ks)} = \hat{r}(\cos(\ln B\cdot \omega t) + i\sin(\ln B\cdot \omega t)), \qquad (2.18)$$

where $\hat{r} = re^{-i\ln B\cdot ks}$ is the bimodule of the number-wave.

Evidently, in the space along the beam *s*, the nonlocal wave-beam is characterized by the relative s_Δ and the absolute $s_ƛ$ space periods-quanta (Fig. 2.1):

$$s_\Delta = 2\pi\log_B e = \Delta, \qquad s_ƛ = \Delta\cdot ƛ. \qquad (2.19)$$

Additive and multiplicative algebra of binumbers of affirmation-negation, $\hat{Z}_1 = a_1 + ib_1$ and $\hat{Z}_2 = a_2 + ib_2$, is determined by the following equalities

$$\hat{Z}_1 + \hat{Z}_2 = (a_1 + ib_1) + (a_2 + ib_2) = (a_1 + a_2) + i(b_1 + b_2), \qquad (2.20)$$

$$\hat{Z}_1 \cdot \hat{Z}_2 = (a_1 + ib_1)\cdot(a_2 + ib_2) = (a_1a_2 - b_1b_2) + i(a_1b_2 + b_1a_2), \qquad (2.21)$$

Numbers of affirmation-negation $\hat{Z}$ form a bifield of binary real numbers with different algebras of signs.

The wave binumerical field describes effectively the quantitative wave ideal field-space of zero dimensionality with the fundamental period-quantum (2.14). The fundamental period is inseparably connected with the qualitative reference units – the gram, the centimeter, and the second, because it and a triad of base units represent two sides of an unique process in the Universe [1, 2].

The algebra of binumbers coincides formally with the algebra of complex numbers, however, the dialectical binumerical field is a quite different numerical field and not all aspects of complex numbers are valid here. Components of the binumber reflect the bipolar symmetry in nature and have a quite definitive sense. Complex numbers can be considered as a particular case of the more general dialectical field of binumbers.

The binumerical field of affirmation-negation (*bifield* briefly) repeats the geometry of real processes, which are realized in three-dimensional space, whereas the field of complex numbers is localized only on the complex plane. At that, the “imaginary” component is still an “imaginary” quantity in the solving of many fundamental problems of physics. Therefore, the “imaginary” part is sometimes rejected, artificially, as it takes place, for example, in quantum mechanics. The dialectical bifield uncovers the nature of complex numbers, formally introduced in mathematics without understanding of their deep philosophical sense, with their “imaginary” unit.

Dialectics of the bifield requires realization of the *principle of complementability of notions*: if there is not the notion *No* with the measure of negation *ib* then it is necessary to introduce this notion complementary to the notion *Yes*, with the measure of affirmation *a*, because without the notion *Yes-No* the complete description of a studied phenomenon is impossible.

A semiformal theory of the dialectical bifield, described here briefly, makes it possible to consider the base units of matter-space-time in their interdependence with processes of the Universe [1, 2].

3. The fundamental quantum and spectrum of measures

Dialectics considers the World as the Material-Ideal Formation, therefore, ideal processes in the Universe must run their course on the basis of the informational material-ideal bifield lying in the base of the quantitative-qualitative code of the Universe.

A material facet of the Universe is described on the basis of physical laws – the first kind laws, whereas the laws reflecting an ideal side of the Universe should relate to the second kind laws – the non-physical laws [1].

We will assume that the numerical quantitative-qualitative wave bifield of affirmation-negation with some *fundamental basis B* and *period* $2\pi ad_B(e)$ is one of the elementary levels of an informational field of the ideal facet of the Universe with its distinctive laws – the second kind laws.

The structure of human hands prompts the choice of the *fundamental basis B*, which should be to accept *equal to ten*. Then, the *fundamental* relative and absolute *periods-quanta* of bifield of decimal basis are equal, correspondingly, to

$$\Delta = 2\pi ad_{10}(e) = 2\pi \lg e = 2.7288\,, \qquad (3.1)$$

$$\Delta = 2\pi ad_B(e)e_t\,. \qquad (3.1a)$$

Here, e_t is a base unit of a physical quantity, defined on the basis of the decimal base, $e_t = 10^{\pm n} \cdot e_M$, where $n \in N$ and e_M is the base unit measure of the physical quantity. As the *base units of matter-space-time*, we regard the gram (*g*), the centimeter (*cm*), and the second (*s*).

The fundamental quantum-period (3.1a) defines the quantum-period of half-wave (the wave half-period – half-quantum)

$$\Delta(1/2) = \pi ad_{10}(e)e_t = \pi \lg e \cdot e_t \approx 1.3644 \cdot e_t\,. \qquad (3.2)$$

The base measures are closely connected with the perception of the World by human beings on the basis of the "*golden section*" law; more correctly, the *Law of Decimal Base*. This law and its fundamental period are related to the second kind laws. If an interval of possible random scattering of a measure is taken and divided into sixteen equal intervals (metameasures), then nature most often selects the left or right tenth metameasure. When this interval is divided into eight metameasures, it is distinguished first of all by the fifth dominant metameasure (the dominant), and later on by the third subdominant metameasure (the subdominant).

The choice of dominants and subdominants occurs unconsciously. This phenomenon was noticed long ago and in art the similar selection of measures was called the golden section law, which formally (conventionally) is explained by the irrational ratio. In actual fact, under the name of the golden section law is hidden the *law of decimal base*. Five dominant metameasures are quite often equal to the fundamental half-period (3.2). This exhibits itself, for example, in the appearance of books. The fifth metameasure of book covers about one span of height, 2.184 *dm*, is at the level of 1.365 *dm*, distinguishing usually the title of books.

The *base unit measures* are closely related to perception of the World by men, which intuitively follow the Law of Decimal Base (or other words, the law of the Decimal Code of the Universe). The fundamental period-quantum (3.1), originated from this law, defines the spectrum of measures [1], expressed by the formula

$$M = 2^k \cdot 3^l \cdot 5^m \Delta\,, \qquad (3.3)$$

where k, l, $m \in Z$.

The fundamental period-quantum pierces natural science and art, it reveals itself in processes of perception by men of ambient nature, it is characteristic also for music, etc. The Law of Decimal Base expressed by the formulae (3.1) and (3.3), as it turned out [1], *is in the foundation of metrology* revealing, in particular, the quantum character of the numerical values of the fundamental physical constants.

4. The unit of mass, the gram

Measures of mass, inseparable from development of measures of volume, were forming in the course of a long material and spiritual history of human kind. As follows from the analysis, carried out in [1], these measures, interrelated with the fundamental period Δ, were based on the comparison of masses and volumes of liquid and free-flowing substances. In the epoch of initial land cultivation, water (wine as well as beer) and grain were main factors determining ancient natural measures. Water generated the formula, which relates mass and volume

$$M = \varepsilon_0 U_0 = \varepsilon_0 \varepsilon U , \qquad (4.1)$$

where M is the mass of water equal to the mass of a substance; U_0 is the volume of water; U is the volume of the substance; $\varepsilon_0\varepsilon$ is the density of the substance, at that $\varepsilon_0 = 1\, g/cm^3$ is the unit mass density of substance and $\varepsilon = U_0/U$ is the relative mass density.

The inverse relation has developed simultaneously:

$$U = \frac{1}{\varepsilon_0 \varepsilon} M = \frac{1}{\varepsilon} U_0 \qquad (4.2)$$

or

$$U = \mu_0 \mu M = \mu U_0 , \qquad (4.2a)$$

where $\mu_0\mu = \frac{1}{\varepsilon_0\varepsilon}$ is the permeability of substance (the volumetric density), $\mu_0 = \frac{1}{\varepsilon_0}$ is the unit of volumetric density, and $\mu = \frac{1}{\varepsilon}$ is the relative volumetric density.

Comparing the modern data on relative volumetric densities of grain crops with ancient measures, it is possible to state that average values of the relative volumetric density of grain were approximately equal to one-half of the fundamental period:

$$\mu = 2^{-1}\Delta = \pi \lg e \approx 1.3644 . \qquad (4.3)$$

Accordingly, the relative mass density was

$$\varepsilon = 1/\mu = 0.7329 \approx 0.73 . \qquad (4.4)$$

Hence, relations between the mass of grain and its volume are as follows

$$U = 1.3644 \mu_0 M , \qquad M = 0.7329 \varepsilon_0 U . \qquad (4.5)$$

The Old English bushel of free-flowing substances, defined the unit of mass in one bushel of mass, was equal to $1\, bu_m \approx 27.28\, kg \approx 10^4 \cdot \Delta\, g$. This unit lies in the base of Oriental measures. The Old English pound of mass was equal at that time to 273 *g*. Five bushels of mass generated a barrel of 136.4 *kg*.

A Japanese koku of grain of 136.88 *kg*, an English tierce of meat of 137.89 *kg*, an Australian bale of wool of 136 *kg*, and numerous barrels of petroleum products are related to the same level of spectrum of measures (3.3). In Iran, a barrel is equal to 136.4 *kg*, in Brazil – 136.7 *kg*, in Bahrain Islands – 136.3 *kg*, in Kuwait – 137.8 *kg*, etc.

In the Middle Ages, in Europe, a pound of mass of about 233.769 *g* was in use. As the unite of volume, it is equal to the golden section of the pound of 272.88 *g*:

$$233.769\, cm^3 \cdot 0.73\, g \cdot cm^{-3} = 170.651\, g = \frac{5}{8} \cdot 272.88\, g = 2^{-3} \cdot 5 \cdot 10^2 \Delta\, g .$$

The most important ancient Roman unit of mass, the ounce, was equal to $27.288\, g = 10\Delta\, g$. In ancient Greece, the unit of volume the kotyla (cup) was equal to 10 ounces of volume, 1 kotyla = 0.27288 *l*, and 100 kotylas had determined the metret of 27.288 *l*.

The Old Russian metrological spectrum of mass is closely related to wheat grain (corn) which was called the pirog (pie). According to the historical and archeological data, this spectrum is also represented by the formula (3.3):

$$1 \text{ pirog} = 2^{-6}\Delta\ g, \qquad 64 \text{ pirogs} = 16 \text{ pochkas (buds)} = 2.7288\ g.$$

By the end of the 15th century, the common Russian monetary count on the basis of a rouble had been formed: 1 rouble = 100 kopecks = 200 money =1600 pirogs = 68.22 *g* = $2^{-2}\cdot 10^{2}\Delta\ g$.
The rouble and its derivatives had been used simultaneously as units of mass during the 15-17th centuries (1 kopeck = 0.6822 g = $2^{-2}\Delta\ g$).

The above presented and other numerous data, which can be found in relevant literature on folk measures, uniquely confirm their relation to the fundamental period-quantum (3.1).

5. The unit of length, the centimeter

The first natural units of the simplest measures of length were fingers and their joints, palms, spans, feet, elbows and other parts of the human body. In the Old Russian metrology, a foot of about 2.73 *dm* and a finger of 2.73 *cm*, characteristic also for all European nations and nations of other continents, were the constitutive measures. Of course, the other measures apart from the above mentioned, but multiple to them, had also been used. Let us consider now the nature of length in one centimeter.

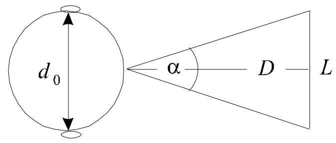

Fig. 5.1. A geometrical scheme of eyesight parameters; D_0 is a diameter of human skull with the characteristic average value $D_0 \approx 137$ *mm* (based on anthropological data); D is the average distanse of the best eyesight, D ≈250 *mm*; L is the average distance of the effective field of eyesight, L ≈137 *mm*; α is the angular size of the field of visual perception, $\alpha \approx 30^0$.

As known, keenness of eyesight of man – the least distance between two points $s_{\min}$, which is able to distinguish the man, – is about one angle minute, i.e.

$$s_{\min} \approx \frac{\pi}{180\cdot 60} D \approx 7.3\cdot 10^{-3}\ cm \quad \text{or} \quad 1\,cm \approx 137 s_{\min}, \tag{5.1}$$

where $D = 25\,cm$ is the average distance of the best eyesight (Fig. 5.1).

Thus, it is possible to suppose that for most people a tendency to the ideal equality

$$1cm = 50\cdot 2\pi \lg e\, s_{\min} \tag{5.2}$$

takes place. Hence, the reference value of a quantum of keenness of eyesight $s_{\min}$ is

$$s_{\min} = \frac{1cm}{50\cdot 2\pi \lg e}, \tag{5.3}$$

that is equivalent to an existence of a wave of perception of length

$$\psi = ae^{i2\pi z} = a10^{\frac{z\cdot cm}{50\cdot s_{\min}}i} = a10^{2\pi \lg e\cdot zi}, \tag{5.4}$$

where *a* is a module proportional to the probability of perception, and $z \in R$.

If *z* is an integer, the wave periodic function of perception (7.4) selects millimeters, centimeters, decimeters, and meters.

1) $\frac{1}{5}mm = 2\pi \lg e\, s_{\min}$, 3) $1\,cm = 5\cdot 2\pi \lg e\cdot 10\, s_{\min}$,

2) $1\,mm = 5\cdot 2\pi \lg e\, s_{\min}$, 4) $1\,m = 100\,cm = 5\cdot 2\pi \lg e\cdot 10^3 s_{\min}$, etc. (5.5)

Thus, measures of length follow the fundamental period-quantum of the Decimal Code of the Universe. In this sense, the measures (7.5) are the “magic” units. In turn, millimeters, centimeters, decimeters, and meters determine the fundamental physical parameters, which are also related to the fundamental period Δ.

6. The unit of time, the second

For the sake of a standard representation of numerical values of measures, let us agree that all physical constants be presented by eight or more signs after a decimal point, because most of them were defined with such precision.

In the year 2000, a star day T will be equal to $23^h56^m04^s.10056$. An angular speed of Earth's revolution, corresponding to this day, $\omega_Z = 7.29211501 \cdot 10^{-5}\ s^{-1}$, hence, a daily radius T_R is

$$T_R = \frac{1}{\omega_Z} = \frac{T}{2\pi} = 1.37134425 \cdot 10^4\ s. \qquad (6.1)$$

Thus, the daily radius is in the vicinity of the fundamental half-period, and if the new canonical second $\underline{s}$ is introduced, according to the equality

$$1\,\underline{s} = 1.00510702\ s, \qquad (6.2)$$

then a duration of the period will be exactly equal to the fundamental quantity

$$T_R = \frac{T}{2\pi} = 2^{-1}\Delta \cdot 10^4\ \underline{s} = 1.36437635 \cdot 10^4\ \underline{s}, \qquad (6.3)$$

and the angular speed of Earth's revolution will also be the fundamental one,

$$\omega_Z = \frac{1}{T_R} = 2 \cdot \frac{1}{\Delta} \cdot 10^{-4}\ \underline{s}^{-1}. \qquad (6.4)$$

As was shown in [1], the gravitational field is characterized by the gravitational frequency ω_g, coupled with the gravitational constant G by the equality

$$\omega_g = \sqrt{4\pi\varepsilon_0 G} = 9.15697761 \cdot 10^{-4}\ s^{-1}, \qquad (6.5)$$

where $G = 6.67259000 \cdot 10^{-8}\ cm^3 \cdot g^{-1} \cdot s^{-2}$ and $\varepsilon_0 = 1\,g \cdot cm^{-3}$,
and the gravitational period

$$T_g = \frac{2\pi}{\omega_g} = 0.68616366 \cdot 10^4\ s. \qquad (6.6)$$

The gravitational period defines the gravitational wave radius of the cylindrical gravitational field, which is the basic kind of gravitation in the Universe,

$$\lambda\!\!\!^{-}_g = \frac{c}{\omega_g} = 3.273923676 \cdot 10^{13}\ cm. \qquad (6.7)$$

The wave radius divides the solar gravitational field into the nearest and distant wave zones, between which is a ring of small planets – asteroids.

The value of the gravitational wave radius is in the vicinity of $\frac{6}{5}\Delta = 2 \cdot 3 \cdot 5^{-1}\Delta$ – the distinctive value of ancient measures. If to introduce the canonical centimeter $\overline{cm}$, according to the equality

$$1\,\overline{cm} = 0.999823004\ cm, \qquad (6.8)$$

the gravitational wave radius will take the fundamental value

$$\lambda\!\!\!^{-}_g = \frac{c}{\omega_g} = 2 \cdot 3 \cdot 5^{-1}\Delta \cdot 10^{13}\ \overline{cm} = 3.27450325 \cdot 10^{13}\ \overline{cm}. \qquad (6.9)$$

On the other hand, the gravitational period is in the vicinity of a quarter of the fundamental period (1.1), and if to introduce the canonical second

$$1\,\underline{\underline{s}} = 1.00582754\ s, \qquad (6.10)$$

we will arrive at the fundamental measure of the gravitational period

$$T_g = 2\pi/\omega_g = 2^{-2}\Delta \cdot 10^4\,\underline{\underline{s}} = 0.68218818 \cdot 10^4\,\underline{\underline{s}} \qquad (6.11)$$

and the fundamental gravitational frequency

$$\omega_g = \frac{8\pi}{\Delta} \cdot 10^{-4}\ \underline{\underline{s}}^{-1} = \frac{4}{\lg e} \cdot 10^{-4}\ \underline{\underline{s}}^{-1} = 9.210340372 \cdot 10^{-4}\ \underline{\underline{s}}^{-1}, \qquad (6.12)$$

which determines the fundamental value of the gravitational constant

$$G = \frac{\omega_g^2}{4\pi\varepsilon_0} = \frac{4\pi}{(0.5\Delta)^2 \varepsilon_0} 10^{-8} \underline{\underline{s}}^{-2} = 6.75058634 \cdot 10^{-8}\ cm^3 \cdot g^{-1} \cdot \underline{\underline{s}}^{-2}. \qquad (6.13)$$

The canonical second (6.10) and the centimeter (6.8) define the canonical measure of the speed of light

$$c = \bar{\lambda}_g \omega_g = 96\pi \cdot 10^8\ \overline{cm} \cdot \underline{\underline{s}}^{-1} = 3.015928947 \cdot 10^{10}\ \overline{cm} \cdot \underline{\underline{s}}^{-1}. \qquad (6.14)$$

Since $1\underline{\underline{s}} \approx 1\underline{s}$, equalities

$$T_R = 2T_g \qquad \text{and} \qquad T = 2\pi T_R = 4\pi T_g \qquad (6.15)$$

point to the relation of Earth's time circumference (day) and its radius with the gravitational constant and the quarter of the fundamental period.

7. Canonical measures on the basis of the electron mass and charge

An analysis [1] of interaction of elementary particles with an ambient field has shown that masses of the particles have associated character and equal to

$$m = \frac{4\pi r^3 \varepsilon_0 \varepsilon}{1 + k^2 r^2}, \qquad (7.1)$$

where $k = 2\pi / \lambda$ is the wave number, r is the radius of the boundary sphere of the particles. For the electron $kr << 1$, therefore, with large precision, taking into account that at the field level $\varepsilon = 1$, we have

$$m = 4\pi r^3 \varepsilon_0. \qquad (7.1a)$$

As follows from the theory of exchange (interaction) [1], the interrelation between the electron charge and mass is

$$e = m\omega_e, \qquad (7.2)$$

where ω_e is the fundamental frequency of exchange at the atomic and subatomic levels.

The Coulomb phenomenological measure of the electron charge is

$$e_C = 1.60217733 \cdot 10^{-19}\ C = 4.803206799 \cdot 10^{-10} \sqrt{g} \cdot \sqrt{cm^3} \cdot s^{-1}.$$

It contains the fractional powers of reference units which makes it impossible to understand the essence of the electron charge. The interrelation between this measure and the theoretical measure e of the electron charge [1] is as follows

$$e = \sqrt{4\pi\varepsilon_0} \cdot e_C. \qquad (7.3)$$

Hence, the theoretical measure of the electron charge is

$$e = 1.702692478 \cdot 10^{-9} g \cdot s^{-1}, \qquad (7.4)$$

that means that the electron charge represents the elementary mass speed (power) of exchange of elementary particles with the ambient field.

Expressions (7.2) and (7.4) make it possible to determine the fundamental frequency ω_e and wave radius $\bar{\lambda}_e$ of the exchange field at the atomic and subatomic levels [1]:

$$\omega_e = e / m_e = 1.86916197 \cdot 10^{18}\ s^{-1}, \qquad (7.5)$$

$$\bar{\lambda}_e = c / \omega_e = 1.603886998 \cdot 10^{-8}\ cm. \qquad (7.6)$$

The wave diameter $D = 2\bar{\lambda}_e$ characterizes the wave discreteness of space at the atomic level and it is equal to the average interatomic distance in crystals:

$$D_e = 2\frac{c}{\omega_e} = 3.207773996 \cdot 10^{-8}\ cm. \qquad (7.7)$$

The radius of the boundary sphere of the electron, according to (7.1a), is

$$r_e = \left(\frac{m_e}{4\pi\varepsilon_0} \right)^{1/3} = 4.169587953 \cdot 10^{-10}\ cm. \qquad (7.8)$$

We called r_e (7.8) the electron radius or the radius of intra-electron space.

The average mass of the electron, $m_e = 9.1093897 \cdot 10^{-28}\ g$, is in the vicinity of one third of the fundamental period Δ. Therefore, if to introduce the canonical gram g_e, according to the equality

$$1\,g_e = 1.001489399\,g, \tag{7.9}$$

then the average mass of the electron will take the fundamental value

$$m_e = 3^{-1}\Delta \cdot 10^{-27}\ g_e = 9.09584236 \cdot 10^{-28}\ g_e. \tag{7.10}$$

Since $\varepsilon_0 = 1\,g \cdot cm^{-3}$ is valid for the canonical gram (7.9) as well, hence, the canonical centimeter

$$1\,cm_e = 1.00049622\,cm. \tag{7.11}$$

The measure of the electron charge (7.4) lies at the level of the golden section of the fundamental period. Therefore, if the canonical second is introduced as

$$1\,s_e = 1.00312334\,s, \tag{7.12}$$

then we will get the fundamental value of the electron charge

$$e = \frac{5}{8}\Delta \cdot 10^{-9} \cdot g_e \cdot s_e^{-1} = 1.705470443 \cdot 10^{-9}\ g_e \cdot s_e^{-1}. \tag{7.13}$$

Canonical units define also the canonical radius of the electron

$$r_e = \left(\frac{\Delta}{12\pi}\right)^{1/3} \cdot 10^{-9}\ cm_e = 10\left(\frac{\lg e}{6}\right)^{1/3} \cdot 10^{-10}\ cm_e = 4.167519945 \cdot 10^{-10}\ cm_e. \tag{7.14}$$

8. Conclusion

1. The fundamental quantum of measures, originated from the Law of Decimal Base, exists independently of the consciousness of man. It is equal to the fundamental period of the dialectical binumerical wave field.

2. The universal spectrum of measures and numerical values of fundamental constants of physics depend on the value of the fundamental period-quantum.

3. Fundamental constants of physics and the reference units (i.e., the gram, the centimeter, and the second), selected by the collective experience of humanity, are the values related to the processes in the Universe. They reflect harmony of the material and ideal fields-spaces expressed in particular by the Law of Decimal Base.

4. Analysis of correspondence of experimental values of the fundamental physical constants with the fundamental quantum of measures may serve for verification of correctness of their selection and determination.

References

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