The System of Primordial Concepts in Dialectical Physics (Outline)

1. *Introduction in the logic of dialectical numerical fields*

Dialectical physics rests on two opposite algebras of signs: the *positive algebra of signs* (*Yes*-algebra),

$$(\pm)(\pm) = +, \qquad (\pm)(\mp) = -, \tag{1.1}$$

and the *negative algebra of signs* (*No*-algebra),

$$(\mp)(\mp) = -, \qquad (\mp)(\pm) = +. \tag{1.2}$$

Both algebras express the fundamental relations in nature. For example, an interaction of electric charges follows the *Yes*-algebra: the identical (in sign) two charges repeal (the sign "+" in the equality (1) shows it) and the opposite charges attract (the sign "–" in the equality (1) reflects it). In the magnetic field, the *N*o-algebra acts: currents of the same direction (that is equivalent to the same sign) attract (the sign "–" in the equality (2) expresses this) and opposite (in sign) currents repeal (the sign "+" in the equality (2) expresses this).

Accordingly, the field of binary numbers *Yes-No*, which follows the opposite algebras of signs, describes an electromagnetic field, as the binary (electric and magnetic) field. In the electromagnetic field, the *Yes*- and *No*-algebras express, respectively, the central and transversal interactions.

In dialectical logic and physics, the field with the algebra of signs *Yes-No* is represented by the interrelated fields of affirmative and negative judgements *Yes* and *No*. Two basic laws of judgements acts in the binary field of the aforementioned judgements. The first law states: "the affirmation of an arbitrary affirmation is the affirmation". At the level of algebraic affirmations (affirmations with signs), the formula of this law is expressed, according to (1), through the following equalities:

$$(\pm Yes)(\pm Yes) = +Yes, \qquad (\pm Yes)(\mp Yes) = -Yes. \tag{1.3}$$

The second law states: "the negation of an arbitrary negation is the affirmation". At the level of algebraic negations, the formula of this law is expressed, according to (2), as

$$(\mp No)(\mp No) = -Yes, \qquad (\mp No)(\pm No) = +Yes. \tag{1.4}$$

If we denote the unit of affirmation by the symbol 1 and the negation unit by the symbol $\dot{1}$, the algebra of unit judgements *Yes* and *No* is presented by the equalities:

$$(\pm 1)(\pm 1) = +1, \quad (\pm 1)(\mp 1) = -1, \quad (\mp\dot{1})(\mp\dot{1}) = -1, \quad (\mp\dot{1})(\pm\dot{1}) = +1. \tag{1.5}$$

As follows from these equalities, in the numerical subfield *Yes* of the binary field *Yes-No*, the square root of +1 exists, but does not exist of –1. On the contrary, in the numerical subfield *No*, the square root of +1 does not exist, but exists of –1.

By means of unit judgements, an additive element of the binary numerical field

$$\hat{Z} = Yes + No \tag{1.6}$$

can be presented in the form $\hat{Z} = a\cdot 1 + b\cdot\dot{1}$. It is convenient to present the unit of negation $\dot{1}$ by the letter i and to omit the unit of affirmation 1. At such an agreement, an additive element of the field *Yes-No* is expressed as

$$\hat{Z} = a + ib. \tag{1.7}$$

In the binary numerical field, the power $x\cdot 1$ of the number e (the basis of natural logarithms) expresses ***quantitative*** changes, which are defined by the equality:

$$e^{x\cdot 1} = e^{x}. \tag{1.8}$$

The power $y\cdot\dot{1}$ of the number e, as the power with the opposite property, expresses ***qualitative*** changes, which are defined by Euler's formula:

$$e^{y\cdot\dot{1}} = \cos y\cdot 1 + \sin y\cdot\dot{1} \qquad \text{or} \qquad e^{y\cdot\dot{1}} \equiv e^{iy} = \cos y + i\sin y. \tag{1.9}$$

On the basis of the formulae (1.8) and (1.9), a multiplicative element of the binary numerical field *Yes-No*, expressing the quantitative-qualitative changes, takes the form

$$\hat{Z} = e^x e^{iy} \equiv e^{x+iy} = e^x(\cos y + i\sin y)\,. \qquad (1.10)$$

In particular, if $\hat{Z}$ describes an elementary harmonic wave, we have

$$\hat{Z} = ae^{i(\omega t - ks)} = ae^{-iks}(\cos\omega t + i\sin\omega t)\,. \qquad (1.11)$$

Under the condition $s = 0$, the number $\hat{Z}$ is represented by the time spatial graph (Fig. 1). In such a wave, its components are defined by the measures: *Yes* = $a\cos\omega t$ and *No* = $ia\sin\omega t$. An elementary wave is characterized by two points-extremes *No* (dark circles) and two points-extremes *Yes* (light circles). The four discrete states of the elementary wave correspond to these points-extremes. If, for example, the discrete points *No* express the extremes of motion ("kinetic points"), then, the discrete points *Yes* express the extremes of rest ("potential points"). In this case, the graph $\hat{Z}$ is a graph of the potential-kinetic wave.

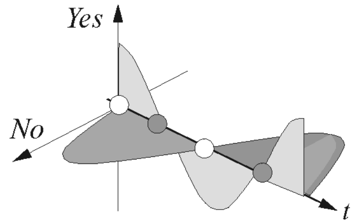

Fig. 1. A graph *Yes* + *No* of the potential-kinetic wave.

Formally, the binary numerical field *Yes-No* can be perceived as the field of neocomplex numbers, but this is not true. The numerical field *Yes-No* and the field of complex numbers differ essentially. The possibilities of the field *Yes-No* are incomparably higher, even because the field *Yes-No* is realized in the real space of events. The field of complex is limited by an abstract complex plane with Riemann surfaces far from the real physical world.

2. *The logic of Yes-No-field and the potential-kinetic field of an oscillating material point*

Oscillations of a material point have the potential-kinetic character. The symmetrical binary notions and measures must describe them. Let us consider the binary notions with an example of harmonic oscillations.

If the potential displacement (a displacement from the equilibrium state) *Yes* exists, the kinetic displacement *No* must exist as well. Correspondingly, the kinetic speed, as the speed of change of motion, must be conjugated with the potential speed of change of rest. The last supposes the supplementation of the kinetic momentum with the potential momentum, etc.

We will introduce the lack notions. Let us assume that the potential displacement *Yes* of a material point is described by the equality

$$Yes = a\cos\omega t\,. \qquad (2.1)$$

In the oscillatory process, motion (the kinetic field) and rest (the potential field) are shifted in phase by a quarter-period. Accordingly, if the potential displacement *Yes* changes following the cosine law (2.1), the kinetic displacement *No* follows the sine law

$$No = ia\sin\omega t\,, \qquad (2.2)$$

which will be also presented in the form

$$iNo = ia\sin\omega t\,. \qquad (2.2a)$$

The last form stresses the character of measures of the field *No*.

Both displacements, reflecting an indissoluble bond of rest and motion, form the potential-kinetic displacement $\hat{\Psi}$:

$$\hat{\Psi} = Yes + iNo\,. \qquad (2.3)$$

Denoting by x_p the potential displacement *Yes* and ix_k the kinetic displacement *iNo*, the potential-kinetic displacement will take the form

$$\hat{\Psi} = x_p + ix_k = ae^{i\omega t} = a\cos\omega t + ia\sin\omega t\,. \qquad (2.4)$$

The displacement $\hat{\Psi}$ characterizes the *potential-kinetic state* $\hat{S}$ of a material point, which is defined by the product of its mass *m* by the displacement $\hat{\Psi}$:

$$\hat{S} = m\hat{\Psi} = s_p + is_k, \quad (2.5)$$

where $s_p = mx_p$ and $is_k = mix_k$ (2.5a)

are, respectively, the potential and kinetic states of a material point in the harmonic motion.

The potential-kinetic displacement defines the *potential-kinetic speed*

$$\hat{\upsilon} = \frac{d\hat{\Psi}}{dt} = \upsilon_k + i\upsilon_p, \quad (2.6)$$

where $\upsilon_k = i\omega \cdot ix_k = -\omega x_k$ (2.6a)

is the kinetic speed of change of motion, and

$$i\upsilon_p = i\omega \cdot x_p \quad (2.6b)$$

is the potential speed of change of rest. The amplitude of the speed is the total speed:

$$\upsilon = \omega a. \quad (2.6c)$$

As follows from the formulae (2.6a) and (2.6b), the kinetic displacement defines the kinetic speed and the potential displacement – the potential speed.

The field of *potential-kinetic momentum* $\hat{P}$ defines the rate of change of potential-kinetic state $\hat{S}$ of a material point:

$$\hat{P} = \frac{d\hat{S}}{dt} = m\hat{\upsilon} = m(\upsilon_k + i\upsilon_p) = p_k + ip_p, \quad (2.7)$$

where $p_k = m\upsilon_k = mi\omega ix_k = -m\omega x_k$ (2.7a)

is the kinetic momentum, and

$$ip_p = mi\upsilon_p = mi\omega x_p \quad (2.7b)$$

is the potential momentum.

The kinetic momentum is related with the potential displacement, the potential momentum is related with the kinetic displacement. The amplitude value of momentum is defined by the amplitude speed:

$$p = m\upsilon. \quad (2.7c)$$

The field of momentum $\hat{P}$ is the field of motion-rest of the first level with respect to the $\hat{S}$-state.

The potential-kinetic speed defines the *potential-kinetic acceleration*

$$\hat{w} = \frac{d\hat{\upsilon}}{dt} = -\omega^2(x_p + ix_k) = w_p + iw_k, \quad (2.8)$$

where $w_p = -\omega^2 x_p$ (2.8a)

is the potential acceleration, and $iw_k = -\omega^2 \cdot ix_k$ (2.8b)

is the kinetic acceleration.

The potential-kinetic state can be also presented in the following forms:

$$\hat{S} = me^{i\omega t}a = (m\cos\omega t + im\sin\omega t)a = (m_p + im_k)a = \hat{m}a = s_p + is_k, \quad (2.9)$$

where $\hat{m} = me^{i\omega t} = m_p + im_k$ (2.9a)

is the *potential-kinetic mass* of a material point (with the module *m*) in the harmonic oscillation.

If $Yes = m\cos\omega t$ and $iNo = im\sin\omega t$, a graph $Yes + iNo$ is the graph of the potential-kinetic mass. The last defines the *potential-kinetic* (*kinematic*) *charge* $\hat{q}$ of a material point:

$$\hat{q} = \frac{d\hat{m}}{dt} = i\omega\hat{m} = -\omega m_k + i\omega m_p, \quad (2.10)$$

where $q_k = -\omega m_k$ and $iq_p = i\omega m_p$ (2.10a)

are, respectively, the kinetic and potential charges.

The kinematic charge is the field of rate of change of the potential-kinetic state of mass $\hat{m}$ in oscillatory and wave processes. Its amplitude is equal to

$$q = \omega a. \quad (2.10b)$$

The field of rate of change of the potential-kinetic charge is the *field of the potential-kinetic* (*kinematic*) *current*

$$\hat{I} = \frac{d\hat{q}}{dt} = \frac{d^2\hat{m}}{dt^2} = i\omega\hat{q} = -\omega^2\hat{m} \quad (2.11)$$

with the amplitude $I = \omega q = m\omega^2 = k$. (2.12)

The amplitude of kinematic current (2.12) is called the elasticity coefficient. Such a name relates the amplitude of kinematic current with the biological sensation of the field of rest. The field of potential-kinetic current $\hat{I}$ is the field of potential-kinetic accelerations of the potential-kinetic field of the state of mass $\hat{m}$.

The field of rate of change of the potential-kinetic momentum is the field of potential-kinetic rate ("force" $\hat{F}$) of exchange of momentum:

$$\hat{F} = \frac{d\hat{P}}{dt} = f_p + if_k = m\hat{w} = m(w_p + iw_k) = -I\hat{\Psi}, \quad (2.13)$$

where

$$f_p = \frac{dp_k}{dt} = mw_p = -kx_p = Ix_p \quad (2.13a)$$

is the potential rate (the vector power) of exchange of kinematic momentum, and

$$if_k = \frac{dip_p}{dt} = miw_k = -kix_k = -Iix_k \quad (2.13b)$$

is the kinetic rate (the vector power) of exchange of potential momentum.

The power of exchange of momentum $\hat{F}$ is the field of motion of the second level with respect to the $\hat{S}$ -state. The integral

$$\hat{A} = \int_0^t \hat{F} d\hat{\Psi} = \left. \frac{m\hat{\upsilon}^2}{2} \right|_0^t = \frac{m\hat{\upsilon}^2}{2} - \frac{m\hat{\upsilon}_0^2}{2} \quad (2.14)$$

defines the kinematic energy $\hat{E}$:

$$\hat{E} = \frac{m\hat{\upsilon}^2}{2} = \frac{m(\upsilon_k + i\upsilon_p)^2}{2} = \frac{m\upsilon_k^2}{2} - \frac{m\upsilon_p^2}{2} + im\upsilon_k\upsilon_p. \quad (2.15)$$

The first and second components of energy are kinetic and potential energies:

$$E_k = \frac{p_k^2}{2m} = \frac{m\upsilon_k^2}{2} = -\frac{k(ix_k)^2}{2}, \qquad E_p = \frac{(ip_p)^2}{2m} = \frac{m(i\upsilon_p)^2}{2} = -\frac{kx_p^2}{2}. \quad (2.15a)$$

The third component is the sum of the potential-kinetic and kinetic-potential energies:

$$E_{pk} = \frac{im\upsilon_p\upsilon_k}{2} = \frac{ikx_px_k}{2}, \qquad E_{kp} = \frac{im\upsilon_k\upsilon_p}{2} = \frac{ikx_kx_p}{2}. \quad (2.15b)$$

Thus, in dialectical physics, the kinematic energy is presented by the four components: the kinetic energy *Yes-Yes*, the potential energy *No-No*, the potential-kinetic energy *No-Yes*, and the kinetic-potential energy *Yes-No*.

As follows from the formulae, the kinetic displacement and the kinetic speed define the kinetic energy, and the potential displacement and the potential speed define the potential energy.

The potential displacement, which defines the potential field of oscillations, is observed by sight. Therefore, it can be also called the "material" displacement. The kinetic displacement, which defines the kinetic field of oscillations, can be called the "ideal" displacement. The "ideal" displacement is not observed by sight.

The material displacement is the measure of the perfect real oscillation, i.e., the measure of the past process. The ideal displacement is the measure of the possible oscillation, i.e., the measure of the future process. Thus, the potential-kinetic displacement is a synthesis of the past and future, real and possible process of oscillations.

The amplitude value of potential-kinetic energy is defined by the difference of the kinetic and potential energies:

$$E = \frac{p^2}{2m} = \frac{m\upsilon^2}{2} = \frac{ka^2}{2} = E_k - E_p\,. \tag{2.16}$$

In the case of two mutually perpendicular oscillations, generating the circular motion, the amplitude energy doubles,

$$E = m\upsilon^2\,, \tag{2.16a}$$

and the sum of potential and kinetic energies, which we will also call the total energy, turns out to be equal to zero:

$$E = E_k + E_p = \frac{m\upsilon^2}{2} + \left(-\frac{m\upsilon^2}{2}\right) = 0\,. \tag{2.16b}$$

Thus, the circular motion is characterized by the zero energy. Moreover, motion at a small part of any trajectory can be regarded, in every instant, as the motion along the instant tangential circumference to this trajectory. Therefore, any motion is the motion with an infinite continuous series of circular motions with the total zero energy. By virtue of this, the energy of the Universe is equal to zero that expresses the numerical equality of energies of potential and kinetic fields in the Universe, as the energies with the opposite signs.

Because the total energy is constant and equal to zero, during the transitions of potential-kinetic systems from one state to another, their potential and kinetic energies are changed by the equal quantities. We should regard this statement as the generalized law of conservation (the total zero energy) and change (non-conservation in the equal quantities) of potential and kinetic energies. In essence, this is the *binary law of conservation-non-conservation of energy*.

If the superposition of two mutually perpendicular harmonic oscillations takes place, the wave motion along a circle arises. In the simplest case, one half-wave is placed on an orbit. An orbiting material point is situated in the node of such an orbit. Its motion is characterized by the kinematic moment

$$\hat{\mu}_k = \hat{I}S \qquad \text{or} \qquad \hat{\mu}_k = \frac{1}{c}\hat{I}S\,, \tag{2.17}$$

where $\hat{I}$ is the kinematic current, *c* is the speed of wave processes in the ambient space, and $S = \pi a^2$ is the area of a circular orbit. The speed on the orbit is $\upsilon = \frac{\lambda}{T} = \frac{4\pi a}{T}$, then an average value of the kinetic moment is

$$\mu_k = \frac{2}{\pi}IS = \frac{2}{\pi}\omega q \pi a^2 = \upsilon q a = p\upsilon = m\upsilon^2 = E \tag{2.18}$$

or

$$\mu_k = \frac{2}{\pi}\cdot\frac{1}{c}IS = \frac{\upsilon}{c}qa = \frac{\upsilon}{c}p = \frac{1}{c}m\upsilon^2 = \frac{1}{c}E\,, \tag{2.18a}$$

where $p = qa$ is the total charge moment (it also is the total momentum $p = m\upsilon$) and *E* is the amplitude of total energy.

The ratio of the average kinetic moment to the moment of the total momentum $L = m\upsilon a$ is

$$\frac{\mu_k}{L} = \frac{q}{m} = \omega \qquad \text{or} \qquad \frac{\mu_k}{L} = \frac{q}{mc} = \frac{\omega}{c} = k\,, \tag{2.19}$$

where *k* is the wave number.

The dialectical physics mathematical tool provides the complete description of harmonic oscillations, excluding subjective “interpretations”. This allows clarifying the nature of atomic phenomena, where the unimaginably high speeds and frequencies take place.

3. *The fundamental period of the wave binary Yes-No-field and reference units*

3.1. The first and second kind laws

Quantitative-qualitative wave properties of the field of matter-space-time form the proper ***quantitative-qualitative binary Yes-No field of symmetrically opposite properties of the Universe***.

The *Yes-No* field is the field-space of zero dimensionality, localized in the physical space of the Universe and, simultaneously, being outside the space of the Universe. This is an ideal field-space, it induces in the ideal space of thinking the ***binary numerical field of Yes-No***. The numbers $\hat{Z}$ of this field with basis *B* and an exponent (superstructure) $i\varphi$ are presented in the form

$$\hat{Z} = r\exp_B(i\varphi)\,, \quad \text{or} \quad \hat{Z} = rB^{i\varphi} = re^{\ln B i\varphi} = r(\cos(\ln B\cdot\varphi) + i\sin(\ln B\cdot\varphi))\,, \qquad (3.1)$$

where *r* is the constant component (modulus) of the number $\hat{Z}$.

The condition of periodicity $\ln B\cdot\varphi = 2\pi n$, where *n* is an integer, defines the fundamental period-quantum of the number-measure with basis *B*:

$$\Delta = 2\pi\log_B e\,. \qquad (3.2)$$

The universal process engendered in the space of human thought the decimal base *B* = 10, which should be regarded as the law of decimal base. ***This is the law of the ideal field of the Universe***. We will call it the ***second kind law*** as against the physical laws (the laws of material processes) regarded as the ***first kind laws***. The decimal base forms the fundamental quantum-period of the second kind law:

$$\Delta_p = 2\pi\log e \approx 2.7288 \qquad (3.3)$$

or briefly the ***fundamental quantum-period of the second kind***.

There are reasons to assume that the numerical wave *Yes-No* field with the period-quantum Δ_p is one of the elementary levels of an informational field of the ideal facet of the Universe.

The fundamental quantum defines the quantum-period of half-wave Δ_s or briefly the wave half-period–half-quantum:

$$\Delta_s = \pi\lg e \approx 1.3644 \approx 1.37\,. \qquad (3.3a)$$

Reference measures are closely related with the fundamental quantum Δ_p.

3.2. The gram

The *Ancient Roman ounce* is practically equal to the fundamental period:

$$\Delta_p = 2.7288\,dg\,. \qquad (3.4)$$

In ancient Babylon, the units of mass *minas*, proportional to the Ancient Roman ounce Δ_p, were widely spread. In ancient Egypt, a *kedet*, alone third of the ounce Δ_p, was the main unit of mass. In ancient Rome, the unit of mass, a *libra*, was equal to the twelve ounces. Other units of mass, multiple to the ounce Δ_p, were also widespread. In ancient Greece, a *metret* (a unit of volume) was equal to 1000 ounces, or to the volume of 27.2878 *l*.

The volumetric density of cereals in England was within 0.73 – 0.79 *kg/l*. With the volumetric density equal to $0.75\,kg\cdot l^{-1}$, the Old English bushel of free-flowing substances, defined the unit of mass of one *bushel*, was equal to $1\,bu_m \approx 36.3677\,l\cdot 0.75\,kg\cdot l^{-1} \approx 27.28\ \ kg \approx 10^3\cdot\Delta_p$. Through liquids (water, wine, and beer), the bushel of mass formed an equal (in value) bushel with a volume of 27.28 *l*.

Like the pounds of volume 0.373242 *l* with the volumetric density 0.73 *kg/l*, British apothecaries' and monetary pounds gave rise to the *pounds* with the mass 0.273 *kg*. One hundred of these pounds composed a bushel of mass. Five bushels of mass generated a *barrel* of 136.4 *kg*, etc.

The Russian metrological spectrum of mass is closely related with the wheat grain, which in Russia was called *pirog*. According to historical and archaeological data, the Russian metrological spectrum of mass has been represented by the series:

1 pirog (pie) (a wheat corn) = 42.625 *mg*, 1 polupochka (a half-bud) = 2 pirogs = 85.25 *mg*,
1 pochka (a bud) = 4 pirogs = 0.1705 *g*, 2 pochkas = 8 pirogs = 0.3411 *g*,
4 pochkas = 16 pirogs = 0.6822 *g*, 8 pochkas = 32 pirogs = 1.3644 *g*,
12 pochkas = 48 pirogs = 2.0466 *g*, 16 pochkas = 64 pirogs = 2.7288 *g*, etc.

Thus, the reference unit of mass the *gram* is the measure, which forms the decimal period-quantum Δ_p; therefore, the gram belongs to the second kind quanta ("magic measures").

3.3. The centimeter

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

$$s_{\min} \approx \frac{\pi}{180 \cdot 60} D \approx 7.3 \cdot 10^{-3} cm \qquad \text{or} \qquad 1cm \approx 137 s_{\min}, \qquad (3.5)$$

where D = 25 *cm* is the average distance of the best eyesight. Accordingly, it is possible to suppose that for most people a tendency towards the ideal equality takes place:

$$1\ cm = 50 \cdot 2\pi \lg e \cdot s_{\min} \qquad (3.5a)$$

Thus, the measures of length on the basis of centimeter follow the fundamental period-quantum Δ_p:

$$1\ mm = 5 \cdot 2\pi \lg e \cdot s_{\min}, \quad 1\ dm = 5 \cdot 2\pi \lg e \cdot 10^2 s_{\min}, \quad 1m = 5 \cdot 2\pi \lg e \cdot 10^3 s_{\min}. \quad (3.6)$$

In this sense, the *centimeter* is the "magic" units.

The Old Russian system of measures is mainly described by the following formula:

$$M = 2^k 3^l 5^m 7^n \Delta_p, \qquad (3.7)$$

where numbers 2, 3, 5 and less frequently 7 are ordinal units of count and $k, l, m, n \in Z$. This system has the universal character and is peculiar to ancient measures of many nations.

3.4. The second

In the year 2000, a star day T was equal to $23^h 56^m 04^s.10056$. An angular speed of Earth's revolution, corresponding to this day, $\omega_e = 7.29211501 \cdot 10^{-5} s^{-1}$, hence, a daily radius T_R is

$$T_R = \frac{1}{\omega_e} = \frac{T}{2\pi} = 1.37134425 \cdot 10^4 s. \qquad (3.8)$$

The daily radius is in the vicinity of the fundamental half-period, and if the new canonical second s_k is introduced, according to the equality $1 s_k$ = 1.00510702 s, then a duration of the period will be exactly equal to the fundamental quantity

$$T_R = \frac{T}{2\pi} = 2^{-1} \Delta_p \cdot 10^4\ s_k = 1.36437635 \cdot 10^4 s_k, \qquad (3.9)$$

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

$$\omega_e = \frac{1}{T_R} = \frac{2}{\Delta_p} \cdot 10^{-4} s_k^{-1}. \qquad (3.10)$$

Thus, the *second* must also be referred to the "magic" units. Accordingly, ***all reference units are the second kind quanta***.

4. *Matter-space according to dialectical physics and the basic parameters of exchange*

4.1. The density and embeddedness of the physical field of matter-space

In dialectical physics, matter and space are regarded as the indissoluble single wave potential-kinetic field of matter-space. It represents by itself an infinite series of spaces embedded in each other:

$$\Omega = \Pi_M + \Pi_A + \Pi_H + \Pi_\mu + \Pi_C + ... + \Pi_{C_\mu} + ... + \Pi_X + ..., \qquad (4.1)$$

where Π_X is an arbitrary level of such a single field. The series (4.1) is analogous to the functional series. The subscripts express the molecular (M), atomic (A), H-atomic (H), and microparticles (μ) spaces and the spaces with the basis speed c (C) and c_μ (C_μ) ; etc.

The infinite series of embedded physical fields-spaces (and fields of matter) expresses the fundamental idea of dialectical philosophy – the *infinite divisibility* of matter-space-time according to approaching to the zero field of the Universe, as the ideal formation.

Every level of space is the ***basis level*** for the nearest above situated level and, simultaneously, it is the ***level of superstructure*** for the nearest below situated level of space. It means that above situated field-spaces are formed on the basis of below lying fields-spaces. Accordingly, in dialectics, there is no sense to speak about the very last elementary particles in the common classical sense of this word.

The *C*-space with the basis speed *c* is the general basis space for the spaces *M, A, H*, and μ.

Dialectical physics rests only on a triad of the field of matter-space-time, therefore, only three reference units, the *gram g*, the *centimeter cm*, and the *second s* are included in its physical basis. The remaining units are derivative of these reference units.

The rational relations between matter, space, and time take place during the exchange (interaction) of all wave fields of matter-space-time. Therefore, formulae of dimensionality of derivative units are defined only through integer powers of reference units:

$$\mathrm{E} = Q\mathrm{E}_{nom} = Q \dim M^{n_M} L^{n_L} S^{n_S}, \qquad \text{where} \quad n_M, n_L, n_S \in Z, \qquad (4.2)$$

E is an arbitrary physical quantity and *Q* is its quantitative measure, $\mathrm{E}_{nom} = 1\dim M^{n_M} L^{n_L} S^{n_S}$ is the unit of the physical quantity.

We call the system of units, based on the formula (4.2), the reference system of units on the basis of the *gram g*, the *centimeter cm*, and the *second s* (*RGCS*). The *RGCS* system is universal. It does not contain those fundamental errors, which are contained (in an implicit form) in the existing systems, including *SI*.

The units *CGS*, *CGSE*, and *CGSM* contain the derivative units, which are expressed through fractional powers of reference units. Such units have no physical sense and relate to the class of pseudomeasures. On their basis, many units of *SI* were created.

The *RGCS* system is the system of notes of dialectical physics, which are able to describe any compositions of nature. On the contrary, the notes of irrational noise of *CGS*, *CGSE*, *CGSM*, and *SI* systems cannot do it.

Between the mass of a substance *M*, as the measure of a concrete kind of matter, and the volume of space *V*, in which the substance is localized, takes place the proportionality:

$$M = \varepsilon V = \varepsilon_0 \varepsilon_r V, \qquad (4.3)$$

where $\varepsilon_0 = 1g/cm^3$ is the unit density, ε_r is the relative density (equal to the number of unit densities), and $\varepsilon = \varepsilon_0 \varepsilon_r$ is the absolute density. Along with the densities, it is convenient to operate with the permeabilities $\mu_0 = 1/\varepsilon_0$, $\mu_r = 1/\varepsilon_r$, and $\mu = 1/\varepsilon$. Then, the equality (4.3) takes the form

$$V = \mu M = \mu_0 \mu_r M. \qquad (4.3a)$$

It follows from the theory of wave exchange of matter-space-time, the *gram is the unit measure of wave exchange of matter-space-time*. On the other hand, the relation $\varepsilon = \varepsilon_0 \varepsilon_r = M/V$ is the measure of embeddedness of substance-matter, as the physical space *M*, in the volume *V*. In this sense, the *gram is, simultaneously, the unit measure of embeddedness of physical space in itself.* And the *measure of mass M is the measure of physical space with regarding for its embeddedness in itself.* With that, ε_r is the coefficient of relative embeddedness, $\varepsilon = \varepsilon_0 \varepsilon_r$ is the coefficient of absolute embeddedness, and $\varepsilon_0 = 1g/cm^3$ is the unit embeddedness of space. It was fully developed in time that, at the level of *C*-space, $\varepsilon_r = 1$.

4.2. The vectors of exchange of matter-space

At the elementary level, the pair of vectors of the central (longitudinal) exchange characterizes wave processes of exchange of matter-space:

$$D = \varepsilon E = \varepsilon_0 \varepsilon_r E, \qquad (4.4)$$

where *E* is the kinematic vector of speed and *D* is the vector of density of momentum of the field of matter-space.

The analogous pair of vectors, *H* and *B*, represents the transversal (non-central) wave field of exchange:

$$H = \varepsilon B = \varepsilon_0 \varepsilon_r B \qquad \text{or} \qquad B = \mu_0 \mu_r H. \qquad (4.4a)$$

The vectors D and E describe spherical wave fields, the vectors H and B describe the cylindrical wave fields.

4.3. Charges and masses of exchange of matter-space

The differential wave exchange of mass-space dm between any microobject of spherical structure of the radius r_e, including an electron, and the basis space C during the time dt can be expressed by the following equality:

$$dm = \varepsilon_0 d\Omega = \varepsilon_0 4\pi r_e^2 E dt \qquad \text{or} \qquad dm = \varepsilon_0 4\pi r_e^2 \upsilon dt, \tag{4.5}$$

where $E = \upsilon$ is the speed of exchange of space in the wave field-space C. The speed υ is the speed of wave pulsations of the spherical electron field-space at its boundary surface of the radius r_e, as an amplitude quantity.

The *intensity of electron exchange e* (i.e., the power of exchange or the volumetric rate of exchange of physical space) is called in dialectical physics the *electron charge* or the *exchange charge* or simply the *charge*:

$$e = \frac{dm}{dt} = \varepsilon_0 \frac{d\Omega}{dt} = 4\pi r_e^2 \varepsilon_0 E = 4\pi r_e^2 D = 4\pi r_e^2 \varepsilon_0 \upsilon_e, \tag{4.6}$$

where υ_e is the speed of oscillations in the spherical wave field-space at the electron's surface. In the steady-state wave spherical field of exchange, in accordance with the equality (4.6), a field of the E-vector is

$$E = \frac{e}{4\pi\varepsilon_0 r^2}. \tag{4.6a}$$

In a general case, E is the vector of the wave rate of kinematic exchange. Its potential-kinetic structure, in the simplest case, is

$$E = \hat{E}_m e^{i(\omega t - kr)}. \tag{4.7}$$

If $\upsilon_e = \omega_e r_e$, the amplitude value of the electron charge is

$$e = 4\pi r_e^3 \varepsilon_0 \omega_e, \tag{4.8}$$

where ω_e is some fundamental frequency of exchange of the field of matter-space. It should be stressed that the electron charge of exchange above all is the field parameter of electron's exchange with the ambient field of matter-space. And only afterwards, it can be regarded also as the parameter of the electron itself. Accordingly, the classical expression "an electron has the electric charge e or an electron is charged with the charge e" is (in dialectical physics of the wave exchange of matter-space-motion-rest) a conditional expression, which is incorrect, in essence.

The exchange has the wave potential-kinetic character. Therefore, one should speak about the potential-kinetic field of matter-space. By this reason, the differential electron exchange can be expressed in the following way:

$$dm = d(m_m e^{i(\omega t - kr)}) = i\omega m dt. \tag{4.9}$$

Then, the measure of the charge is presented as

$$e = \frac{dm}{dt} = i\omega m \tag{4.10}$$

with the amplitude measure

$$e = \omega m, \tag{4.11}$$

where m is the elementary amplitude mass of exchange of physical space, inseparable of the electron. Further, if one needs to stress its exchange character, this mass will be marked by the subscript e: m_e.

The mass m_e, or simply the electron mass, is the characteristic of interdependence of the electron and the ambient basis space C.

Comparing the formulae (4.8) and (4.11), we obtain the explicit expression for the electron mass m_e, as the amplitude quantity:

$$m_e = \frac{e}{\omega_e} = 4\pi r_e^3 \varepsilon_0 = m_m. \tag{4.12}$$

The above-stated notions of dialectical physics, for the sake of popularity, have been presented here in the simplest form. However, this allows clarifying, in outline, the essence of the notions. All they are described in detail, in the authors' books of 1996, 1998, and 2001. The deeper analysis of exchange on the basis of the equation of exchange shows that the field mass of exchange of a microparticle with the ambient space of matter-space-time is expressed by the formula

$$m = \frac{4\pi\varepsilon_0 r^3}{1 + k_e^2 r^2}, \qquad (4.12a)$$

where r is the radius of a microparticles and $k_e = \omega_e / c$ is the wave number.

This formula is valid for any microparticle, because it was obtained on the basis of solutions of the general problem of wave exchange of matter-space-time. In the case of an electron, $k_e^2 r_e^2 << 1$, therefore, one can use the simplest formula of mass (4.12).

5. *Charges and some parameters of the field of exchange of matter-space*

The rate of exchange of momentum of matter-space at the level of *C*-space, related only with the change of mass in the field of speed *E*, is defined by the expression

$$F = \frac{d(mE)}{dt} = \frac{dm}{dt}E = eE = \frac{eq}{4\pi\varepsilon_0 r^2}. \qquad (5.1)$$

Coulomb's law in the empirical form corresponds to this expression:

$$F = \frac{e_c q_c}{r^2}. \qquad (5.1a)$$

The empirical expression (5.1a) contradicts to the law of integer powers of reference units, because the dimensionality of "electric charge", originated from the expression, has no physical sense:

$$\dim e = g^{1/2} \cdot cm^{3/2} \cdot s^{-1}. \qquad (5.2)$$

Indeed, nobody can show an object, which has the mass with the strange dimensionality of $g^{1/2}$, in the strange space of $cm^{3/2}$ and with the rate of exchange of $g^{1/2} \cdot cm^{3/2} \cdot s^{-1}$. These dimensionalities are the result of errors of classical electrodynamics, about which many discussions and talks took place during the two last centuries. By virtue of their complexity, physics was not able to remove these errors and began relying on the measures with fractional powers of reference units, which represent by themselves the subjective measures (pseudomeasures).

The relation between the two forms of Coulomb's law, (5.1) and (5.1a),

$$F = \frac{eq}{4\pi\varepsilon_0 r^2} = \frac{\frac{e}{\sqrt{4\pi\varepsilon_0}}\frac{q}{\sqrt{4\pi\varepsilon_0}}}{r^2} = \frac{e_c q_c}{r^2} \qquad (5.3)$$

defines the correlation between the "electric Coulomb charge" q_c and the exchange charge q:

$$q = q_c\sqrt{4\pi\varepsilon_0}. \qquad (5.4)$$

The exchange charge reveals the true nature and measure of the "electric charge". Using the relation (5.4), we find the correlation between the exchange and Coulomb vectors and the corresponding potentials:

$$E_c = \frac{E}{\sqrt{4\pi\varepsilon_0}}, \qquad B_c = \frac{B}{\sqrt{4\pi\varepsilon_0}}; \qquad (5.5)$$

$$\varphi = \frac{q}{4\pi\varepsilon_0 r} = \frac{1}{\sqrt{4\pi\varepsilon_0}}\frac{q_c}{r} = \frac{\varphi_c}{\sqrt{4\pi\varepsilon_0}}. \qquad (5.6)$$

Let us present the central exchange of matter-space in the form of the elementary law of central "interaction of masses" or the "law of universal gravitation":

$$F = \frac{qQ}{4\pi\varepsilon_0 r^2} = \frac{1}{4\pi\varepsilon_0 r^2}\frac{dm}{dt}\frac{dM}{dt} = -\frac{\omega_g^2 mM}{4\pi\varepsilon_0 r^2} = -\gamma\frac{mM}{4\pi\varepsilon_0 r^2} = -G\frac{mM}{r^2}, \qquad (5.7)$$

where $\gamma = \omega_g^2$ is the constant of exchange, connected with the "gravitational" constant by the relation

$$G = \frac{\gamma}{4\pi\varepsilon_0} = \frac{\omega_g^2}{4\pi\varepsilon_0}. \qquad (5.8)$$

From this, we obtain the fundamental frequency of the "gravitational" exchange

$$\omega_g = \sqrt{4\pi\varepsilon_0 G} = 9.156956336\cdot 10^{-4}\, s^{-1}. \qquad (5.9)$$

if one accepts $G = 6{,}672590000\cdot 10^{-8}\, g^{-1}\cdot cm^3\cdot s^{-2}$. Thus, the "*gravitational field*" *is the wave field-space of C-basis of superlow frequencies*.

The gravitational frequency defines the gravitational wave number and the corresponding wave radius of microparticles, which simultaneously is the radial elementary "gravitational" wave,

$$\lambda\!\!\!^{-}_g = \frac{c}{\omega_g} = 3.273931282\cdot 10^{13}\, cm = 327.39 Mkm. \qquad (5.10)$$

The shell of the gravitational radius in stellar systems (i.e., in spherical objects of megaspace as atoms of the megaworld) divides the oscillatory domain of the spherical field-space of a star and its wave domain. Asteroids are situated in this intermediate domain.

In the *spherical* wave field of the elementary structure, the following correlation between the speed and radial distance takes place:

$$\upsilon r = const. \qquad (5.11)$$

This equality expresses Kepler's second law. In the *cylindrical* field of the elementary structure, this correlation is different,

$$\upsilon^2 r = const, \qquad (5.12)$$

it represents by itself Kepler's third law (in the simplest form). Thus, Kepler's second and third laws express the complicated spherical-cylindrical character of wave fields of exchange of matter-space.

On the basis of introduced and obtained measures of exchange, in the central spherical field, it is possible to define electron's wave parameters.

From the formula of electron's wave mass (4.12), assuming that it is equal to $m_e = 9.1093897\cdot 10^{-28}\, g$, we define the radius of electron's boundary sphere

$$r_e = \sqrt[3]{\frac{m_e}{4\pi\varepsilon_0}} = 4.169587953\cdot 10^{-10}\, cm. \qquad (5.13)$$

Using the relation (5.4), we arrive at the true measure of electron's charge

$$e = e_c\sqrt{4\pi\varepsilon_0} = 1.70269248\cdot 10^{-9}\, g/s, \qquad (5.14)$$

where $e_c = 4.803206834\cdot 10^{-10}\, g^{1/2}\cdot cm^{3/2}\cdot s^{-1}$ is the Coulomb pseudomeasure of electron's charge.

Knowing the true measure of charge (5.14) and the electron's exchange mass, we find the fundamental frequency of wave exchange of space of the mass m_e:

$$\omega_e = \frac{e}{m_e} = 1.869161968\cdot 10^{18}\, s^{-1}. \qquad (5.15)$$

The following fundamental quantum-period of the electron time corresponds to this frequency:

$$T_e = \frac{2\pi}{\omega_e} = 5.349991151\cdot 10^{-19}\, s. \qquad (5.15a)$$

The wave radius, corresponding to the fundamental frequency (5.15), at the level of *C*-space, is

$$\lambda\!\!\!^{-}_e = \frac{c}{\omega_e} = 1.603886998\cdot 10^{-8}\, cm. \qquad (5.16)$$

This value corresponds to the average atomic radius of the elements of periodic table. *It means that the wave exchange-radiation takes place continuously and the so-called "electrostatic field" is the exafrequency field of the space of C-basis and μ-superstructure*.

Resting on the elementary wave formulas of exchange in the form of Ohm's law

$$I = \frac{\varphi}{R}, \qquad \text{where} \qquad R = \rho \frac{l}{S}, \qquad (5.17)$$

we can obtain the relation between the quantum of specific resistance of exchange ρ_e and the fundamental frequency (5.15) in the spherical field of exchange. With that end in view, let us assume that $\varphi = \frac{e}{4\pi\varepsilon_0 r}$, $l = r$, $S = 4\pi r^2$, and $I = \omega_e m_e$, then, we arrive at the *quantum of specific resistance*

$$\rho_e = \frac{SR}{l} = \frac{S\varphi}{Il} = \frac{1}{\varepsilon_0 \omega_e} = \frac{m_e}{\varepsilon_0 e}. \qquad (5.18)$$

The rate of exchange at the electron's surface is

$$\upsilon_e = \frac{e}{4\pi r_e^2 \varepsilon_0} = 7.793635231 \cdot 10^8 \, cm/s. \qquad (5.19)$$

Then, the rate of exchange at the cylindrical wave surface of the Bohr radius $r_0 = 5.29177249 \cdot 10^{-9} \, cm$ will be equal to

$$\upsilon_0 = \upsilon_e \sqrt{\frac{r_e}{r_0}} = 2.187691417 \cdot 10^8 \, cm/s. \qquad (5.20)$$

Relying on the formula (4.12a), one can estimate the average field mass of exchange of the *H*-atom. As the first approximation, we accept the radius of the wave shell of the *H*-atom to be equal to the Bohr radius, then its mass will be equal to

$$M_0 = \frac{4\pi r_0^3 \varepsilon_0}{1 + k_e^2 r_0^2} = 1.679337431 \cdot 10^{-24} \, g = 1843.523481 m_e. \qquad (5.21)$$

The obtained value of nucleon mass insignificantly (only by a few tenths of a percentage point) differs from the mass of the proton and neutron, which represent the different kinds of states of the *H*-atom (more exactly, of its isotopes of the subatomic level). The radius of the wave proton sphere, corresponding to the mass of the proton $M_p = 1.6726231 \cdot 10^{-24} \, g$, is

$$r_p = 5.28421703 \cdot 10^{-9} \, cm. \qquad (5.22)$$

In the field of exchange of matter-space-time, the exchange of exchange also takes place. It is defined by the value of the wave current of exchange

$$I = \frac{dq}{dt} \qquad (5.23)$$

and by the value of the *dynamic linear density of exchange* of matter-space-time along a wave beam

$$\Gamma = \frac{dq}{dz}, \qquad (5.24)$$

where dz is an element of the wave beam of exchange of matter-space-time. At the level of the basis *C*-space, we have

$$\Gamma = \frac{dq}{dz} = \frac{dq}{cdt} = \frac{1}{c} I. \qquad (5.25)$$

The density of exchange Γ has obtained, in classical electrodynamics, the incorrect name an "electric current in the magnetic system of units".

The two charges, the electric charge q and the "electric charge in the magnetic system of units" q_h, are related with the two notions of a current I and a "current in the magnetic system of units" Γ:

$$q_h = \frac{1}{c} q = \frac{dm}{cdt} = \frac{dm}{dz} = \tau_m. \qquad (5.26)$$

The charge q_h represents by itself the *dynamic linear density of the wave mass exchange* along the wave beam.

In this case, the formula (2.18a) defines the orbital "magnetic moment of an electron" on the basis of the density Γ:

$$\mu_\gamma = \frac{\upsilon_0}{c} e r_0 = \frac{e}{m_e c} \hbar = 2\mu_B. \qquad (5.27)$$

It is equal to the two formal Bohr magnetons. Furthermore, the ratio of the magnetic moment to the moment of orbital momentum ħ, according to (2.19) and (5.27), is expressed by the following value:

$$\frac{\mu_\gamma}{\hbar} = \frac{e}{m_e c} = \frac{\omega_e}{c} = k_e = \frac{1}{\lambda\!\!\!^{-}_e} = 6.234853211 \cdot 10^7 \, cm^{-1}, \qquad (5.28)$$

which corresponds to the experiment.

6. *The correlation of a series of electrodynamic units of SI with the units of the universal GCS system*

6.1. The coulomb

In physics, as the practical unit of charge, the measure on the basis of 10^{-1} unit of "charge in the magnetic system" (5.26), which was called the *coulomb*, was accepted:

$$1C_c = c \cdot \frac{q_h}{10} = c \frac{1}{10} \frac{g^{1/2} \cdot cm^{3/2} \cdot s^{-1}}{cm/s} = 2.99792458 \cdot 10^9 \, g^{1/2} \cdot cm^{3/2} \cdot s^{-1}, \qquad (6.1)$$

where $1 \frac{g^{1/2} \cdot cm^{3/2} \cdot s^{-1}}{cm/s} = 1 g^{1/2} \cdot cm^{1/2}$ is the unit of "electric" charge in the "magnetic system". The subscript *c* indicates that the coulomb belongs to pseudomeasures.

For convenience, the formula of the pseudomeasure, the coulomb, can be presented as

$$1C_c = \frac{c_0}{10} CGSE_q, \qquad \text{where} \quad c_0 = \frac{c}{cm/s} \quad \text{and} \quad 1CGSE_q = 1g^{1/2} \cdot cm^{3/2} \cdot s^{-1}. \qquad (6.2)$$

In metrology and in courses of physics, the integer number $1C = 3 \cdot 10^9 CGSE_q$ that is incorrect in principle presents the coulomb pseudomeasure (6.1). It is difficult to clarify now, whether this was done deliberately or/and for the sake of simplicity, or rather for a third aim, expressing unknown interests of builders of such the measure. One thing is indisputable: this equality points to the lack of understanding of the essence of the problem. The like equalities fill up the reference literature on metrology.

On the basis of the correlation (5.4), we obtain the objective measure of coulomb

$$1C = \sqrt{4\pi\varepsilon_0} \cdot 1C_c = \frac{\sqrt{4\pi} \cdot c_0}{10} g/s = 1.062736593 \cdot 10^{10} g/s, \qquad (6.2a)$$

which defines the objective metric coulomb C_m:

$$1C_m = 1 \cdot 10^{10} g/s. \qquad (6.2b)$$

6.2. The ampere

It follows from the formula (6.2), the pseudomeasure of ampere is

$$1A_c = \frac{c_0}{10} CGSE_I, \quad \text{where} \quad 1CGSE_I = 1g^{1/2} \cdot cm^{3/2} \cdot s^{-2}. \qquad (6.3)$$

The corresponding objective and metric objective measures are

$$1A = \sqrt{4\pi\varepsilon_0} \cdot 1A_c = \sqrt{4\pi} \cdot \frac{c_0}{10} g/s^2 = 1.062736593 \cdot 10^{10} g/s^2. \qquad (6.3a)$$

$$1A_m = 1 \cdot 10^{10} g/s^2. \qquad (6.3b)$$

Is it possible to regard the ampere in the capacity of the basic unit of *SI* if it actually is the complicated pseudomeasure, defined by the reference measures? Undoubtedly, it is not! Whatever the worshippers might say about perfection of *SI* units, the fact remains the ampere is the complicated derivative unit, containing the inextractable square roots of the gram and centimeter. An introduction of the ampere in a series of basic units allows one to hide fractional powers of basic units under the name the ampere, creating an illusion of the solution of the problem.

6.3. The volt

Historically, the electric volt was defined as 10^{18} units of "potential in the magnetic system":

$$1V_c = \frac{U_h}{c} = \frac{10^8 g^{1/2} \cdot cm^{3/2} \cdot s^{-2}}{c} = \frac{1}{299.792458} g^{1/2} \cdot cm^{1/2} \cdot s^{-1}, \qquad (6.4)$$

or

$$1V_c = \frac{10^8}{c_0} CGSE_\varphi, \qquad \text{where} \quad 1CGSE_\varphi = 1\, g^{1/2} \cdot cm^{1/2} \cdot s^{-1}. \qquad (6.5)$$

As follows from the relation (5.6), the objective volt is

$$1V = \frac{1V_c}{\sqrt{4\pi\varepsilon_0}} = \frac{10^8}{\sqrt{4\pi c_0}} cm^2 / s = 9.409669398 \cdot 10^{-4} cm^2 / s. \qquad (6.5a)$$

It defines the objective metric volt

$$1V_m = 1 \cdot 10^{-3} cm^2 / s. \qquad (6.5b)$$

6.4. The ohm

The ampere and volt define the corresponding measures of ohm:

1) the coulomb measure (pseudomeasure)

$$1\Omega_c = \frac{1V_c}{1A_c} = \frac{10^9}{c^2} cm / s = \frac{10^9}{c_0^2} s / cm; \qquad (6.6)$$

2) the objective measure

$$1\Omega = \frac{1V}{1A} = \frac{10^9}{c_0^2} \mu_0 \cdot s / cm, \qquad \text{where} \quad \mu_0 = cm^3 / g; \qquad (6.6a)$$

3) the objective metric ohm

$$1\Omega_m = 1 \cdot 10^{-12} \mu_0 \cdot s / cm. \qquad (6.6b)$$

6.5. The farad

The subjective measure of farad is

$$1F_c = \frac{1C_c}{1V_c} = \frac{c_0^2}{10^9} CGSE_C = 8.987551787 \cdot 10^{11} cm, \qquad (6.7)$$

where $1CGSE_C = 1CGSE_q / CGSE_\varphi = 1cm$ is the pseudomeasure of the unit of capacity in the "electric" system, although fractional powers of reference units are absent here.

The objective and metric objective measures of farad are

$$1F = \frac{1C}{1V} = \frac{1C_c\sqrt{4\pi\varepsilon_0}}{1V_c / \sqrt{4\pi\varepsilon_0}} = 4\pi \frac{c_0^2}{10^9} \varepsilon_0 \cdot cm = 1.129409067 \cdot 10^{13} \varepsilon_0 \cdot cm, \qquad (6.7a)$$

$$1F_m = 1 \cdot 10^{13} \varepsilon_0 cm. \qquad (6.7b)$$

6.6. The henry

The subjective henry is obtained on the basis of the elementary relation

$$1H_c = \frac{1V_c}{1A_c / s} = \frac{10^9}{c_0^2} cm^{-1} \cdot s^2 = 8.854187818 \cdot 10^{-14} cm^{-1} \cdot s^2. \qquad (6.8)$$

Analogously, we define the objective henry

$$1H = \frac{1V}{1A / s} = \frac{10^9}{4\pi c_0^2} \mu_0 \cdot cm^{-1} \cdot s^2 = 8.854187818 \cdot 10^{-14} \mu_0 \cdot cm^{-1} \cdot s^2. \qquad (6.8a)$$

The corresponding objective metric henry is

$$1H_m = 1 \cdot 10^{-13} \mu_0 \cdot cm^{-1} \cdot s^2. \qquad (6.8b)$$

6.7. The tesla

The pseudomeasure of magnetic field strength (induction) B is the gauss

$$1Gs_c = 1 \cdot g^{1/2} \cdot cm^{-1/2} \cdot s^{-1}. \qquad (6.9)$$

According to (5.5), the following objective measure of gauss corresponds to such a pseudomeasure:

$$1Gs = \frac{Gs_c}{\sqrt{4\pi\varepsilon_0}} = 0.2820947918\,cm/s, \qquad (6.10)$$

which defines the objective metric gauss

$$1Gs_m = 1cm/s. \qquad (6.10a)$$

The subjective tesla was accepted to be equal to 10^4 gauss:

$$1T_c = 10^4\,Gs_c = 1 \cdot 10^4\,g^{1/2} \cdot cm^{-1/2} \cdot s^{-1}. \qquad (6.11)$$

Then, the objective tesla and objective metric tesla are, respectively, equal to

$$1T = 1 \cdot 10^4\,Gs = \frac{10^4}{\sqrt{4\pi}}\,cm/s = 2.820947918 \cdot 10^3\,cm/s, \qquad (6.11a)$$

$$1T_m = 1 \cdot 10^4\,Gs_m = 1 \cdot 10^4\,cm/s. \qquad (6.11b)$$

6.8. The magnetic μ_0 and electric ε_0 constants

Taking into consideration (6.8), we obtain the actual "rationalized" measure of the magnetic constant

$$\mu_0 = 4\pi \cdot 10^{-7}\,H_c/m = 4\pi \cdot 10^{-9}\,H_c/cm = \frac{4\pi}{c^2}. \qquad (6.12)$$

This measure is absurd, even because the magnetic field does not have the spherical symmetry.

The electric constant ε_0 of Coulomb's law (in *SI*) is

$$\varepsilon_0 = \frac{1}{4\pi}\frac{10^{11}}{c_0^2}F_c/m = 8.854187818 \cdot 10^{-12}\,F_c/m. \qquad (6.13)$$

Knowing the measure of farad (6.7), we arrive at the actual "rationalized" measure ε_0:

$$\varepsilon_0 = \frac{1}{4\pi}\frac{10^{11}}{c_0^2}F_c/m = \frac{1}{4\pi}. \qquad (6.13a)$$

This measure is incorrect as well, because the factor $4\pi\varepsilon_0$ in such a "rationalized" Coulomb's law is equal to one,

$$4\pi\varepsilon_0 = 1, \qquad (6.13b)$$

and, hence, it negates the spherical symmetry of the field of a point electric charge.

7. *The measures of some parameters of the field of exchange*

The values of electron's charge in subjective and objective units are as follows:

1) the Coulomb empiric pseudomeasure

$$e_c = 4.803206834 \cdot 10^{-10}\,g^{1/2} \cdot cm^{3/2} \cdot s^{-1} = 1.60217733 \cdot 10^{-19}\,C_e; \qquad (7.1)$$

2) the physical objective measure

$$e = e_c\sqrt{4\pi\varepsilon_0} = 1.70269248 \cdot 10^{-9}\,g/s = 1.70269248 \cdot 10^{-19}\,C_m = 1.60217733 \cdot 10^{-19}\,C. \qquad (7.1a)$$

The physical measure of electron's charge in reference units defines its proper measure in *g/s*. The last is the same, to within the decimal factor, also for the objective metric coulomb C_m. Whereas the measure of charge expressed in the objective coulomb distorts its proper measure. Because of this, even the objective coulomb C cannot be regarded as the correct unit of electron's charge.

Returning to the formula of the specific wave quantum of resistance (5.18), let us define its objective value:

$$\rho_e = \frac{1}{\varepsilon_0 \omega_e} = \frac{T_e}{2\pi\varepsilon_0} = \frac{\mu_0 m}{e} = 5.349991151 \cdot 10^{-19} \mu_0 \cdot s . \quad (7.2)$$

In the objective ohm, this quantum is equal to

$$\rho_e = \frac{1}{\varepsilon_0 \omega_e} = 6.042328513 \cdot 10^{-6} \Omega \cdot cm . \quad (7.2a)$$

An average specific resistance of the elements of Mendeleev's periodic table, at the temperature 273 *K*, is equal approximately to the quantum of specific resistance (7.2a). For example, the specific resistance of nickel, at 273K, is equal to $6.141 \cdot 10^{-6} \Omega \cdot cm$.

Under the condition $\upsilon = \upsilon_0$, $r = r_0$, and $q = e$, the formula (5.27) defines the electron's orbital magnetic moment equal to the doubled formal Bohr magneton. If we will operate with the reference units and the objective metric tesla, we will obtain:

$$\mu_{orb} = \frac{\upsilon_0}{c} e r_0 = 2\mu_B = 6.575105736 \cdot 20^{-20} \frac{g}{s} \cdot cm = 6.575105736 \cdot 10^{-23} J / T_m . \quad (7.3)$$

In the case of usage the objective tesla, the distortion of the proper reference measure of the magnetic moment takes place:

$$\mu_{orb} = \frac{\upsilon_0}{c} e r_0 = 2\mu_B = 1.854803083 \cdot 10^{-23} J / T . \quad (7.3a)$$