dinates is the center. Periodic solution of the system (3) corresponds to the letter event.

Thus, conditions of existence of periodic solutions for system (3) comes to the fulfillment of two requirements:

a) Function $F(x, y)$ must be defined in sense;

b) $a_n = \frac{1}{\pi}\int_0^{2\pi} \frac{R_n^{(m+1)}(\theta)}{F_n^{(m+1)}(\theta)}d\theta = 0.$

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The work was submitted to the International Scientific Conference «Fundamental Research», Dominican Republic, April, 10-20, 2012, came to the editorial office 14.05.2012.

ABOUT A BOUNDARY-VALUE PROBLEM OF STURM-LIOUVILLE WITH NOT SEPARABLE BOUNDARY CONDITIONS OF THE FIRST TYPE

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Let's consider differential operator Sturm-Liouville of the second order:

$$-y''(x)+q(x)\cdot y(x)=\lambda\cdot a^2\cdot y(x),\quad 0\le x\le\pi,\quad a>0, \tag{1}$$

with not separable boundary conditions of the first type (see [1]):

$$\begin{cases} y'(0)+a_{11}\cdot y(0)+a_{12}\cdot y(\pi)=0, \\ y'(\pi)+a_{21}\cdot y(0)+a_{22}\cdot y(\pi)=0, \end{cases} \tag{2}$$

where $a_{km}\in C\quad (k,m=1;2)$, and it is supposed that potential $q(x)$ – summable function on the segment $[0;\pi]$:

$$q(x)\in L_1[0;\pi](=)\left(\int_0^x q(t)dt\right)'_x = q(x) \tag{3}$$

almost everywhere on $[0;\pi]$.

Theorem. Asymptotics of the eigenvalues of the differential operator (1)–(2) with a condition (3) has the following kind:

$$s_k=\frac{k}{a}+\frac{d_{1k}}{ak}+\frac{d_{2k}}{ak^2}+\underline{O}\left(\frac{1}{k^3}\right),\quad k=1,2,3,... \tag{4}$$

and for this

$$d_{1k}=\frac{1}{2\pi}\cdot\left[\int_0^\pi q(t)dt+\int_0^\pi q(t)\cos(2kt)dt-2(a_{11}-a_{22}+a_{12}-a_{21})\right], \tag{5}$$

$$d_{2k}=-\frac{d_{1k}}{2\pi}\cdot\int_0^\pi(2t-\pi)q(t)\cdot\sin(2kt)dt+\frac{a_{11}-a_{22}}{2\pi}\cdot\int_0^\pi q(t)\sin(2kt)dt-$$
$$-\frac{1}{4\pi}\cdot\int_0^\pi q(t)\cdot\left(\int_0^t q(\zeta)\cdot\left[\sin(2k\zeta)-\sin(2kt)-\sin(2k(\zeta-t))\right]\cdot d\zeta\right)dt,... \tag{6}$$

The theorem is proved by methods of the chapter 5 of the monograph [2].

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The work is submitted to the Scientific International Conference «Research on the priority of higher education on-directions of science and technology», on board the cruise ship MSC Musica, June, 10-17, 2012, came to the editorial office on 03.05.2012.

THE MATERIAL WORLDS HIERARCHY EMPIRICAL MODELS

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As, now, it was known, on the basis of all those natural science models, having described in the author's papers [1, 2] etc, having taking into account the physicists' empirical conclusions, the findings, and the experimental results after Albert Einstein, the STEREOCHRONODYNAMICS objective reasons had been noted – the physical theory, that could be created the time – space mathematical model, which should to be had the quite necessary and the sufficient flexibility in the time – space all the properties description, including the modern physical phenomena vast fields, that is, in accordance with our conclusion on the physical theories axiomatics completeness for our four – dimensional world, we have assumed, as the basis the FIVE fundamental axioms, the main among which our essentially new PARADIGM for the attributively – substantive NATURE of our world is.

Now, we are needed each of all these FIVE above – mentioned axioms to be subjected by the empirical or the experimental verification, in order to fill this STEREOCHRONODYNAMICAL AXIOMATICS by the specific physical content. So, by following the numbering order of the axioms mentioned [2], we recall the FIRST of the:

All the material objects of our world, in the form of the fields or the material bodies, are presented themselves the general continuous medium – the physical ether, in which all the material objects have been located (e.g. the bodies, the fields), having interacted with each other, according to the established laws. For all this, for the world dimension we have the right to take the number of the independent properties of this world, that is, its attributes number, inherent its in the definition. It should be remembered, that the deformed medium neighborhood is the DEFONOM around the LOCAL DEFORMATION at the *O* point with the indicated components of the normal σ_i and the tangential τ_{ik} strains. It is quite clear, that the substance in the deformation world has the physical properties, which are similar to the physical vacuum properties, the exemplary representations of which we have on the instrumental studies results of the near space: the temperature is close to the absolute zero, the viscosity is corresponded to the superfluidity at the very low temperatures, etc.

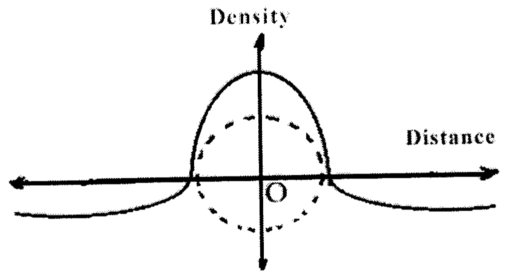


Fig. 1

For all this, from the known deformation compatibility property in the geometry, it is quite clear, that the ρ_d substance density in such DEFONE compression is greater, than the ρ_p substance density in its neighborhood, that we have graphically presented some dependency

$$\rho = f(r), \qquad (1)$$

where r – distance from the *O* point, as it has been shown in Fig. 1.

So, it is quite known, that the DIRECTION notion in the GEOMETRY is determined by the ANGLE – value quantity, which is appeared only in the two – dimensional worlds – surfaces (e.g. radian), and in the three – dimensional worlds (e.g. steradian). For all this, if for the plane ANGLE value uniqueness should be its sign indication (the right one – clockwise, the left one – counterclockwise, relative to the given REFERENCE – line), then the space ANGLE value uniqueness yet it is necessary the indication, and its orientation, relative to the surface.

To be illustrated the marked circumstance, let us use the vector fields topological studies results on the surfaces [3] and the others. Let us imagine to ourselves the simple such spheroid DEFON compression in the neighborhood of the O point, as in Fig. 2, whereas in Fig. 3, we will obtain the σ_i normal vector fields image (e.g. Fig. 3, a) and the τ_{ik} tangential (e.g. Fig. 3, b) stress components in the adjacent neighborhood with the spheroid, which by the definition are the orthogonal ones to each other.

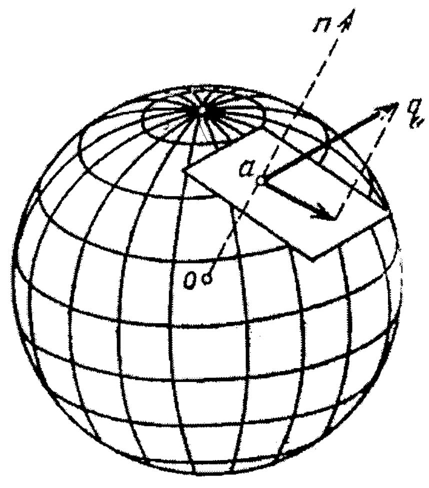
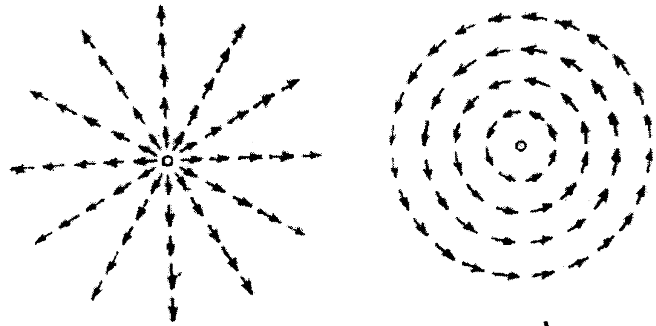


Fig. 2 (fig. 88 by [3])

At the same time, the two similar DEFONES, having located closed to each other, will be appeared on the opposite sides of any surface, which will be always able to be presented in closed indefinitely for the improper lines around any of the DEFONES, as it has been graphically shown in the Fig. 4, in which l – is the trace of the boundary surface between the A and B DEFONES neighborhoods, having had the m and m^1 characteristics, correspondingly.

As we have already noted earlier [1], this surface curvature radius l for the A and B DEFONES will be had the opposite signs. So, from the above – mentioned circumstances, it is followed immediately the need convergence of the two neighboring such DEFONES – SPHEROIDS compression, which is equivalent to the attraction, as it has been shown in the Fig. 4.



a b

Fig. 3 (fig. 89-a) and b) by [3])

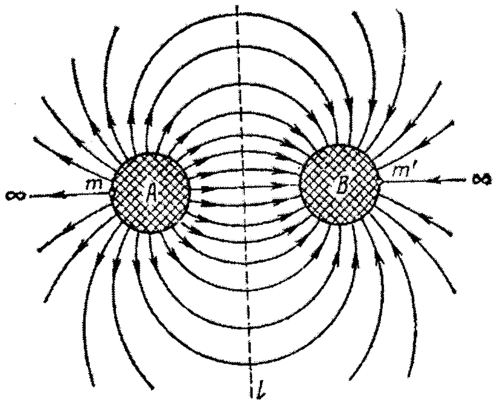


Fig. 4

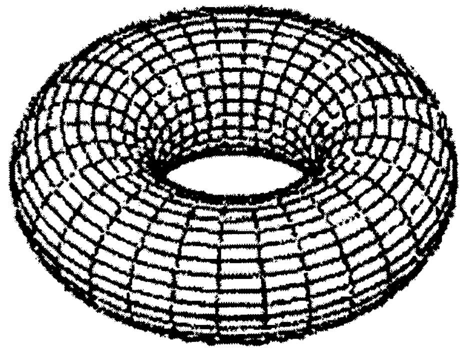


Fig. 6

As we have already determined previously [1], such surface can be accepted one from the shown in the Fig. 5 (e.g. the sphere), in the Fig. 6 (e.g. the torus), and in the Fig. 7 (e.g. the twisted torus) forms:

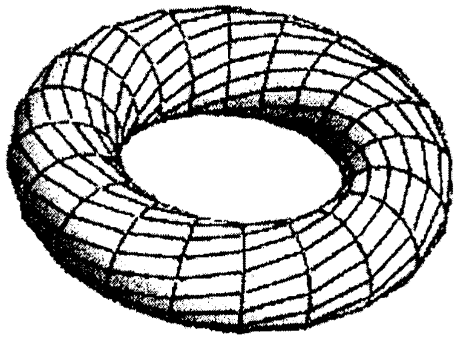


Fig. 7

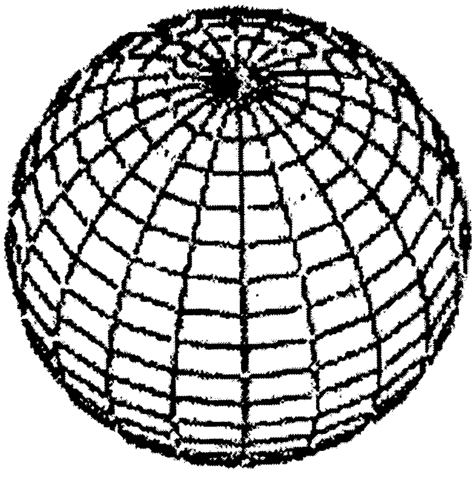


Fig. 5

From one of the fact, that in contrast to the simply connected spheroid, the toroid (see, Fig. 6) is the biconnected one [1], it is immediately led to the conclusion, that there is no vector field central symmetry of the normal σ_i component of the stress, inherent to the spheroid, having got in the polar plane, the toroid orthogonal to the equatorial plane, the axial symmetry, having allowed the change to be provided the vector field of the normal σ_i stress component, having omitted the mathematical transformations, having done by the author earlier [4], as it has been shown in the Fig. 8, in which the n и -n limits levels values of the vector field of the normal σ_i component are indicated by the dashed lines.

From the circumstances, mentioned again, the conclusion is followed, the convergence necessity between the two neighboring such DEFONES – TOROIDS compression, which is equivalent to the attraction, like DEFONES – SPHEROIDS attraction in the Fig. 13, but the DEFONES – TOROIDS gravitation magnitude is dependent not only on the distance between them, but on the relative spatial orientation to each other: their interaction in the equatorial planes is subjected to the central symmetry, like the DEFONES – SPHEROIDS interaction (see, the Fig. 4), and the DEFONES – TOROIDS compression interaction is subjected to the axial symmetry in the polar plane, also here it is leaving until the challenge of this attraction magnitude is opened.

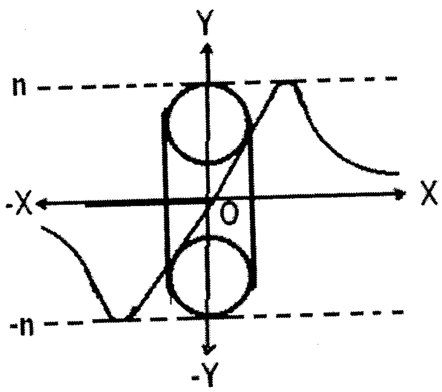


Fig. 8. Component of the stress

For all this, here it is significant to be noted the distinguished feature action of the DEFONES – TOROIDS interaction, unlike the DEFONES – SPHEROIDS interaction only, as it is quite clear from the graphical dependence, which has been shown in the Fig. 8, at the distances between the DEFONES – TOROIDS, comparable to their own dimensions. Moreover, we know [1], that the deformed environment neighborhood around the LOCAL DEFORMATION at the O point with the indicated components of the normal σ_i and the tangential τ_{ik} stresses, having bounded by the surface, is formed the DEFONES – SEROIDS and the DEFONES – TOROIDS, which, in their turn, are formed the asymmetric BRACKETS, in the vicinity of which accompanying deformations are also co-created the asymmetrical regions, within which the values and the directions of the normal σ_i and the tangential τ_{ik} stress component are shown this surrounding areas asymmetry from the various sides, regarding the TWISTED DEFONE – TOROID BRACKETS.

Also, having taken into consideration the circumstance, that the DIRECTIONS notion in the GEOMETRY is determined by the ANGLE sign and the magnitude, it is necessary to be recognized the decisive influence upon the magnitude and the interaction direction, and also as well as the TWISTED DEFONES – TOROIDS TWISTING DIRECTIONS, which can be two: the right one and the left one. In fact, the DEFONE – TWISTED TOROID formation can be presented, as the circumference moving process around some point of the deformable medium by the external axis – that is the close trajectory at this circle rotation, with respect to the center moving trajectory of this circle up to the closure of the path – which is the TOROID axis.

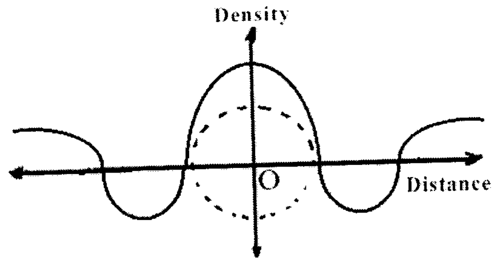


Fig. 9

As we have seen earlier [1], the torsion deformations are accompanied by all the other types of the deformation: as the compression, well as the tensile, as the shear, well as bending. Therefore, the special practical interest for us is presented that dependence $\rho = f(r)$ (1) density from the distance within the DEFONE – TWISTED TOROID itself and in its neighborhoods, as we have been found for the DEFONE – SPHEROID (see, Fig. 1), and also the vector field dependence of the normal σ_i stress components in its neighborhood, as we have already found above for the DEFONE – TOROID.

In accordance with the distinguished «DEFORMATIONS COMPATIBILITY CONDITIONS» after Saint – Venant [1], it is perfectly clear, that at the DEFONE – TOROID torsion, its surficial layer is tested the tension, which, if necessary, can be calculated even, having compared the helix lengths with the toroid corresponding equator length. This circumstance is led to the necessity of the tensile strain in the nearest TORSIONED DEFONE – TOROID neighborhood, as in the Fig. 9.

The ether substance organization five leves

As it is turned out, the briefly – described above information from [1] on the deformation worlds is able to be interpreted, on the basis of the empirically established regulations. So, for example, it is quite known from the CTO, that:

$$m = \frac{m_o}{\sqrt{1-\frac{v^2}{c^2}}} = m_o\left(1-\frac{v^2}{c^2}\right)^{-1/2}. \qquad (2)$$

Then followed by A. Einstein [5], having expanded the Newton binomial theorem into the Taylor series, we will get:

$$m_o\left(1-\frac{v^2}{c^2}\right)^{\frac{-1}{2}} = m_o\left(1+\frac{1}{2}\frac{v^2}{c^2}+\frac{3v^4}{4c^4}+...\right). \quad (3)$$

And having assumed along with A. Einstein

$$\frac{3}{4}\frac{v^4}{c^4} << 1 \to 0 \quad (4)$$

we will get:

$$m = m_o\left(1+\frac{v^2}{c^2}\right)^{\frac{-1}{2}} = m_o\left(1+\frac{1}{2}\frac{v^2}{c^2}\right). \quad (5)$$

Then

$$E = mc^2 = m_o c^2 + \frac{1}{2}m_o v^2 + (...) \quad (6)$$

that is and followed by A. Einstein, at $v = 0$, we get the well – known expression

$$E_o = m_o c^2. \quad (7)$$

At the same time, here, it is necessary to be remembered, that the full expression of the Newton binominal [6]:

$$(a+b)^n = a^n + na^{n-1}\cdot b^1 + \frac{n(n-1)}{1\cdot 2}\cdot a^{n-2}\cdot b^2 + \frac{n(n-1)(n-2)}{1\cdot 2\cdot 3}a^{n-3}b^3 + ... \quad (8)$$

that, in our case, it is required to be rewritten the expression (3), in the form completely, as it is already subsequent to the fifth member after the fraction comma has become into the constant term, which is independent of c^n the constant value, if this expression (9) is led to the common denominator, that is to divide the value of

$$M = m_o\left(1-\frac{v^2}{c^2}\right)^{\frac{-1}{2}};$$

$$m_o\left(1-\frac{v^2}{c^2}\right)^{-\frac{1}{2}} = m_o\left(1-\frac{1}{2}\frac{v^2}{c^2}+\frac{3}{4}\frac{v^4}{c^4}-\frac{5}{16}\frac{v^6}{c^6}+\frac{35}{128}\frac{v^8}{c^8}+...\right) \quad (9)$$

Indeed, after getting rid of the common denominator the FIFTH term on the right c^o is obtained, that is, it is converted into the UNIT, that do not affect this term meaning:

$$M\cdot 128c^8 = 128m_o c^8 - 64m_o v^2 c^6 + 96m_o v^4 c^4 - 40m_o v^6 c^2 + 35m_o v^8 c^o. \quad (10)$$

In another way, the expression (10) can be rewritten in the form, as (11):

$$M = m_o - \frac{m_o}{2}\left(\frac{v}{c}\right)^2 + \frac{3m_o}{4}\left(\frac{v}{c}\right)^4 - \left(\frac{40m_o}{128}\right)\left(\frac{v}{c}\right)^6 + \left(\frac{35m_o}{128}\right)\left(\frac{v}{c}\right)^8, \quad (11)$$

from which the conclusion is unequivocally followed on the WORLDS DEFORMATIONS SUBSTANCE QUINTUPLE HIERARCHY, that is, the worlds, having contained the DEFONES.

So, the received expression (11) is remined us from the base storage [1] the TOPOLOGY CATEGORIES QUINTUPLE HIERARCHY, the WORLDS HIERARCHY FIVE LEVELS, etc. are prompting us, here, to be formulated the similar conclusion, by the analogy, on the ETHER SUBSTANCE ORGANIZATION FIVE LEVELS: the SUBSTANCES QUANTITY IN THE GIVEN NEIGHBORING AROUND THE WORLD OF THE DEFORMATIONS IS MET THE DEFONES MOTION VELOCITY IN THE DEGREES 0, 2, 4, 6 and 8. In other worlds, this value M in (11) can be presented by the FIVE – MEMBERED TERM:

$$M = M_1 + M_2 + M_3 + M_4 + M_5, \quad (12)$$

where

$$M_1 = m_O; \quad (13)$$

$$M_2 = -\frac{m_O}{2}\left(\frac{v}{c}\right)^2; \quad (14)$$

$$M_3 = \frac{3m_O}{4}\left(\frac{v}{c}\right)^4; \quad (15)$$

$$M_4 = -\left(\frac{40m_O}{128}\right)\left(\frac{v}{c}\right)^6; \quad (16)$$

$$M_5 = \left(\frac{35m_O}{128}\right)\left(\frac{v}{c}\right)^8. \quad (17)$$

The defone – spheroid with the defones – toroids and the defones – toroids between each other coupling geometry

Without wishing to be anticipated here yet the empirically established names:

1) the elementary parts;
2) the clusters;
3) the atomic nuclei;

4) the chemical elements atoms;

5) the chemical compounds molecules,

now, we imagine ourselves these DEFONES various configurations on the basis of our paradigm on the ATTRIBUTIVELY – SUBSTANTIVE EXPANDING DEFONES WORLD, in accordance with the established types of the INTERACTION SYMMETRY [1].

Indeed, as previously [1], we have already spread the very general topological principle of the continuity and for the dimension of the topology those categories, for which this principle is the fundamental one on the basis of the multiple processes geometry fractality, then it is appropriate and our conclusion, that

$$M = \int_{n_1}^{n_2} dM_n = \int_{n_1}^{n_2} m^n \ln m dn. \qquad (18)$$

Thus, having considered the n PARTICLES dimension, depending on the specific physical properties of the DEFONES, CLUSTERS, NUCLEI, ATOMS, AND MOLECULES WORLD, that is, as the DIMENSION of the corresponding DEFONES COUPLING WORLDS:

n_1 – размерность – DEFONE – SPHEROID,

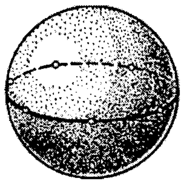
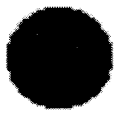
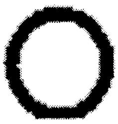
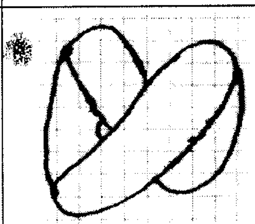
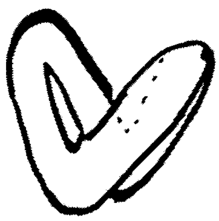
n_2 – размерность – DEFONE – TOROID,

n_3 – размерность – RIGHT – TWISTED DEFONE – TOROID,

n_4 – размерность – LEFT – TWISTED DEFONE – TOROID and so on, it is quite possible to be imagined oneself the DEFONES WORLDS, in the form of the illustrative tables, having used, for example, the appropriate symbolic notations:

Table 1

The elementary (the simplest) defones

Number	n	Visual representation	Simplified representation	Simbol	Name
1	n_1				DEFONE – SPHEROID
2	n_2				DEFONE – TOROID
3	n_3				RIGHT – TWISTED DEFONE–TOROID
4	n_4				LEFT – TWISTED DEFONE–TOROID

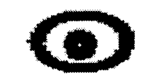
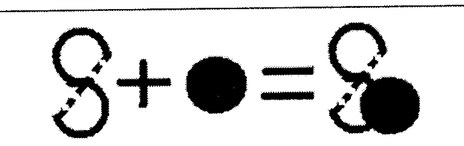
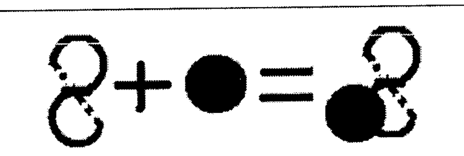
Still, having left aside outside our attention, as more than triple, well as the multiple COUPLINGS, it is quite possible to be used our reasonable conclusion from [1], on the basis of the given table, that

$$M = \ln m \int_{n_1}^{n_2} m^n dn = \ln m \frac{m^n}{\ln m} = m^n = m^{n_2} - m^{n_1} \qquad (19)$$

to the dimension determinations of the corresponding COUPLINGS:

Table 2

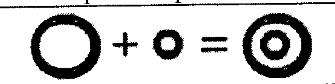
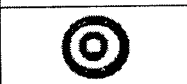
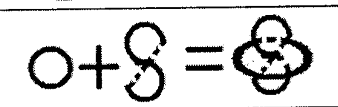
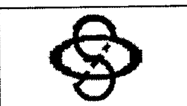
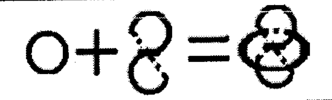
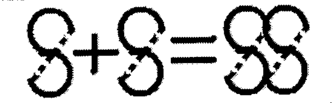
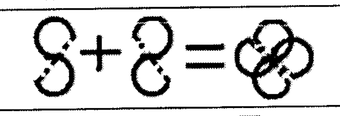
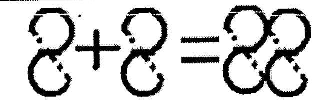
The simplest defones – spheroids with the defones – toroids pair couplings

Number	n	Simplified representation	Simbol	Name
1	n_5			SPHEROID WITH TOROID COUPLING
2	n_6			SPHEROID WITH RIGHT TOROID COUPLING
3	n_7			SPHEROID WITH LEFT TOROID COUPLING

Thus, as have repeatedly pointed out previously [1, 7, 8], that the quantitative increase of the additional directions and the areas (e.g. the properties, the abilities, the possibilities…) is led to the appearance of the new qualitative features, values, and parameters. In other words, the system is usually gained or lost some of its properties (e.g. at the dimension increasing – the properties number is increased, and at the dimension decreasing – their number is decreased, respectively) in the process of the dimension changing, that it is graphically illustrated to us the above – listed DEFONES COUPLINGS, having had their dimensions: $n_1, n_2, n_3, n_4, n_5, n_6, n_7, n_8, n_9, n_{10}, n_{11}, n_{12}, n_{13}$, etc.

Table 3

The simplest defones – toroids between each other pair couplings

Number	n	Simplified representation	Simbol	Name
1	n_8			TOROID WITH TOROID COUPLING
2	n_9			TOROID WITH RIGHT TOROID COUPLING
3	n_{10}			TOROID WITH LEFT TOROID COUPLING
4	n_{11}			RIGHT TOROID WITH RIGHT TOROID COUPLING
5	n_{12}			RIGHT TOROID WITH LEFT TOROID COUPLING
6	n_{13}			LEFT TOROID WITH LEFT TOROID COUPLING

The SPHEROID WITH THE TOROUD  and the TOROID WITH THE TOROID COUPLINGS  geometry is paid the special attention to itself, which are easily explained by the dependence nature (1) $\rho = f(r)$ in the Fig. 1, the Fig. 8, and the Fig. 9, having reproduced, here again, in the comparative scales:

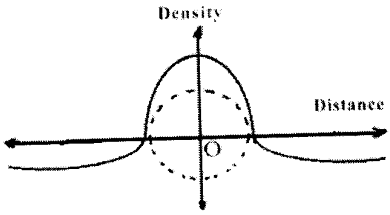


Fig. 1

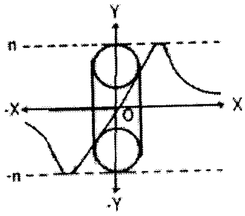


Fig. 8

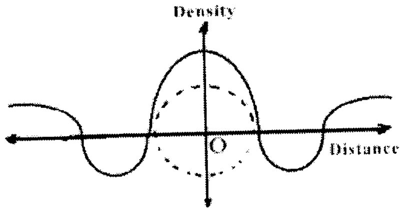


Fig. 9

Indeed, in contrast to the Figure 1, the dependence (1) $\rho = f(r)$, which is defined only the central symmetry of the gravity interaction of the Fig. 4, this dependence (1) $\rho = f(r)$ for the Fig. 8, and the Fig. 9 is determined and the interactions axial centrally symmetry, which is the special case of the stable position of one from the DEFONES inside another one, in the so called the potential well [8].

Conclusions

1. The interpretation on the basis of empirically established dependencies of the STEREOCHRONODYNAMICS guideline, that all the material objects of our world, in the form of the fields or the real bodies are presented themselves the common continuous medium – the physical ether, in which all the material objects (e.g. the bodies and the fields) have been localized, having interacted between each other, according the established laws, unambiguously is led us to the conclusion on the WORLDS DEFORMATIONS SUBSTANCE QUINTUPLE HIERARCHY, that is, the worlds, having contained the DEFONES:

$$M = M_1 + M_2 + M_3 + M_4 + M_5. \quad (12)$$

2. Having considered the n Particles dimension, depending on the specific physical properties of the DEFONES, the CLUSTERS, the NUCLEI, ATOMS, AND the MOLECULES WORLD that is, as the DIMENSIONS of the corresponding DEFONES COUPLINGS WORLDS, one can imagine oneself the DEFONES WORLDS, in the form of the empirically established ideas on:

1) the elementary particles;
2) the clusters;
3) the atomic nuclei;
4) the chemical elements atoms;
5) the chemical compounds molecules.

3. The pair couplings feature of the DEFONES BETWEEN EACH OTHER is the SPHEROID WITH THE TOROID and the TOROIDS BETWEEN EACH OTHER COUPLINGS, because of the DEFONES interactions axis centrally symmetry, which is the special case of the stable position of one from the DEFONES inside another one, in the so called the potential well.

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The work was submitted to international scientific conference «Topical issues of Science and Education», Russia (Moscow), May 21-23, 2012, came to the editorial office 16.05.2012.