

On Materiality and Dimensionality of the Space. Is There Some a Unit of the Field?

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The article presents arguments with a view to recognize that space is material and has possibly a fractal dimension in the range of from three to two. It is proposed that along to the unit of substance (atom) some a unit of the field (vortex tubes) should be set. It is shown that the formation of the field structures being a kind "doubles" of atomic ones is possible. The existence of the three-zone electron structure is confirmed. It is indicated that this concept have already resulted in to the successful explanation of phenomena and to finding of their important parameters at different levels of the organization of matter.

1 Introduction

Some of the observed cosmological effects can not find a satisfactory explanation. These include, in particular, mismatch of the rotation velocity around the galactic center of the substance, located on the periphery of galaxies, to the Kepler's laws.

In accordance with the laws of Kepler, following the law of universal gravitation, the peripheral rotation velocity of galactic objects should, in accordance with their distancing from the galactic center to the periphery, decrease inversely proportional to the square of their distance from the center. Measurements also showed that this rotation velocity remains almost constant for many galaxies at a very significant distance from the center. The need to explain these facts has led to the conclusion that there is a dark matter filling up the galactic halo.

The other explanation was given by Israeli astrophysicist Mordechai Milgrom. His Modified Newtonian Dynamics (MOND) is an empirical correction of the Newton's laws of gravity and inertia, proposed as an alternative to dark matter. The basic idea is that at accelerations below $a_0 \sim 10^{-8} \text{ cm/sec}^2$ effective gravitational attraction approaches the value $(g_N * a_0)$, where g_N -- usual Newtonian acceleration; that allows phenomenologically to reproduce the flat rotation curves of spiral galaxies [1].

It is possible that the reported anomalous acceleration detected by the Pioneer spacecrafts refers to the same type of phenomena, i.e. it is caused by not so rapid decrease in the force of attraction, as the Newton's law requires.

2 On the true dimensionality of the space and of its materiality

Is there a need to involve extra entities (dark matter) or to modify forcibly the fundamental Newton's law to explain of this and others cosmological effects? Could be more natural to accept reduction of the dimensionality of the space from three -- in the region of cluster masses, to two -- for the void intergalactic space?

Assume that with distancing from the cluster masses at intergalactic distances the three-dimensional space gradually "flattens" in a two-dimensional surface. The force of gravity in the case of the three-dimensional space is inversely proportional to the square of the distance between gravitating masses. With decreasing the dimensionality of the space the natural modification of Newton's law occurs, and the force of gravitational attraction for the two-dimensional space becomes inversely proportional to the distance in the first degree, which leads to the constancy of the rotation velocity of objects at great distances from the galactic center.

Perhaps a slight dimension decreasing and therefore the modification of Newton's law manifest itself at a lower scale with the distance increasing from the Sun, which may explain the anomaly of the Pioneer spacecrafts.

Thus, a picture emerges of three-dimensional or nearly three-dimensional material galaxies islands floating in a two-dimensional or nearly two-dimensional void spatial sea. Obviously, need

has ripened for recognizing of the existence of *a unified material medium* and for replacement by this concept of the whole variety entities like ether, physical vacuum, space, and matter.

Indeed, according to the concept of J. A. Wheeler's idea, the surface can be two-dimensional, but at the same time is fractalized, topologically non-unitary coherent and consists of linkages of "appendices" or "wormholes" of the first and subsequent orders forming as a whole the three-dimensional structure [2]. Thus matter itself can finally be organized with step-by-step complication of the initial cells and be a "woven cloth", which in its turn, is deformed into the objects (masses, substance) we observe. The objects therefore are the very fractalized (upto micro-world scales) *surfaces*, which have a fractional dimension of the value almost approaching three and presumably equal to the number e [3]. As a result, empty space is logically interpreted as a nondeformed surface and, accordingly, electromagnetic waves as *surface waves* thereon.

Note, it is the concept of a flat two-dimensional intergalactic space that agrees best with the point of view existing today among the majority of cosmologists that the observable universe has zero curvature and is very close to spatially flat having local deformations at the location where there are massive objects (flat Universe).

There are also other facts pointing to the reasonableness of the foregoing. Recently in the paper [4] interesting effects have been given, namely :

- the unusual nature of the distribution of "hot" and "cold" spots in the cosmic microwave radiation;
- the damping of a signal at large scales (there is absence of any clearly expressed "hot" or "cold" areas at the angles greater than about 60 degrees);
- the form of small spots on the map, drawn WMAP, like an ellipse.

The authors consider that these effects can be explained by assuming that the Universe has the shape of a horn. Then its curvature explains these facts, because the whole surface of the horn is a continuous saddle. This negatively curved space acts like a distorting lens, turning spots in something like an ellipse.

It would be interesting to analyze, whether the same effects can be explained in accordance with the concept set forth above, i.e. be the result of observation out of the three-dimensional space of our galaxy of remote objects through a void two-dimensional space?

Finally, there is a known *photometric paradox* that is, in the framework of the proposed concept, explained naturally by decrease in the amount of luminous objects entering the target of the observer during the transition of a solid angle in a planar angle as far as these objects are moving away from the observer.

3 Field masses and their structurization

The idea about transitions between distant regions of space in the form of Wheeler's "appendices" or "wormholes" can be extended to the scale of macrocosm, and some contemporary astrophysical theories has already made use of it [5]. These "wormhole", obviously, should be interpreted as vortical current tubes or threads, or field lines of some kind.

It is considered that matter exists in the form of the substance and the field. A familiar element of our world is an atom, i.e. the *unit of the substance* is the structure that is, on the Bohr' model, based (simplified, of course) on the balance between dynamic and electric forces. By analogy, one can imagine the *unit of the field* -- the structure that is based (also simplified) on the balance between *dynamic and magnetic forces*.

In the paper [6] it is shown that the balance of dynamic and magnetic forces defines a family of unidirectional vortex threads of number n_i , of the length l_i , rotating about the longitudinal axis of the radius r_i with the rotary velocity v_{0i} ; with the additional presence of the balance of *gravitational and magnetic forces* contra-directional closed vortex tubes form closed structures or contours. These structures can be attributed to some mass, but not in the ordinary sense of the word, but as having the sense of the measures of organization of the field.

It is given that the elementary unit of vortex tubes is the unit with the radius and mass close to those of a classical electron (r_e and m_e) [7, 8]. Then the linear density of the vortex tube for vacuum will be:

$$\varepsilon_0 = m_e/r_e = 3.231*10^{-16} \text{ kg/m.} \quad (1)$$

Accepted that for a medium other than vacuum the mass of a vortex tube or the mass of a contour, i.e. the mass per unit of the field, is proportional to the number of vortex threads in the tube. Then the total mass of the contour of the length l_i will be:

$$M_i = \varepsilon_0 n_i l_i. \quad (2)$$

Number of vortex threads shows how material medium differs from vacuum, and their greatest value corresponds to the ratio of electrical-to-gravitational forces, i.e. value:

$$f = c^2/(\varepsilon_0 \gamma) = 4.167*10^{42}, \quad (3)$$

where c , γ are the light velocity and the gravitational constant.

The balance of *electrical and magnetic* forces gives a characteristic linear parameter that is independent of the direction of the vortex tubes and the number of charges and etc :

$$R_c = (2\pi)^{1/2} c*[\text{sec}] = 7.515*10^8 \text{ m,} \quad (4)$$

a magnitude close to the Sun radius and the sizes of typical stars.

Further, this value corresponds to the characteristic gravitational mass, close to the *Jeans mass* during recombination:

$$M_m = R_c c^2/\gamma = f R_c \varepsilon_0 = 1.012*10^{36} \text{ kg.} \quad (5)$$

Let the field structure meets the above conditions and has a total mass $M_0 = z_i M_i$, i.e. consists of z_i vortex tubes which, in turn, consist of n_i of vortex threads. While atomic objects are complicated with increasing its mass, field objects are, on the contrary, complicated with decreasing its mass, forming the hierarchy of structures. These changes can be traced if some additional relations are set, for example:

$$z_i = R_c / l_i, \quad a^j = R_c / r_i, \quad (6)$$

where a is the reciprocal fine structure constant and $j = 0, 1, 2 \dots$

In the paper [6] the formulas are given, where all parameters of objects are expressed in the terms of a dimensionless mass $M = M_0 / M_m$.

Table that here shows the hierarchy of the parameters z_i , r_i , l_i , v_{0i} , M_0 , n_i with decreasing the mass M_0 for some values of j . It is evident that the fine structure constant is the scale factor in the whole range of mass.

Calculations show that some parameters of objects are quite characteristic. For example, at $j = 2$ the mass of an object is exactly equal to the mass of the Sun, at $j = 4$ the mass of an object is equal to the mass of Earth-like planets. Apparently, the mass range for $j = 11 \dots 15$ correspond to the masses of living multicellular organisms.

Indeed, for the minimum mass at $j = 15$ parameter $n_i = 1$, and it limits the existence of the complex structures having masses below $1.9*10^{-7}$ kg. For the maximum mass at $j > 11$ $r_i < r_e$. In this case, there is a possibility of the formation within the vortex tubes of $p^+ - e^-$ contours of general radius r_e (their parameters were previously determined from the condition of the charge constancy [7]) of *even more fine secondary structures* consisting of the vortex elements of radius r_i .

It would be reasonable to assume that the additional information filling of such structures, i.e. the ability to record and store information on a deeper level than the atomic-molecular level (DNA), just also is the condition of the formation of the most complex organisms (multicellular ones).

Provided $r_i = r_e$, the maximum mass of such organism is limited to 59 tons (with roughly at $j = 11$). The overwhelming diversity of living multicellular organisms fit into this mass range. This applies to both flora and fauna. The smallest animals endowed with a cerebrum and nervous system are rotifers (Rotatoria), and the most massive animals are whales (Cetacea), and among multicellular plants - from wolffia rootless (*Wolffia arrhiza*) to redwoods (*Sequoia*). Their mean masses are close to those specified in the table of minimum and maximum masses.

It is interesting to note that at $j = 12$ the mass of the object becomes equal to the average mass of a human individual, while the length of the vortex tube corresponds to the length of a stretched human DNA. Complexity of such a field structure containing $3.5 \cdot 10^8$ vortex tubes, each of which contains nearly the same amount by $2.8 \cdot 10^8$ vortex threads, is comparable to the complexity of a human body, which contains about 10^{15} cells.

Таблица

Objects Parameters	Jeans mass	Typical star	Typical small planet	Biggest multicellular organism	Human individual	Most small multicellular organism
j	0	2	4	11	12	15
z_i	1	26.6	706	$6.8 \cdot 10^7$	$3.5 \cdot 10^8$	$4.8 \cdot 10^{10}$
r_i, m	$7.5 \cdot 10^8$	$4.0 \cdot 10^4$	2.13	$2.3 \cdot 10^{-15}$	$1.7 \cdot 10^{-17}$	$6.8 \cdot 10^{-24}$
l_i, m	$7.5 \cdot 10^8$	$2.8 \cdot 10^7$	$1.1 \cdot 10^6$	11.0	2.13	0.016
$v_{i0}, m/sec$	$3.0 \cdot 10^8$	$1.1 \cdot 10^7$	$4.2 \cdot 10^5$	4.4	0.85	0.0063
M_0, kg	$1.0 \cdot 10^{36}$	$2.0 \cdot 10^{30}$	$4.1 \cdot 10^{24}$	$4.6 \cdot 10^4$	65.5	$1.9 \cdot 10^{-7}$
n_i	$4.2 \cdot 10^{42}$	$8.3 \cdot 10^{36}$	$1.7 \cdot 10^{31}$	$1.9 \cdot 10^{11}$	$2.8 \cdot 10^8$	≈ 1

Thus, the atomic structures are accompanied by their field "doubles"; this duality in general determines the total properties of objects. And possibly it is the "harmonic complexity" of the existing wave objects having masses close to that of human that defines the most highly organized biological life and the existence of mind.

One might ask why these vortex structures are not detected. But it is not quite so. There where there is a suitable material medium, plasma, for example, vortex structures manifest themselves at the different levels of organization of matter.

Undoubtedly, inside the Sun there is a gravimagnitodynamical structure that manifests itself in the form of paired dark spots in the equatorial zone of the Sun. These spots seem to be the outputs of the vortex force tubes undergoing magnetic reversal and changing their intensity and polarity.

Their registered quantity (from several one to a hundred) does not contradict the calculated mean $z_i = 26.6$ [6].

On the Earth's surface the reflection of such structures are numerous geomagnetic anomalies, at least those that are not associated with the features of geological structure.

Regarding the scale of human, it can be assumed that the material essence of living in his field form is expressed through the form and structure of the corona discharge observed around living organisms (Kirlian effect).

4 About the three-zone electron structure and the divisibility of charge

In the microcosm the charge and spin of the electron are determined by momentum and angular momentum of the vortex $p^+ - e^-$ contour, and these values are constant regardless of the size of the contour [7].

Let for some wave object, whose parameters are determined from the foregoing balances, the momentum of *one* vortex tube $M_i v_{0i}$ is also equal to the total momentum $p^+ - e^-$ contour, i.e. the amount of charge (in the "coulombless" system) corrected by the Weinberg angle cosine $e_x = e_0 / \cos q_w$, where $q_w = 28.7^\circ$ [8]. Then using the formulas given in [6] one can find the number of vortex threads, which one vortex tube is composed of:

$$n_i = f e_x^{2/3} / (c M_m)^{2/3} = 2.973 \approx 3. \quad (7)$$

Thus, a unit contour or vortex tube having a momentum equivalent to the electron charge contains *three* unit vortex threads. This fact points to the three-zone electron structure and possible divisibility of the charge and confirms the conclusions reached in papers [8, 11].

5 Conclusion

The concept of the unified material medium and recognition of the existence the elementary vortex structures as material units of the field made it possible to reflect on and explain logically variety physical phenomena at the different scale levels of organization of matter using the single approach -- J.Wheeler's geometrodynamics concept.

Someone might say that the author's constructions are too simplistic, mechanistic, even speculative and not supported by a properly mathematical apparatus, and some results could be occasional coincidences. However, the author has repeatedly stated that these works are not a formalized theory. These papers only have demonstrated by means of the illustrative mechanistic models the opportunities for understanding, interpretation, and, in some cases, for calculation of important physical parameters on the scale of from microcosm to cosmos.

This approach has proved successful. This proves the results, for example: the definition of the independent determination of the ultimate density of physical vacuum [3], the explanation of the nature of electron charge and finding its numerical value as well as numerical values of the constants of radiation [7, 9], the determination of the proton-electron mass ratio, the accounting of the forces of gravity in microcosm, the finding the neutron lifetime [8], the modeling the Hertzsprung-Russell diagram, the definition of model parameters of pulsars [6], the conclusion about the existence of two types of planetary systems [10], etc.

The obtained results totality, correct both qualitatively and quantitatively, is so great that this fact completely excludes the opportunity of occasional coincidences. Thus, the method of approach and proposed models can serve as a basis for the development of full physical theories based on the recognition of the existence of the unified material medium.

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