SIMPLE HARMONIC RELATION AND STABILITY OF THE UNIVERSE

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Использование Золотого сечения в модели Вселенной как потенциальной гиперсферы мнимого радиуса позволяет по новому взглянуть на проблему времени и структуру Мироздания.

Sharipov M.R. Using a golden section in the Universe model as a potential hypersphere of an imaginary radius allows to have a new look on the problem of time and structure of the Creation.

About actuality and potentiality of objects in the Creation

Discoveries in XXth century physics allow to cover many natural phenomena and to predict new ones by a unified theory. Obviously, the most common representations about structure and evolution of the Creation make the basis of such theory. And the concept of actual and potential objects and processes found in dialectic unity and evolution should play not the last role [1-10].

If in an object appropriate to any form and level of organization of matter the inherent kinds of movement do not render appreciable influence on movements of other forms and levels of organization of matter, such object is considered actual. Let us designate it by an actual object symbol 0_{act}. Further, any movement inherent in an actual urgent object can be presented as some potential process. Limitlessness and continuity of this process allows to designate it as ∞_{pot}. Moreover, the potential object is an uncompleted object 0_{pot} that emerges as a result of potential processes. The transition of potential processes to their completed, actual value or actualization of the entire set of potential processes is an actual process. Let us designate it by an actual infinity symbol ∞_{act}.

Let n-dimensional potential process (∞^n_{pot}), acting in a structure made of a countable set of (n-1)–dimensional actual objects (0^{n-1}_{act}), form a new structure made of an uncountable set of these objects as a result of actualization. Obviously, this structure will represent an intrinsically new n-dimensional actual object (0^n_{act}) as a result of actualization of potential process in (∞^n_{act}) [10]. The above process of actualization will be schematically presented as:

$$\ldots \rightarrow 0^{n-1}_{act} \rightarrow 0^n_{pot} \rightarrow \infty^n_{pot.} \rightarrow \infty^n_{act.} \leftrightarrow 0^n_{act} \rightarrow \ldots$$

The concept of actuality and potentiality of processes and objects allows, at the most general approach to the problem of space-time, to correlate completed, integer dimension of space to its actuality, and uncompleted (including fractional) dimension of potential objects to their potentiality, i.e. time. In other words, the classical time is a 4D potential, i.e. uncompleted, process acting in a structure

made of any objects inclusive of fractal ones with fractional dimension; whereas an isolated space has properties of an actual 3D object. The diagram of our space-time level organization of matter shows the structural element of 3D space in parenthesis (but it is not a quantum of space):

$$\rightarrow (\infty^{3}_{act} \leftrightarrow 0^{3}_{act}) \rightarrow 0^{4}_{pot} \rightarrow \infty^{4}_{pot.} \rightarrow \infty^{4}_{act} \leftrightarrow 0^{4}_{act} \rightarrow 0^{5}_{pot} \rightarrow$$

The transition arrows mean that 3D space structural elements evolve into arbitrary 4D potential objects (0^{0}_{pot} to 0^{4}_{pot}, similar to quantum ones) having any structure inclusive of fractal one, producing, finally, structural elements of 4D actual elements ($\infty^{4}_{act} \leftrightarrow 0^{4}_{act}$, similar to quark ones) and these objects proper, which continue their potential evolution both in 3D space (forming more of new 0^{4}_{pot}) and also in their inherent 4D actual space, forming 0^{5}_{pot} (similar to the elements of substances and fields).

It should be noted, that the self-similarity of fractal structures originates from the potential process of their evolution, while their actualization brings about transition from fractal geometry of these structures to an intrinsically new classical geometry, i.e. transition from fractional dimension of fractals to integer dimension of continuous and coherent space. In turn, a potential process of the object structure evolution is determined by an attribute of potential detection [10] and two factors. By the internal factor - as a tendency of increasing capacity of a potentially (structurally) developing object structure to alignment with capacity of an intrinsically new structure during actualization of this object having completely different properties. And the external factor of occurrence of potential processes is the presence of inconsistent structural properties in the potential object insoluble by its resources. These inconsistent (antagonistic) properties of the potential object form a class of universal functors [7] having properties of extrinsic elements of a potential object. In such case, the real time is an abstraction of the most common potential processes in 0^{4}_{pot}, whose parameter is the mathematical time (t). When separated and viewed individually, the real time corresponds by its meaning to the substantial approach to a problem of time, while the mathematical time corresponds to the relational approach.

The system of the Creation structure organization levels in both the material as well as the mental form of its existence is a description of the actualization process of not 3D space alone, but applies to all spaces starting from a (-1)D set (properties) and Ø [10, 14, 16].

Structure of the Creation

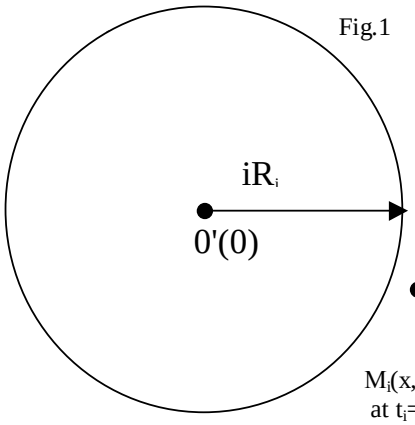
I

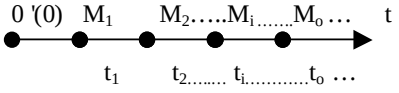
Alongside with known special relativity postulates, namely: 1. Einstein relativity principle, 2. interaction ultimate velocity existence principle (c_0) – let us introduce also 3. cosmological principle (principle of the Universe space-time homogeneity and isotropy), [17], 4. fundamentality of cosmologi-

cal redshift (CRS), 5. homogeneous and isotropic connate radiation observability principle.

The sources [11; 14; 16; 18] show that the cosmological principle allows to build a space-like hypersurface, that has its world lines of events orthogonal in each of its points, for all synchronized local IFRs (inertial frame of reference). This conclusion leads to two possible geometries of the Universe: flat and spherical. However, postulates 2 and 4 leave a place only for the hypersphere of an imaginary radius as a possible model of the Universe. Besides, this model is implemented in the form of a simple and potential hypersphere. Cosmology of these models reflects pseudosphericity of the Universe, [refer to 11; 14; 16]. It should be noted, in particular, that the space – time continuum of the Universe for a simple model of the hypersphere of an imaginary radius (iR) is formed by the entire countable set of homogeneous space-like hypersurfaces orthogonal with world time (t). Every homogeneous space-like hypersurface (t_i = const) is an instantaneous "section" of the Universe Mi (x, y, z) (Fig. 1). The time related constructive arrangement process $0 < t_i \le t_0$ for all homogeneous space-like hypersurfaces Mi is a potential process of building a 4D space-time (Fig. 2), where t is a potential

Fig.1

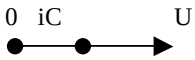




M$_i$(x,y,z), at t_i=const

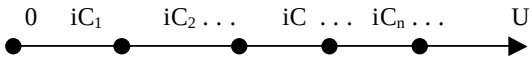
Fig. 2

parameter of time related arrangement. In other words, t is an inherent parameter of the Universe describing its evolution. The border enclosing the entire set of these hypersurfaces, a special point 0', that belongs to each event of a 4D potential space, yields a 4D actual space-time M(x,y,z,t) at every value of $0 \le t_i < \infty$. In this case M(x,y,z,t) is a compact set (Fig. 3) and represents a steady state of the Universe at its postinflation stage on axis U. During the inflationary period the position of this compact set on axis U is uncertain and unstable. Axis U is the Creation axis, that



M(x,y,z,t)

Fig. 3



M$_1$ M$_2$ . . .M . . .M$_n$ . . .

Fig. 4

accommodates orderly other (parallel) universes Mn(x,y,z,t) with their imaginary invariant radii iCn, where n = 0,1,2,3 (Fig. 4). Similar to our Universe, other universes are also compact sets, because each of them has its own limiting point 0' as an enclosure. The imaginary invariant measure iC is a conditional level of actual ("quantum") steady state of the Universe separating the entire set of actual (real) points of the material Universe M(x,y,z,t) from a set of imaginary, irreal points (0), identical for all parallel universes. This set of irreal points forms a 0-D space representing the quality space [10; 14; 16]. In turn, every irreal point is an actual status in a set of properties forming a peculiar (-1)D space coexistent and arising from an empty set (∅).

Obviously, for all parallel universes on the Creation axis the conditional level of space of imaginary points (0) is common, i.e., the border of the Creation. Enclosing the Creation axis by this border we get a set, that is tight anywhere on a 0D space. So, the Creation axis is countable and tight anywhere on a 0D space, i.e. on ∞^0_{pot} [14]; then, U is a separable and relatively Hausdorffian space of compact sets, i.e. separable except a conditionally assumed point 0. On the whole, set U is one real multi-D point in the quality space (∞^0_{pot}), that could be either stretched into axis U or compressed into a conditional length [0; 1]. Thus, the Creation space is a locally connected continuum, its image is similar to the Cantor curve, Sierpinski surface or Menger universal curve. And elements of this space are parallel universes (compact sets) on a 0D space.

Compact set M(x,y,z,t) as a 4D actual space-time represents a combination of all space-like hypersurfaces of homogeneity at all values of parameter $0 < t < \infty$. In other words, M(x,y,z,t) is a space-time diversity of the Universe with concrete value of a constant C = 1/c. Apparently, a space-time diversity of the Universe, i.e. a compact set forming the model of a potential pseudosphere with radius $\mu = i \cdot C = i/c$ (Fig. 5), can be assumed to be a potential hypersurface. Also, constant c is the speed of light c_0 [14], and this concurrence is a direct corollary of principle 5, i.e., observability of connate radiation, which is homogeneous and isotropic, is permanently observable and does not fly past the Earth. Otherwise, we would observe the Metagalaxy either prior to the beginning of its expansion (at $c > c_0$) or fail to observe this radiation (at $c < c_0$) at all. Thus, $\mu = iC = i/c$ is the external measure of the Universe separability from 0D quality space. Let us designate the measure of intensity (speed) of a potential process inside the Universe M(x,y,z,t) as $\tau(t)$. Apparently, $\rho(t) = \mu / \tau(t)$ is the internal measure of remoteness of a simple hypersurface of homogeneity (i.e. a potential process) from its enclosure 0'. Let us find $\tau(t)$. For this purpose, let us assume, that at the Universe steady-state postinflation stage independent from each other measures $|\mu|$ and $|\tau|$ are associated with t by a simple harmonic relation (Golden section of the Creation):

$$|\mu| : \tau(t) = t : |\mu|, \text{ i.e. } \tau(t) = 1/c^2 \cdot t = \text{const} / t.$$

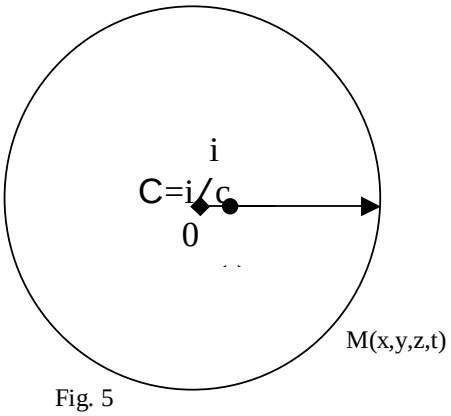


Fig. 5

Then, $\rho(t) = \mu / \tau(t) = i\ c\ t = i\ R$, (Fig. 1). The last result indicates interrelation of two models of the Universe, where the simple model of a pseudosphere (Fig. 1) is a corollary of the potential model of a hypersphere having imaginary radius (i C) during its steady postinflation evolution, when the measure of intensity of potential processes in the Universe is $\tau(t) \sim 1/t$. As we see, the external measure of the Universe separability or radius of the ("quantum") steady state of the Universe $\mu = i\ C$ is a constant (invariant) value. It is only the internal measure of intensity of potential processes $\tau(t)$ taking place in the Universe that changes; and in the present time $\tau(t) \sim 1/t$. Then, due to potential parameter t exclusively the Universe radius $R = c\ t$ increases, and, accordingly, the Doppler actual component of the expansion of the hypersurface of the pseudosphere simple model adopted as of today in science by CRS explanation arises [11; 12; 14; 15].

In these studies one more CRS component is introduced unknown in astronomy, but representing a well-known corollary of Lorentz transformation laws in relativistic mechanics. This component is stipulated by pseudosphericity of space-time and results in additional red shift of lines in spectra of remote cosmological objects. However, this contribution to CRS has an apparent effect, mirroring existence of relative turn between local IFR in a 4D space–time, and similar to apparent effects observed in a 3D space associated with curvature of the Earth. Such turn on a space-like hypersurface of the observer creates apparent 3D disbanding speed that ought to be called a Lorentz speed of cosmological objects disbanding. The joint contribution of both components to CRS gives common relativistic formula of cosmological objects disbanding:

$V = -c(th\chi + \chi) \,/\, (1 + \chi\, th\chi) = H_o(\chi) \cdot r_o$, where the Hubble constant relativistic formula $H_o(\chi) = H(\chi) = H_o(th\chi + \chi) \,/\, 2\chi(1 + \chi th\chi)$, while χ is an angular parameter of cosmological objects remoteness from an IFR-observer in the hyperspherical space и $r_o = -c\ t_o\chi = -2c\chi \,/\, H_o \approx cz \,/\, H_o$. The calculation displays,

that value Ho was less in the past. Apropos, irreparability of pseudospherical space-time curvature is also the reason of "a mysterious repulsive force" and allows to find the cosmological member: $\Lambda = 1 \,/\, c^2 \cdot t^2 = H_o^2 \,/\, 8c^2(1+\chi)^2$. Moreover, now $\Lambda_o = 1{,}304 \cdot 10^{-57} cm^{-2}$, (at $\chi = 0$ and $H_o = 80$ km/s · Mps), [12].

II

Constant C is an invariant value of the imaginary radius of a potential hypersphere model, i.e. a peculiar quantum characteristic of the Universe. Let us site one more quantum corollary of the models under consideration. In microphysics there is a Heisenberg uncertainty principle: $\Delta p \cdot \Delta x \geq h$ and $\Delta E \cdot \Delta t \geq h$ or $\delta p \cdot \delta x \geq h$ and $\delta E \cdot \delta t \geq h$, that can be also represented as $\Delta p \cdot \delta x \leq h$ and $\Delta E \cdot \delta t \leq h$. Here x is the coordinate of a particle position, p is the particle momentum towards x, t is the time coordinate and E is the value of particle energy, while Δ is an area of uncertain values of an appropriate physical quantity, and δ is an area of definite values of same physical quantity. Let δt be a definite period during which a steady-state structure of a potential object $0^4_{pot.}$ is formed: it takes place during the preinflation period of the Universe evolution. Clear, that in this period for the given object all known conservation laws are upset. Assume, that δt, the potential object structure stabilization time, is the time quantum. Let us assume, that the structure stabilization time is an inherent inflationary period of the potential object evolution. This period of evolution is characterized by emergence and stabilization of basic physical quantities and allegedly non-harmonic form of their interrelation (i.e. non-observance of the Golden section rule). It should be noted, however, that during this so defined inherent inflationary period the stabilization of potential process proper, i.e. of time duration (time quantum), also occurs. And time quantum fluctuations in this period are actually uncertain. Therefore, a certain value of the time quantum is expressed in terms of the potential object structure steady-state units. Besides, let it be noted, that the introduced concept of inherent inflationary period of the potential object evolution is incompletely congruent with what was brought into science by A. Guth in 1980, since it relates to the postinflation stage of space and time formation. This period reveals full uncertainty of all known and unknown kinds of interaction and appropriate physical quantities.

Let us designate the stability level of interactions in a potential object structure by action S, where $S = \int L(\dot{q},q,t) \cdot dt$. Then, ΔS is a measure of instability of interactions of a potential object in this moment. Apparently, the action fluctuation is determined by area $S \pm \Delta S$, while $[S] = J \cdot s$. However, following the preinflation stage of evolution of the Universe a quantum of action h (Planck constant) starts to set in. Then, the action area of uncertainty is $\Delta S \leq h$. But $\Delta S = \Delta E \cdot \delta t$, and instability of interaction or instability of a potential process is represented as $\Delta S \cdot \delta t \leq h$, in precise conformity with the ratio of uncertainty. Or else, uncertainty of a potential object formed structure stability measure in the range of a definite time period δt manifests itself by value ΔE, i.e. revealing uncertainty of a

measure of power of accumulated qualities in the structure of this object. In other words, in area δt the violation of energy conservation law is determined by value ΔE.

On the other hand, $\Delta S = \Delta p \cdot \delta x \le h$, i.e. instability of interactions in the potential object structure generates uncertainty (Δp) of its momentum in area δx leading to violation of the momentum conservation law in space area δx. So, in a certain area of space δx and time δt the macroworld conservation laws are upset (E and p). If δx corresponds to that area of space where similar upsets are found, inclusive of interaction threshold velocity upsets ($v >> c$), this area of space could be called a quantum of space. Then in the space quantum area δx and in the time quantum area δt the signal is transmitted instantaneously, i.e. the ranges of values δx and δt are minimum ranges of the formed space-time values. In other words, the basic properties of space-time and the principle of causality are upset in the ranges of values smaller than δx and δt. They might accommodate exotic, unstable ethereal objects and develop cellularity of space-time.

The fluctuation of unstable behavior of the potential object structure can be associated with frequency of chatter (ν) of a potential system during its stabilization (relaxation): $\nu \le 1 / \delta t$, since for minimum areas of space-time $\delta t = \delta x / c$ is already valid, then, $\nu \le c / \delta x$.

Let us introduce a measure of interaction process intensity m(t) to characterize the potential object structure interaction level-time relationship. Apparently, both the measure of potential object structure evolution potential process intensity $\tau(t)$ and the measure of the object structure interaction potential process intensity m(t) decay in the course of time due to solution of a Universal Contradiction. Moreover, the measure of interaction process intensity has dynamic (inertial) properties. Joint manifestation of these two measures can be represented through their invariant (quantum) values: quantum value h as a minimum measure of interaction uncertainty ΔS separating actual (dynamic) properties of a potential object from its generating set of qualities ∞^0_{pot} and imaginary invariant measure $\mu = i \cdot C$ as a steady actual level of the Universe material status. Their joint interaction $\mu \cdot h$ is an elementary dynamic property of the entire potential 4D space (∞^4_{pot}). By linking independent from each other measures $|\mu| \cdot h$ and m(t) to t and $|\mu|$ by a simple harmonic ratio true for the postinflation stage of the Universe evolution we have: $|\mu| \cdot h \,/\, m(t) = t \,/\, |\mu|$. Hence, $m(t) = h \,/\, c^2 \cdot t$, but $\tau(t) = 1 \,/\, c^2 \cdot t$, hence

$$m(t) = h \cdot \tau(t); \qquad (*)$$

In other words, the measure of potential structure interaction intensity and the measure of potential process evolution intensity in 0^4_{pot} are proportional. The resulting formula is the formula of a spectrum of weights generated by vacuum at its potential evolution.

Allow the Planck elementary unit of length to be a quantum of space: $\delta x = l_0 \ge \sqrt{hG/c^3} = 1{,}5 \cdot 10^{-35}$ м, then the frequency of vacuum chatter at the 0^4_{pot} level at the moment of a beginning of the Universe expansion: $\nu \le c / \delta x = 2 \cdot 10^{43}$

Hz. Accordingly, the time quantum is $\delta t \leq 0{,}5 \cdot 10^{-43}$s. The momentum and energy of potential objects in this epoch according to the uncertainty ratio are defined by area: $\delta p \geq h / \delta x = 44$ kg·m\s and $\delta E \geq h / \delta t = 8{,}28 \cdot 10^{22}$ MeV. On the other hand, the formula of a spectrum of weights in this case yields the same result. Actually, $m(\delta t) = h / c^2 \cdot \delta t = 1.47 \cdot 10^{-7}$ kg, while $E(\delta t) = m(\delta t) \cdot c^2 = h / \delta t = 8{,}28 \cdot 10^{22}$ MeV.

It is interesting to determine an instant t_e from the "Beginning" when vacuum fluctuation started to generate particles by electronic mass. Since $m_e = 10^{-30}$ kg ~ 0.6 MeV, then, from (*): $t_e = h / c^2 \cdot m_e = 0.74 \cdot 10^{-20}$ s.

Let us calculate the minimum weight capable of been generated from vacuum in the contemporary epoch. Allow [12; 14]: $t_o \sim 24 \cdot 10^9$ years $= 7{,}25 \cdot 10^{17}$ s, then $m(t_o) = \delta m_o = h / c^2 \cdot t_o = 1.01 \cdot 10^{-68}$ kg. Or $E(t_o) = 1{,}9 \cdot 10^{-23}$ eV that corresponds to the observable minimum values of energy levels in nuclear and molecular spectra in the contemporary epoch.

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