The Base of Dialectical Physics (Grand Survey)

1. *Introduction*

At the base of *classical and contemporary physics* lies the model of the Universe, which can be called the model of one space, presented throughout the 19th century by the concept of "world ether". The world ether was regarded as an initial level of the Universe. Today it is referred to as Dirac quantum vacuum, etc. Thus, in essence, the classical "ether" was transformed into the quantum "vacuum". The latter is interpreted as some primordial quantum-mechanical chaos, in which not necessity and chance together, but only chance, in connection with the indeterminacy principle, is presented. One can say now that this model does not respond to the needs of the present time. For this reason, we propose to turn to the dialectical model of the Universe.

Dialectical physics rests on dialectics (dialectical philosophy and dialectical logic) with its elementary judgements of the kind *Yes-No*, reflecting (with the utmost brevity) the symmetrical essence of the Universe with regard to its polar opposite properties.

The essence of the *dialectical model* of an arbitrary state or process is the fact that any property of the Universe, denoted by the limiting brief judgement *Yes*, always responds (without any exceptions) to the property *No*. This fundamental rule is the fundamental principle of the "dialectical model" that thus claims that any *Yes* has its own negation *No*. Moreover, there is not a clear boundary between *Yes* and *No*: many properties of *Yes* continuously and discontinuously turn into the opposite properties *No*.

Thus, the symmetry of a pair *Yes-No* is the foundation of the dialectical model of the Universe, resting upon the fundamental law of dialectical logic – the law of affirmation-negation; Hegel has demonstrated in his time the theoretical and practical value of the law.

More complicated combinations of *Yes-No* allow describing phenomena of nature entirely.

Contemporary physics operates with the dialectical law of affirmation-negation in the implicit, and the extremely cut off form. It mentions discontinuity (*Yes*) and continuity (*No*), particles (*Yes*) and antiparticles (*No*), symmetry (*Yes*) and asymmetry (*No*), rectilinearity (*Yes*) and curvilinearity (*No*), etc. Metaphysics and its formal logic, the logic of either only *Yes* or only *No*, are unable to overcome their one-sided plane view at the World.

Together with Einstein, contemporary physics states that only relative motion exists, but at the same time it operates with the absolute speed of electromagnetic waves, the speed of light, which is the same "for all observers in uniform relative motion, independently of the relative motions of sources and detectors". If we use the accurate language of logic, this assertion means that physics simultaneously implicitly operates with the absolute motion of electromagnetic waves and with their absolute speed, since their absoluteness means their independence of a system of coordinates.

In the dialectical model, the aforementioned logical manipulations are not required, because the property of motion *Yes* = "relative" responds to its symmetrical property *No* = "absolute". It means that any motion in the World is a complicated symmetrical complex of absolute-relative motion, i.e., of motion *Yes-No*, in which the law of conservation and transformation of absolute-relative motion is valid.

2. *The main axioms of dialectical physics*

I. ***<u>The axioms of the structure of the Universe</u>***

I.1. *The Universe is the Material-Ideal System with infinite series of levels of embedded potential-kinetic longitudinal-transversal fields of absolute-relative motion of matter-space-time, in which all processes occur simultaneously both at the same level ("horizontal" processes) and between levels ("vertical" processes).*

I.2. *Mutual transformations of fields with opposite properties (for example, the potential field ⇔ the kinetic field) cause the wave nature of the World. The wave process, appearing at some level,* *generates waves going deep into an infinite series of embedded fields-spaces, and vice versa, wave processes of the exchange of deeper levels, rising up, induce wave processes at the higher lying levels.*

I.3. *Any object of the Universe at a k-level simultaneously belongs to a lower situated infinite series of embedded fields-spaces; therefore, the structure of megaobjects of the Universe is defined by the structure of their microobjects (and the microfields related to them of an infinite series).*

I.4. *Between objects, objects and the ambient field of matter-space-time, there exists an interchange of matter-space-time occurring both in horizontal (within the same level) and vertical (between different levels) directions*.

I.5. *The longitudinal-transversal structure of the wave field of exchange of the Universe of an arbitrary level is presented by the spherical-cylindrical wave field of matter-space-time.*

II. ***<u>The axioms of dialectical elementary judgements</u>***

II.1. *The adequate description of the Universe is possible only on the basis of dialectical functions-judgements* $\hat{\Psi}$ *of the logical structure Yes-No*:

$$\hat{\Psi} = Yes \cdot 1 + No \cdot i \quad \text{or} \quad \hat{\Psi} = Yes + iNo , \tag{2.1}$$

where 1 *and i are units of qualitatively opposite properties*.

The first unit expresses a unit judgement of affirmation; the second unit – the unit judgement of negation. The unit of negation is simultaneously the unit of affirmation of an opposite property.

Measures of judgements Yes and No are defined by the measures of those polar opposite physical magnitudes of the same dimensionality, which describe the real properties of objects and fields of matter-space-time.

The dialectical judgement Yes-No is not the sum of Yes and No; it is a complex of judgements Yes and No and, in this sense, it is a complex judgement. Furthermore, we should understand the notion "complex" in this, and only in this, sense, not mixing it up with complex numbers of plane geometry and Riemann surfaces.

II.2. *In a set of dialectical judgements Yes and No, describing opposite properties of matter-space-time, two different algebras of relations act between judgements.*

The unit of affirmation follows the algebra of affirmation (Yes-algebra):

$$(\pm 1)(\pm 1) = +1 , \qquad (\pm 1)(\mp 1) = -1 . \tag{2.2}$$

This means: affirmation of affirmation is affirmation of the corresponding sign.

The unit of negation follows the algebra of negation (No-algebra):

$$(\pm i)(\pm i) = -1 , \qquad (\pm i)(\mp i) = +1 . \tag{2.3}$$

This means: negation of negation is affirmation of the corresponding sign.

Here is an example of the realization of *Yes*-algebra. The repulsion of two charges of the same sign, ± 1 and ± 1, is expressed by the relative unit measure +1. Whereas charges of opposite signs, ± 1 and ∓ 1, attract to each other, and the measure –1 reflects this fact. This is the objective algebra of central, longitudinal fields of exchange of matter-space-time.

Here is an example of the realization of *No*-algebra. Currents of the same signs, $\pm i$ and $\pm i$, attract over their magnetic (transversal) fields. This attraction has the central character that is represented by the measure –1. Currents of different signs $\pm i$ and $\mp i$ repel, and that is represented by the measure +1.

II.3. *An elementary dialectical judgement about wave processes is characterized by the wave measure of the numerical field of affirmation-negation of dialectics*

$$\hat{\Psi} = \hat{\Psi}_m (kr) \hat{T}(\omega t) = \hat{\Psi}_m (\cos(\omega t - kr) + i \sin(\omega t - kr)) , \tag{2.4}$$

where $\hat{\Psi}_m(kr) = \hat{\Psi}_m \exp(-ikr)$ *is the spatial wave and* $\hat{T}(\omega t) = \cos\omega t + i \sin\omega t$ *is the time wave of physical time, describing an elementary property of some wave field of space-time by means of the mathematical ideal time t of absolutely uniform motion.*

II.4. *The geometry of a dialectical wave judgement repeats the geometry of real fields of matter-space-time. In particular, if the time component* $\cos\omega t$ *expresses the potential (kinetic) time, then,* $i\sin\omega t$ *describes the kinetic (potential) time wave field.*

In other words, the ***physical time field*** is the ***potential-kinetic time wave*** (Fig. 1), where $t_p = \cos\omega t$ is the potential (or kinetic) component and $t_k = \sin\omega t$ is the kinetic (or potential) component of the wave of time.

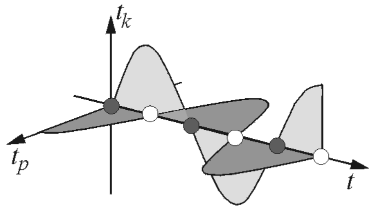

Fig. 1. A graph of the time potential-kinetic wave: $t_p = \cos\omega t$ is the potential component and $t_k = \sin\omega t$ is the kinetic component of the wave of time.

The physical time wave field $\hat{T}(\omega t) = \cos\omega t + i\sin\omega t$ is a particular case of the complicated ideal time wave field-space of the Universe with an infinite series of levels.

III. <u>***The axioms of description of the physical objects and processes in space and time, or axioms of the physical-mathematical "easel"***</u>

III.1. *The easel of space is represented by the mathematical space of three measures with coordinates x, y, and z, which exist in our imagination and, therefore, has a subjective character. The subjective mathematical space x, y, z (in the form of the cylindrical space with cylindrical coordinates* ρ, φ, z *and of the spherical space with spherical coordinates* ρ, θ, φ*) is the basis for the description of the corresponding physical fields-spaces.*

III.2. *The easel of time is represented by the subjective time t of absolutely uniform motion; therefore, the time flows uniformly and cannot be subjected to either dilation or contraction. This absolute, ideal time is the basis for description of the real objective wave field of physical time.*

III.3. *An axiom of reference measures and of the gram*:

The reference units-measures of mass $\hat{M}$*, physical space* $\hat{S}$*, and physical time* $\hat{T}$ *are represented, correspondingly, by the gram g, the cubic centimeter* cm^3*, and the second s. Lines and surfaces of the physical space* $\hat{S}$ *are represented, correspondingly, by the linear centimeter (cm) and the square centimeter* (cm^2)*. The second squared* (s^2) *and the second cubed* (s^3) *describe surfaces and volumes of the field-space of physical wave time.*

The level, on which measures of mass and volume of space, related to the mass (expressed in the reference units), are equal, we call the basis level or C-basis. At the basis level, this equality takes place

$$M = \varepsilon_0 V, \tag{2.5}$$

where $\varepsilon_0 = 1\,g/cm^3$ *is the unit reference density. If the physical space of a basis level turns out to be embedded into itself* ε_r *times, we write*

$$M = \varepsilon_0\varepsilon_r V = \varepsilon V, \tag{2.5a}$$

where $\varepsilon = \varepsilon_0\varepsilon_r$ *is the density, defined by the extent of embeddedness of space* ε_r*; then, the gram is the name of the unit of embeddedness of physical wave spaces. It means that if* $\varepsilon = 3\,g/cm^3$*, then, the extent of embeddedness of a physical space into itself is equal to* 3.

III.4. *An axiom of the natural physical measures*:

The natural complicated measures of kinematic K and dynamic D physical quantities on the basis of reference measures-units are defined by the following dimensionalities

$$\dim K = cm^m \cdot s^n, \qquad \dim D = \varepsilon_0 \cdot cm^m \cdot s^n, \tag{2.6}$$

where m and n are integer (and only integer) numbers; ε_0 *is the unit reference density.*

IV. ***An axiom of change of fields of matter-space-time***:

The comparative estimation of the rate of change of mass $\hat{M}$ *, physical wave field of space* $\hat{S}$*, and physical time* $\hat{T}$ *is defined by the ratio of the differential of the physical measure* $\hat{\Xi}$ *of matter, space, and time to the differential of the absolute mathematical time:*

$$\hat{R}ate = \frac{d\hat{\Xi}}{dt}\,. \qquad (2.7)$$

In particular, if $\hat{\Xi} = \hat{S}$*, then the ratio* (2.7) *defines the rate of change of wave space and the exchange of wave space with the rate*

$$q_0 \equiv \hat{R}ate_S = \frac{d\hat{S}}{dt}\,. \qquad (2.7a)$$

If $\hat{\Xi} = \hat{M}$ *, the ratio* (2.7) *defines the rate of change of the wave field of matter and the exchange of the wave field of matter with the rate*

$$q \equiv \hat{R}ate_M = \frac{d\hat{M}}{dt}\,. \qquad (2.7b)$$

If $\hat{\Xi} = \hat{T}$ *, the ratio* (2.7) *defines the rate of change of the wave field of physical time*

$$\dot{t} \equiv \hat{R}ate_T = \frac{d\hat{T}}{dt}\,. \qquad (2.7c)$$

In the field of time, the exchange of time fields-spaces also takes place. The rates of exchange q and q_0*, or* ***charges of exchange****, describe interaction of a wave object with the field of matter-space-time and the interaction of objects among themselves.*

V. ***The axioms of wave equations of the field of matter-space-time***

V.1. *A complicated dialectical judgement* $\hat{\Psi}$*, describing properties of fields of matter-space-time, satisfies the wave equation*

$$\frac{\partial^2\hat{\Psi}}{\partial\rho_x^2} + \frac{\partial^2\hat{\Psi}}{\partial\rho_y^2} + \frac{\partial^2\hat{\Psi}}{\partial\rho_z^2} = \frac{\partial^2\hat{\Psi}}{\partial\tau^2}\,, \qquad (2.8)$$

where $\rho_x = kx$ *,* $\rho_y = ky$ *,* $\rho_z = kz$ *, and* $\tau = \omega t$ *.*

The equation describes both the spherical and cylindrical components of the function-judgement $\hat{\Psi}$ *about the spherical-cylindrical field of matter-space-time of a level.*

The spherical (longitudinal, central) component of the judgement, we present in the form:

$$\hat{\Psi} = \hat{R}_l(kr)\Theta_{l,m}(\theta)\hat{\Phi}_m(\varphi)\hat{T}(\omega t)\,. \qquad (2.8a)$$

Analogously, we express the cylindrical (transversal, azimuth) component of the judgement

$$\hat{\Psi} = \hat{R}_m(k_r r)\hat{Z}(k_z z)\hat{\Phi}_m(\varphi)\hat{T}(\omega t)\,. \qquad (2.8b)$$

V.2. *The* **longitudinal component** *of the spherical-cylindrical field is described over a* **spherical** *realization of the wave equation (2.8), which comes to one time equation*

$$\frac{d^2\hat{T}}{d\tau^2} = -\hat{T} \qquad (2.9)$$

and three equations of the spherical space:

$$\rho^2\frac{d^2\hat{R}_l}{d\rho^2} + 2\rho\frac{d\hat{R}_l}{d\rho} + \left(\rho^2 - l(l+1)\right)\hat{R}_l = 0\,, \qquad (2.9a)$$

$$\frac{d^2\Theta_{l,m}}{d\theta^2} + ctg\theta\frac{d\Theta_{l,m}}{d\theta} + \left(l(l+1) - \frac{m^2}{\sin^2\theta}\right)\Theta_{l,m} = 0\,, \qquad \frac{d^2\hat{\Phi}_m}{d\varphi^2} = -m^2\hat{\Phi}_m\,, \qquad (2.9b)$$

where $\rho = kr$.

V.3. *The* ***transversal component*** *of the spherical-cylindrical field is described over a* ***cylindrical*** *realization of the wave equation (2.8), which comes to one time equation in the form (2.9) and three spatial equations:*

$$\frac{d^2\hat{R}_m}{d(k_r r)^2}+\frac{1}{k_r r}\frac{d\hat{R}_m}{d(k_r r)}+\left(1-\frac{m^2}{(k_r r)}\right)\hat{R}_m=0\,,\qquad \frac{d^2\hat{Z}}{d(k_z z)^2}=-\hat{Z}\,,\qquad \frac{d^2\hat{\Phi}_m}{d\varphi^2}=-m^2\hat{\Phi}_m\,. \quad (2.10)$$

3. *Masses*

The spherical form of elementary objects of a radius r is characteristic for any level of matter-space-time. The field (associated) mass

$$m=\frac{4\pi\varepsilon_0 r^3}{1+k^2r^2} \quad (3.1)$$

and the field (associated) charge

$$e=\omega m=\frac{4\pi\varepsilon_0 r^3\omega}{1+k^2r^2} \quad (3.2)$$

define the mutual exchange of matter-space-time of elementary objects with the ambient field of matter-space-time. The associated mass and charge generate a whole spectrum of exchange parameters.

The field masses of particles and charges of exchange express the correlation of particles with the ambient multilevel field of matter-space-time. Therefore, these parameters cannot be regarded as proper parameters, they are the parameters of exchange. The proper masses and charges, as follows from the theory of exchange, are equal to zero.

Masses of elementary particles, as measures of wave exchange, do not belong to their spherical volumes, which are defined by their boundary radii. Therefore, it does not make physical sense to refer them to these volumes.

All experience of contemporary physics shows that masses and charges of exchange of particles, within the accuracy of modern experiment, do not depend on the speed of their motion, confirming the expessions (3.1) and (3.2). However, Einstein's relativity theory distinguishes the rest mass m_0 and the mass at motion m, which is the function of speed υ of the particle. The relation between these masses is presented by the formula

$$m=\frac{m_0}{\sqrt{1-\upsilon^2/c^2}}\,. \quad (3.3)$$

It is usual to assume that this formula is in conformity with the experiment. Unfortunately, this is the deep fallacy.

The wave motion of particles in the real physical space is described, precisely enough, by the wave equation

$$\frac{\partial^2\Psi}{\partial x^2}+\frac{\partial^2\Psi}{\partial y^2}+\frac{\partial^2\Psi}{\partial z^2}=\frac{1}{c^2}\frac{\partial^2\Psi}{\partial t^2}\,. \quad (3.4)$$

The wave description of motion is always complicated. In order to turn to the algebraic description with use of derivatives and integrals, we should perform definite transformations of the equation (3.4). Let υ be the speed of motion of a microparticle along x-axis and then the equation (3.4) can be presented as

$$\frac{\partial^2\Psi}{\partial x^2}+\frac{\partial^2\Psi}{\partial y^2}+\frac{\partial^2\Psi}{\partial z^2}=\frac{\upsilon^2}{c^2}\frac{\partial^2\Psi}{\partial(\upsilon t)^2}=\beta^2\frac{\partial^2\Psi}{\partial x^2} \qquad \text{or} \qquad (1-\beta^2)\frac{\partial^2\Psi}{\partial x^2}+\frac{\partial^2\Psi}{\partial y^2}+\frac{\partial^2\Psi}{\partial z^2}=0\,,$$

where $\beta=\upsilon/c$. Thus, we arrive at the following extremely simplified equation of the uniform motion

$$\frac{\partial^2\Psi}{\partial x_f^2}+\frac{\partial^2\Psi}{\partial y^2}+\frac{\partial^2\Psi}{\partial z^2}=0 \quad (3.5)$$

in the ***fictitious mathematical space*** Ω_L with the Lorentz coordinates

$$x_f = \frac{x}{\sqrt{1-\beta^2}}, \qquad y_f = y, \qquad z_f = z. \qquad (3.5a)$$

In the fictitious space (3.5a), one should operate with the fictitious momentum

$$p_f = m\frac{dx_f}{dt} = \frac{m\upsilon}{\sqrt{1-\beta^2}} = m_f\upsilon = m\,\upsilon_f \qquad (3.6)$$

and the fictitious mass and speed,

$$m_f = \frac{m}{\sqrt{1-\beta^2}} \quad \text{and} \quad \upsilon_f = \frac{\upsilon}{\sqrt{1-\beta^2}}, \qquad (3.7)$$

The fictitious mass defines the associated mass of the particle Δm:

$$\Delta m = m - m_f = m\left(1 - \frac{1}{\sqrt{1-\beta^2}}\right). \qquad (3.8)$$

This equation formally takes into account the increasing pull of the ambient space of *C*-basis with waves of perturbation, which are formed in the space of *C*-basis because of the fast moving particle. These effects, the dragging and wave perturbation, request operating (in algebraic expressions) with the fictitious mass $m_f = m + \Delta m$.

The accurate wave description of the motion does not require an introduction of fictitious masses. Unfortunately, the elementary algebra of the Lorentz formal transformations coincided with the real correction (3.8) on the perturbation of space, which was the reason of the triumphal procession of Einstein's theory.

Actually, Einstein's theory confused physics of absolute and relative motion. In the theory of relativity, in fictitious space (3.5a), the mathematical time *t* (by which the real time field-space is described) is "elastic". Sometimes it reduces, sometimes it elongates. It is a complete speculative absurdity, because there is no mathematical time *t* in the real processes and, accordingly, the real time can be neither contracted nor stretched. Accordingly, we deal with the relativistic myths and nothing more. It should be noted that Einstein, declaring that motion is only relative, used for his "theory" the absolute speed of *C*-basis. At that, in order to conceal the word, "absolute", in the expression the "*absolute motion" with the speed c*, he covered it up by the fig-leaf of the "postulate on the *constancy of the speed of light in "vacuum" in all inertial frames of reference*".

The famous Kauffman experiments do not confirm Einstein's relativistic myth.

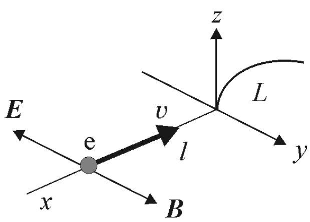

Fig. 2. A scheme of Kauffman's experiments; *E* and *B* are the electric intensity and magnetic induction vectors, correspondingly; *υ* is the velocity of an electron *e*; *l* is the distance to a screen; *L* is the electron beam trace on the screen.

In Kauffman's experiments (Fig. 2), electrons simultaneously pass through the transversal electric and magnetic fields, directed to each other in parallel and aparallel ways. So that deviations of the electron beam in both fields are perpendicular to each other. A theory of Kauffman's experiments was based on the *conception of mechanical motion in the* ***empty space***, described by the equation (3.5).

Motion of electrons in the empty space Ω_L is presented by the equations

$$eE = m\frac{d\upsilon_y}{dt} \quad \text{and} \quad \frac{\upsilon}{c}eB = m\frac{d\upsilon_z}{dt}. \qquad (3.9)$$

On the basis of these equations, we have

$$y_f = \frac{eEt^2}{2m} = \frac{eEl^2}{2m\upsilon^2}, \qquad z_f = \frac{e\upsilon Bt^2}{2mc} = \frac{eBl^2}{2mc\upsilon}. \qquad (3.10)$$

From this, it follows that

$$z_f^2 = \frac{eB^2l^2}{2c^2E}\frac{1}{m}y_f. \qquad (3.11)$$

Using the first of the transformations (3.5a) and taking into account the motion along axes y_f and z_f, we obtain:

$$\left(\frac{z}{\sqrt{1-\beta^2}}\right)^2 = \frac{eB^2l^2}{2c^2E}\frac{1}{m}\frac{y}{\sqrt{1-\beta^2}} \qquad (3.11a)$$

and

$$z^2 = \frac{eB^2l^2}{2c^2E}\frac{1}{m}\sqrt{1-\beta^2}\,y \qquad (3.12)$$

Using the notion of the fictitious mass (3.7), we arrive at

$$z^2 = \frac{eB^2l^2}{2c^2E}\frac{1}{m_f}y. \qquad (3.12a)$$

It is necessary to note that time t, entering in the equations (3.10), cannot be neither decreased nor contracted, since if $x_f = x/\sqrt{1-\beta^2}$, then $\upsilon_f = \upsilon/\sqrt{1-\beta^2}$, hence, $x_f/\upsilon_f = t_f = x/\upsilon = t$. Because of this, the axis x, presented by time t, is not subjected to transformations.

An analysis of motion in the real space with the fictitious mass m_f leads to the same result (3.12a). Kauffman found just this regularity.

Thus, from Kauffman's experiments it uniquely follows the independence of associated masses (of particles) of speed and the dependence of fictitious masses on the speed. The similar conclusion relates also to all the rest experiments "confirming" the relativity theory, which was generated due to the formal multiplier $1/\sqrt{1-\beta^2}$, introduced at the end of the 19th century by Fitz-Gerald and Lorentz for the explanation of negative results in the famous Michelson's-Morley's experiments. An appearance of the formal factor was related with the incorrect model of real space and incorrect understanding of motion in it.

4. *Roots of Bessel Functions Define Spectral Terms of Micro- and Megaobjects*

4.1. Kepler's second law – the law of the spherical component of the wave field

If $\hat{\Psi} = \hat{\upsilon}$ is the longitudinal component of speed of the matter-space-time field, then, according to solutions of the wave equation (2.8) for the spherical wave field, its radial component is

$$\hat{\upsilon} = \frac{\upsilon_s \hat{e}_l(\rho)}{\rho}, \qquad \text{where} \quad \hat{e}_l(\rho) = \sqrt{\frac{\pi\rho}{2}}\left(J_{l+1/2}(\rho) \pm iY_{l+1/2}(\rho)\right). \qquad (4.1)$$

If $\rho = kr >> 1$, then $|e_l(kr)| \approx 1$, and the module of speed υ generates Kepler's second law of the spherical field: $\upsilon \cdot r = const$.

4.2. Kepler's third law – the law of the cylindrical component of the wave field

In the cylindrical field, the radial component of the transversal speed of the matter-space-time field, according to solutions of the wave equation (2.8) for the cylindrical wave field, has the form

$$\hat{\upsilon} = \frac{\upsilon_s \hat{e}_m(\rho)}{\sqrt{\rho}}, \qquad \text{where} \qquad \hat{e}_m(\rho) = \sqrt{\frac{\pi\rho}{2}}\left(J_m(\rho) \pm iY_m(\rho)\right). \qquad (4.2)$$

If $\rho >> 1$, then the module of speed υ (4.2) defines Kepler's third law of the cylindrical field: $\upsilon^2 \cdot r = const$.

4.3. The law of central interaction-exchange of matter-space-time and the spectrum of gravitational shells

The ideology of wave exchange of matter-space-time and the wave equations lead (at the basis level) to the law of central exchange in the form

$$F = \frac{\omega_g^2}{4\pi\varepsilon_0}\frac{mM}{r^2} = G\frac{mM}{r^2}, \qquad \text{where} \qquad G = \frac{\omega_g^2}{4\pi\varepsilon_0}. \qquad (4.3)$$

The "gravitational" constant *G* defines the circular frequency of the "gravitational" exchange,

$$\omega_g = \sqrt{4\pi\varepsilon_0 G} = 9.156956336 \cdot 10^{-4} s^{-1}, \qquad (4.4)$$

and the gravitational radius, $\lambdabar_g$, of both an electron and *H*-atom (a hydrogen atom, hydrogen ion (proton), and neutron),

$$\lambdabar_g = \frac{c}{\omega_g} = 3.273931282 \cdot 10^{13} cm = 327.39\ Mkm. \qquad (4.5)$$

The gravitational radius at the megalevel, in the solar system, is represented by the wave sphere with a ring of asteroids around the Sun. This ring is analogous to the fine-dispersible rings of the big planets. In the sphere of the wave radius (4.5), big planets cannot exist, since, during the development of the solar system, this region was the place of the most intense motion.

The gravitational radius, in accordance with the solutions of the wave equation, defines the radii of shells of the gravitational domain of micro- and megalevels:

$$r_s = r_g z_{m,s} = 327.3 z_{m,s}\ Mkm, \qquad (4.6)$$

where $z_{m,s}$ are roots of the Bessel cylindrical functions.

The formula (4.6) can also be presented as

$$r_s = r_1 \frac{z_{m,s}}{z_{m,1}}. \qquad (4.6a)$$

Then, if r_1 is the radius of Mercury's orbit and $m = 1$, calculations yield a spectrum of stable gravitational shells of the Sun (Table 1). If r_1 is Saturn's radius and $m = 1$, we arrive at the spectrum of Saturn's shells (Table 2) (for the corresponding roots, $j_{1,s}$ and $y_{1,s}$; $\langle r_s \rangle$ are mean radii of shells of Saturn's satellites).

Table 1. The gravitational spectrum of shells

s	$j_{1,s}$	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 (178.0)	Toro
5	16.47063	248.93 (227.9)	Mars

Table 2. The spectrum of Saturn's shells; r_s, *kkm*

s	$r_s\,(j_{1,s})$	$r_s\,(y_{1,s})$	$\langle r_s \rangle$ (experiment)
1	60.33		
2	110.46	85.49	
3	160.18	135.34	137.64, 139.34
4	209.78	184.99	185.52
5	259.32	234.56	238.02
6	308.85	284.09	294.66 (3 satellites)
7	358.35	336.60	
8	407.85	383.10	377.40 (2 satellites)
…	…	…	…
11	556.30	531.55	527.04 (Rhea)

4.4. The wave exchange of matter-space-time at the atomic level and the optical spectra

Elementary atomic classes of spectra are defined by the formula of energetic transitions relating to odd solutions of the wave equation (2.8), when $l = m = s/2$ and s is the positive integer. A module of the polar-azimuth component of odd solutions has the maximum at the equator and, according to the normalizing conditions, is accepted to be equal to the numerical unit.

On the basis of the structure of the speeds field, (4.1) and (4.2), the energetic equation of the exchange between the spherical and cylindrical components of the field leads to the spectral formula of elements of the periodic table:

$$\frac{1}{\lambda} = R\left(\frac{e_p^2(z_{p,m})z_{p,1}^2}{z_{p,m}^2} - \frac{e_q^2(z_{q,n})z_{q,1}^2}{z_{q,n}^2}\right), \quad \text{where} \quad e_r(z_{r,s}) = \sqrt{\frac{\pi z_{r,s}}{2}\left(J_r^2(z_{r,s}) + Y_r^2(z_{r,s})\right)}. \qquad (4.7)$$

Spectra and corresponding energetic transitions are compound ones if $p \neq q$, and homogeneous ones when $p = q$. Variables for equilibrium shells are defined on the basis of the following conditions

$$J_r(j_{r,s}) = 0\,, \qquad Y_r(y_{r,s}) = 0\,. \qquad (4.8)$$

where $r = l + 1/8$ is the order of radial function.

When the first condition of (4.8) is realized, the spectral formula (4.7) defines the *J*-spectra:

$$\frac{1}{\lambda} = \frac{\pi}{2}R\left(\frac{Y_p^2(j_{p,m})j_{p,1}^2}{j_{p,m}} - \frac{Y_q^2(j_{q,n})j_{q,1}^2}{j_{q,n}}\right). \qquad (4.9)$$

If the second condition of (4.8) is realized, we arrive at the formula for the *Y*-spectra:

$$\frac{1}{\lambda} = \frac{\pi}{2}R\left(\frac{J_p^2(y_{p,m})y_{p,1}^2}{y_{p,m}} - \frac{J_q^2(y_{q,n})y_{q,1}^2}{y_{q,n}}\right). \qquad (4.10)$$

Apart from *J*- and *Y*-spectra, homogeneous and compound, the *JY*-spectra of the following form are also possible:

$$\frac{1}{\lambda} = \frac{\pi}{2}R\left(\frac{J_p^2(y_{p,m})y_{p,1}^2}{y_{p,m}} - \frac{Y_q^2(j_{q,n})j_{q,1}^2}{j_{q,n}}\right). \qquad (4.11)$$

The last spectra, as (4.9) and (4.10), are also subdivided into two kinds in dependence on the conditions: $p = q$ or $p \neq q$.

Let us consider the results of the calculations of some spectra. As an example, we will analyze the Pickering series, which possibly is a mixture of the two series: the Balmer *J*-series

$$\frac{1}{\lambda} = R\left(\frac{\pi^2}{(2\pi)^2} - \frac{\pi^2}{(n\pi)^2}\right) \qquad (4.12)$$

and the *JY*-series
$$\frac{1}{\lambda}=R\left(\frac{\pi^2}{(2\pi)^2}-\frac{\pi^2}{((n+0.5)\pi)^2}\right), \quad (4.12a)$$
which both are defined by the radial functions of the order $r=0+\frac{1}{2}=\frac{1}{2}$.

The results of the calculations of the *JY*-series are presented in Table 3. Fragments of the J_4-spectrum of titanium *Ti* are presented in Table 4. In both tables, wavelengths are given (for the air) in angstrom Å (10^{-8} *cm*). The sign → marks the possible correspondence of theoretical lines to the experimental ones *.

Table 3. The fragments of Pickering's *JY*-series

1-(n+*0.5*)	Theory		Experiment *
1-1.5:	1641.174	→	1640.474 *He*
1-2.5:	1085.433	→	1084.91 *He*, 1084.97 *He*
1-3.5:	992.809	→	992.36 *He*, 993.09 *Si*
1-9.5:	921.979	→	921.98 *N*, 921.86 *P*
1-10.5:	920.109	→	919.78 , 919.28 *Ir*
2-(n+*0.5*)			
2-2.5:	10127.969	→	10138 *He*, 10129.7 *Hg*, 10128.78 *Re*
2-3.5:	5413.968	→	5411.55 *He*, 5413.93 *Zr*, 5413.834 *Zr*, 5413.687 *Mn*
2-9.5:	3815.045	→	3815.055 *Mo*, 3815.010 *Ce*, 3815.155 *W*, 3814.932 *Ce*

Table 4. The fragments of Paschen series of the J_4-spectrum of *Ti*.

m-n	Theory		Experiment *	*m-n*	Theory		Experiment *
3-6:	4830.861	→	4820.42 , 4840.87, = <4830.645>	3-19:	3299.783	→	3299.41
3-7:	4315.847	→	4314.80	3-21:	3272.528	→	3272.08
3-10:	3692.4	→	3689.91, 3694.45 = <3692.180>	3-22:	3261.552	→	3261.61
3-11:	3596.576	→	3596.05	3-23:	3251.947	→	3251.91
3-16:	3361.012	→	3361.26	3-25:	3236.008	→	3236.57
3-17:	3337.017	→	3337.85	3-26:	3229.351	→	3229.40
3-18:	3316.872	→	3315.32	3-27:	3223.403	→	3222.84
				3-28:	3218.065	→	3218.27

The lines of the J_4-spectrum of *Ti* are defined by the transitions between energetic levels of the spherical field of *H*-units:
$$w_{4,n}=\frac{\pi hcR}{2}\frac{Y_4^2(j_{4,n})j_{4,1}^2}{j_{4,n}}=hcR\frac{e_4^2(j_{4,n})j_{4,1}^2}{j_{4,n}^2}=w_0\frac{e_4^2(j_{4,n})j_{4,1}^2}{j_{4,n}^2}, \quad (4.13)$$
where $e_4^2(j_{4,n})\approx 1$, if $j_{4,n}>>1$. Within the first 50 zeros of the Bessel function, the formula (4.13) results in the following energetic levels (*e*V):

1) 15.84049	11) 0.495353	21) 0.1540028	31) 0.07413521	41) 0.04346839
2) 6.844235	12) 0.4250272	22) 0.1412529	32) 0.06979798	42) 0.04150151
3) 3.942623	13) 0.3687281	23) 0.1300252	33) 0.06583076	43) 0.03966522
4) 2.589484	14) 0.3229486	24) 0.1200863	34) 0.06219261	44) 0.03794821
5) 1.838769	15) 0.2852157	25) 0.1112461	35) 0.0588481	45) 0.03634036
6) 1.376131	16) 0.2537442	26) 0.1033483	36) 0.05576643	46) 0.03483261
7) 1.069869	17) 0.2272189	27) 0.09626334	37) 0.05292076	47) 0.03341681
8) 0.8562317	18) 0.2046531	28) 0.08988334	38) 0.05028759	48) 0.03208563
9) 0.7011037	19) 0.185295	29) 0.08411774	39) 0.04784625	49) 0.03083246
10) 0.5848159	20) 0.1685633	30) 0.07888999	40) 0.04557854	50) 0.02965133

* A.N.. Zajdel et al., *Spectral Lines Tables* (in Russian), Fizmatgiz, Moscow, 1962.

5. ***Resume***

Dialectical physics is the physics of the Universe, whose formula

$$\hat{M} = M + iR \quad (5.1)$$

expresses the principal axiom of dialectical philosophy and logic:

The Universe is the Material (M)–Ideal (iR) System with infinite series of levels of embedded potential-kinetic longitudinal-transversal fields of absolute-relative motion of matter-space-time, in which all processes occur simultaneously both at the same level ("horizontal" processes) and between levels ("vertical" processes).

Any object of the Universe at a k-level simultaneously belongs to a lower situated infinite series of embedded fields-spaces.

Between objects, objects and the ambient field of matter-space-time, there exists an interchange of matter-space-time occurring both in horizontal (within the same level) and vertical (between different levels) directions.

By virtue of the dialectical structure of the Universe and its components, the adequate description of the Universe is possible only on the basis of dialectical judgements $\hat{\Psi}$ with the logical structure

$$\hat{S} = Yes + iNo\,. \quad (5.2)$$

Mutual transitions of the potential states and processes into the kinetic states and processes cause the wave nature of the World. With that, the wave process, appearing at a k-level, generates waves going deep into an infinite series of embedded fields-spaces.

An elementary dialectical judgement about such transitions is characterized by the wave measure of the material-ideal number of dialectical logic and philosophy

$$\hat{S} = \hat{S}_m \exp\big(i(\omega t - kr)\big) = \hat{S}_m \exp\big(i(\tau - \rho)\big), \quad (5.3)$$

A dialectical judgement $\hat{\Psi}$ satisfies the wave equation

$$\Delta\hat{\Psi} = \frac{\partial^2 \hat{\Psi}}{\partial \tau^2}, \quad (5.4)$$

which describes both the spherical and cylindrical components of the judgement $\hat{\Psi}$ about the spherical (longitudinal)-cylindrical (transversal) field of matter-space-time of a level.

At some distance from objects of the field of matter-space-time, the longitudinal component of the field of space define *Kepler's second law*, and the transversal component of the field leads to *Kepler's third law*.

A material component of exchange is described by the wave equation (5.4). The laws of material exchange (first kind laws) follow from this equation. An ideal component of exchange satisfies the laws of ideal exchange (second kind laws). Fundamental parameters (measures) of physics are directly connected with the Decimal Code of the Universe (the second kind law) with its fundamental period-quantum $\Delta = 2\pi \lg e$.

Elementary objects form complicated atomic systems-associates, whose structure is defined by a successive series of solutions of the wave equation (5.4). Atomic systems form the table of elements of the corresponding level of matter-space-time.

Any cause and effect, in a set of embedded spaces, are reflected in all these spaces. This is expressed through an infinite series of events – causes and effects – at all levels of matter-space-time, generated by the initial event at a level. In accordance with the transition on to deeper levels of space, the wave basis speeds at these levels increase.

Therefore, before a cause A_{k+1} would appear at a level k+1 (regarded as an upper level), in a domain M of matter-space-time, it happens at the deeper levels in the form of a series of causes of the lower situated levels (Fig. 3). The cause A_k of the lower level k is a harbinger of the cause A_{k+1} at the level k+1.

The cause A_k generates in a domain N an effect B_k later at the time τ_k, which is defined by the speed c_k of the wave signal at the k level (Fig. 3).

At the same time, the cause A_{k+1} at the level k+1, in the same domain *N*, generates its own effect B_{k+1}, appeared there later at the time τ_{k+1}, during which the wave signal of this level passes with the speed c_{k+1} (where $c_{k+1} < c_k$).

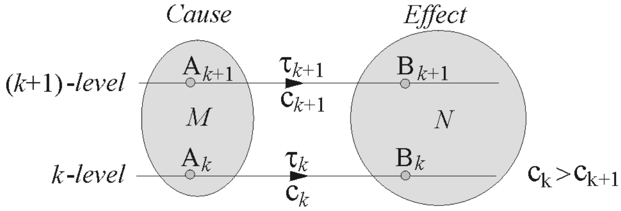

Fig. 3. The dialectics of cause and effect.

Since $\tau_k < \tau_{k+1}$, the effect (of a cause in the domain *M*) in the domain *N* appears later on at the level k+1 than at the level k.

Thus, if an event-cause *P* in a domain *M*, at the level of electromagnetic waves (k+1 level) generates an effect *S* in a domain *N*, then, at the deeper (k) level, this effect can arise in the domain *N* (at the k level) earlier than at the electromagnetic (k+1) level. Therefore, if the time Δt_P of the process of coming into being (the cause *P*) turns out to be significantly less than the time τ_k, then the signal at the k-level can appear in the domain *M* before the cause *P* would happen at the electromagnetic level. If we assume that one of the deep levels is characterized by the speed equal to the fundamental measure, $c_{k+1} = 100\Delta \cdot c_k$, then the signals of this level outstrip the electromagnetic signals 100Δ times.