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ANNOTATION TO I.L. GERLOVIN'S THEORY « FUNDAMENDALS OF THE UNIFIED THERORY OF ALL INTERACTIONS IN MATTER ».

FUNDAMENTALS OF A UNIFIED THEORY OF ALL INTERACTIONS IN THE MATTER

(THEORY OF THE FUNDAMENTAL FIELD, or "TFF", by Ilya L. GERLOVIN, 1990)

INTRODUCTION

The question of the boundary between living and inanimate matter remains open to this day, but it can be clearly stated that the man represents a symbiosis of living and inanimate matter.

Since at the moment there is no common understanding of the surrounding Space, the substance which fills it, and the nature of the forces acting in the space, the existence of new, alternative theories on these subjects is useful matter, since any theory can be considered as "one facet of the truth"…

I would like to introduce the work of a group of scientists who have for many years been like-minded and co-authors of the Theory of Fundamental Field (TFF).

The theory was published in details in the monograph of Ilya Lvovich Gerlovin, dated 1990, with the title: "**Fundamentals of a unified theory of all interactions in matter**" (*translation of the original title in Russian*).

An important application to the theory is the joint work of Mikhail Mikhailovich Protodyakonov (Protodiakonov Jr.) and Ilya Gerlovin ("The electronic structure and physical properties of crystals," 1975), as well as the "Paradigm for viable and developing systems", formulated by Gerlovin back in 1946 (hereinafter referred to the "Paradigm of Gerlovin").

I consider it important to introduce the paradigm first of all, since Gerlovin believed that it contains the methodological and mathematical conditions necessary for any theory, and in particular, for the theory of the noosphere. This Paradigm has been used as the basis for the creation of the TFF.

At the beginning of the 20th century, VI. Vernadskiy expressed and developed the idea that the Mankind on Earth, and the living and inanimate nature surrounding it, represent one unified "thing", living according to the general laws of nature, and he called this unified "thing" the **noosphere**.

N.N. Moiseyev significantly developed the ideas of VI. Vernadskiy and of some other scientists (N.F. Fedorov, V.N. Sukachev, N.V. Timofeev-Resovskii, A.A. Bogdanov), showing that the triad discovered by Charles Darwin (heredity, variability and selection) should play an important role in the evolutionary development of all elements of the noosphere. A great contribution was made by I.R. Prigozhin, P.T. de Chardin and other scientists.

The creation of the Paradigm by Gerlovin was dictated by the need to have a fundamental support, not only for the TFF that he created, but also for any theory, in whatever field of knowledge. Living and inanimate nature, realizing itself in the known and unknown to mankind spaces, must obey the general laws given in this Paradigm.

The paradigm of Gerlovin is designed to solve the following question: what is the essence of the general law of Nature, ensuring the viability of all systems, and with the help of which mathematical apparatus can this law be described and used to create a "Theory of the noosphere" in the future ?

BASICS OF THE PARADIGM OF HERLOVIN

Any theory based on Gerlovin's Paradigm should satisfy the following basic principles:

VIABILITY OF THE SYSTEM

Principle 1.

For a full description of any viable and developing system, it is necessary to consider it being simultaneously present in different sub-spaces (layers) of an enclosing, comprehensive layered space (*NdT : also referred to as "Fiber Bundle" in the English version of the book*).

Principle 2.

The structure of space-time of a system of fibers (base) of an enclosing space under any (no matter how cardinal) differences is strongly controlled by a single law valid in all the layers, the Triunity Law (TL) of space – time – matter.

For any viable system, there exists a mechanism of Spatial Metamorphosis (SM) for which this system in the different layers will have mutually coordinated, but different space-time structures. In other words, the SM involves the simultaneous existence of single object in different sub-spaces / fibers, while in each sub-space / fiber this object has very different characteristics and structures.

Principle 3.

With respect to any sub-space (base and / or layer), any other sub-space, part of an enclosing space, is always in the domain of "imaginary". Here the "imaginary domain" is not a formal mathematical dodge / tool, but it should be understood as a real structural property of all viable and developing systems

SELF-DEVELOPMENT OF THE SYSTEM

Principle 4.

Between the sub-spaces (fibers), and between the basis of the considered layered space (fibration) and its layers (fibers), there exists only an **information channel**.
This channel bears not only data about the processes taking place in the layer which is the origin of this data, but also signals which are regulating general processes. *Here "information" is taken in its broad sense.*

Principle 5.

In a stationary regime, the information channels bears a signal which can bring only negative entropy into the sub-space in which it enters.

Principle 6.

The development of the viable systems involves a sharp increase in the information debit carrying negative entropy. This information can also contain signals, which regulate the Darwin's "Triade": "heredity – variability – (natural) selection".
If the flow of incoming negative entropy dominates the production of positive entropy, then the system becomes capable of self-organization.

Principle 7.

The infiltration (leakage) of a signal carrying a positive entropy along the information channel or the interruption (break) of a channel of information carrying a negative entropy leads to illness or death of the system.

Principle 8.

If the closure and / or the commutability of the reflection / mapping diagram, describing all the information channels of an enclosing space, is broken or violated, then the system loses its viability and necessarily dies.

The **eight principles** above are significantly restraining the quantity of possible solutions contained in the mathematical equations of the theory : dynamic systems, fiber spaces, mappings and other systems used for research.

All these principles, except the triad of Charles Darwin, were used in the development of a unified theory of the fundamental field. The triad of Charles Darwin is included in these conditions under the influence of works by N.N. Moiseyev.

It is not difficult to see that the proposed paradigm of Gerlovin is also in the vein of the ideas of N. Wiener, who considered cybernetics much wider than the concept that was embedded in the concept of "system engineering".

The Paradigm can be successfully applied in politics, economics and other sciences.

Naturally, Gerlovin's Paradigm, which can and should be improved, is open and can be perceived as a methodology for emerging theories.

THEORY OF THE FUNDAMENTAL FIELD (TFF)

The TFF has been developed over 50 years with the active participation and support of numerous colleagues, friends and true workers of science who helped the author: M.M. Protodyakonov, V.A. Krat, S.V. Izmailov, I.Ya. Pomeranchuk, B.M. Kedrov, F.K. Siegel, V.I. Menzhinsky, V.V. Nazarov, I.D. Dvas, V.S. Dvas, R.R. Zapatrin, N.M. Terterov, T.I. Chuklin, V.P. Petrov, Yu.K. Balenko, N.S. Lidorenko, Z.G. Kaganov, A.P. Kazantsev, E.S. Makarov, A.A. Denisov, I.A. Rapoport, B.N. Frolov, V.P. Shelest, D.D. Ivanenko, Ya.P. Terletsky, O.B. Firsov, A.D. Shnarevich, B.V. Akhlibininsky, I.V. Oborenkov, E.V. Gnilovsky, V.K. Zakharov, N.V. Zakrevsky, I.A. Ivanov, L.P. Clauza, V.Ya. Krejnovich, V.I. Lutsenko, S.G. Mikhlin, V.A. Pinsker, B.P. Pereguda, A.R. Regel, I.V. Sergeev, I.S. Sheinin, A.N. Yushchenko, OA Kazantsev, A.P. Kazantseva, A.M. Protodyakonov, S.D. Ascension, A.S. Bondarev, V.Ya. Zhulai, M.D. Ionov, RS Tuterev and others, who took part in discussions, criticism and gave valuable recommendations.

The FFT uses heuristic possibilities of modern mathematics, in particular the theory of mappings.

At the heart of the TFF, we find the principle of space stratification (layering, fibering), which is widely used in modern mathematics.

The substance, in the usual form for us, is observable in space (four-dimensional pseudo-Euclidean or pseudo-Riemannian), called the first subspace (1PP), which is the base of the bundle in the enclosing tardion space.
In the 1PP, only the main parameters of the substance are observed: mass, charge, spin, magnetic moment, etc.

In the coupled layers of the space, which have only one common point (in the mathematical model), the substance is in other states and is inaccessible to us for direct observation. The information arriving successively from one layer to the other has basically a negative entropy.

The physical vacuum, in which the quantum and relativistic properties of matter arise, occupies a separate subspace.

All structures of matter in different layers form a closed and mutually consistent system of discrete structures, realizing spatial metamorphosis. For this reason, it is impossible to accurately calculate the numerical values of the quantum numbers of a substance in 1PP, without seeking information from other layers.

The TFF describes all types of interactions in matter, understood as a material substance, possessing mass as a measure of inertia. In this case, the mass can be positive, negative or imaginary, provided that it should be a quantized number characterizing any structural element of the substance.

Strong, weak, electromagnetic and gravitational interaction in matter can be considered as different manifestations of one fundamental field.

In the TFF, the Physical Vacuum (PV) is responsible for the quantum and relativistic properties of matter. PV is considered as a structured material substance, consisting of Elementary Particles of Vacuum (EPV) formed by the annihilation of particles and antiparticles in 1PP and uniformly filling the entire space.

An EPV forms a system whose mass is zero and which does not create any forces in space, except for internal constraints in the PV.
The EPV fills with the 1PP according to a certain concentration, and is responsible for propagating the signal perturbing these particles.
The perturbation in the PV propagates along the EPVs with a propagation velocity of transverse deformation waves in an infinite medium.
Important parameters of the PV are its dielectric and magnetic permeabilities.

Since the sources of the fundamental field (FF) are charges, it should be shown that they do not radiate, thus forming a mechanically stable system. The solution of the problem of nonradiation of ultrarelativistic rotators has led to a very remarkable result, according to which the phase and frequency conditions of radiation are satisfied only by a discrete series of states, characterized by certain pairs of rotation velocities of charges along the circumference.
Moreover, not only the rotational speeds are discrete, but also the corresponding harmonics numbers and the ratio of the radii.

Due to this, the existence of nine types of PVs was predicted. Interestingly, the so-called "relic radiation" in space is the spontaneous emission of the 8th kind of vacuum.
The wavelength that was observed experimentally, clearly confirms this :

Type of Vacuum	R_m, cm	Type of Vacuum	R_m, cm
1	$1{,}40 \times 10^{-13}$	6	$1{,}07 \times 10^{-6}$
2	$2{,}58 \times 10^{-10}$	7	$6{,}32 \times 10^{-6}$
3	$3{,}70 \times 10^{-10}$	8	0,370
4	$3{,}70 \times 10^{-9}$	9	$1{,}59 \times 10^{3}$
5	$3{,}15 \times 10^{-8}$		

The main contribution to the properties of PV comes from the proton-antiproton vacuum, which has a maximum concentration of 1.5454×10^{39} cm^{-3}.
The nearest vacuum, the electron-positron vacuum, shows a concentration which is ten orders of magnitude smaller. The concentration in other types of vacuum further decreases sharply, therefore the main contribution to the general property of vacuum is made by the proton-antiproton vacuum.
The influence of other types of vacuum is significant only for resonance phenomena in it.

Gravity is an averaged effect and is not related to resonant phenomena in a vacuum.

The PV has a high concentration. If 1 cm^3 of free PV contains approx. 10^{39} elementary particles of a proton-antiproton vacuum (EPVs), elementary particles cannot exist in a "bare" (nude) form. Such "bare" particles form systems with the EPVs, which are called quark structures (CS) in the theory, because they showcase almost all the properties of ordinary quarks, have the advantages and not the drawbacks inherent to "ordinary" quarks.

According to the TFF, the quark structure is a union of an excited "bare" elementary particle and a EPV in a certain way. The quark theory constructed on this principle doesn't only coincide with experimental data and with the basic ideas of the existing quark theory, but explains the nature of these elements in elementary particles-quarks.
This approach explains why quarks have a fractional charge and why they have a certain force field, which is arbitrary and, in essence, is wrongly called a "color". It also explains what one type of quark has differences with the other types of quarks, that is, the theory gives the nature the properties of such quarks, which is also wrongly called "flavor".
The theory of quarks and its consequences are presented in the last subsection of the first part of the book.

Acquaintance with the TFF will begin with a description of the mathematical model of the main "bricks" of the matter.

The universe is a three-dimensional sphere $\mathbf{S^3}$ (the properties of a three-dimensional sphere are described in the original problem of A. Poincaré, solved by G. Ya. Perelman).

By definition, each point inside such sphere is its center.

The most natural object that emerged as image of such S^3 on any of its centers is a torus.

Thus, the "elementary" structures of the universe must be torus. A torus have finite dimensions. The number of them is finite in the universe, with finite dimensions, and their concentration in all finite regions of the universe is also finite.

These elementary entities in the TFF are called "Fundamentons".

The whole world of matter and all its structural manifestations are mappings of various states of these fundamental elements on the 1PP. The calculation shows that the Fundamenton, in the mapping of its properties from the layer S^3 to the base (1PP) should be considered as a "Planck particle".

The space S^3 and its mappings in the form of torus are in relation to the real (tardion) part of the base (1PP), in the imaginary domain. Therefore, we do not directly observe the Fundamenton of our subspace. Actually, our elementary particles are the reflection of the states of the Fundamentons into our real space.

Two stable states of the Fundamenton, mapped on our real part of space (1PP), correspond to elementary particles, whose parameters coincide with those of the proton and electron, and therefore are identified with them.
Metastable states of the Fundamenton correspond to other, unstable (short-lived) elementary particles, including, of course, resonances.

The TFF expands to 7 the range of the quantum ladder, 4 stages being already enclosed in the theory of matter as per the General Theory of Relativity as well as the STR:

1. Molecular-crystalline step.
2. Atomic step.
3. The nuclear stage.
4. Sub-nuclear level.

5. Virtual state.
6. Physical vacuum.
7. Fundamenton.

The TFF shows that the basis of the construction of matter is a scalar field having its sources-charges.

This scalar field forms the main tensions - the forces in the world of matter -, uniting the entire universe with its basic elements (centers of the universe): the charges of the fundamental field (FF).

The basic equation of the scalar component of the physical vacuum is given hereunder :

$$\Delta\varphi(r)(\pm)R^{-2}\varphi(r) = F(r),$$

where $$F(r) = q\frac{e^{-R/r}}{r^3}\left(\frac{R^2}{r^2} - 2\frac{R}{r} + \frac{r^2}{R^2}\right).$$

The potential of the scalar component of the phase transition ϕ, which is the solution of the basic equation:

$$\varphi = q\frac{e^{-R/r}}{r^3}.$$

The scalar component of the PV creates in the Universe not a zero and not an infinite, but a finite charge. It is especially interesting and revealing that if we integrate the charge density created by the Fundamenton in the whole universe, then it turns out that this integral (summing this charge) is not only finite, but is exactly equal to the constant (called a charge) which is present in the equation of the scalar component of the field.
In addition, the charge density of the scalar component of the PV is finite throughout the space, from the charge's center to any point in space.

The potential of the scalar component of the PV has no divergence at any point. There is also no divergence of field intensity and charge density at any point of the field if they are determined accordingly:

$$\vec{E} = -grad\,\varphi = q\frac{e^{-\frac{R}{r}}}{r^2}\left(1-\frac{R}{r}\right)\frac{\vec{r}}{r};$$

$$\rho = \frac{1}{4\pi}\,div\vec{E} = \frac{q}{4\pi}\frac{Re^{-\frac{R}{r}}}{r^4}\left(2-\frac{R}{r}\right).$$

It is especially interesting that

$$Q = 4\pi\int_0^{\infty}\rho dv = qe^{-\frac{R}{r}}\left(1-\frac{R}{r_0}\right) = q,$$

Where v is the volume.

This means that the constant q with the dimension of the charge is numerically equal to the integral of the total charge density over the entire infinite Euclidean space. The fact that the universe is S^3, and not an Euclidean space, doesn't change the physical meaning.

The potential of the PV defined in the zero subspace goes over into the Coulomb potential when it maps into the additional subspace (1PP). This means that with this mapping, the nonlinear part of the scalar potential of the PV is lost.

In the TFF, a unique and first-of-a-kind result was obtained, according to which the constants of gravitational interaction in the « deepest » regions of the micro-world and in the macroworld are very close, almost equal, but not exactly equal... ! This extremely important is the result of calculating these respective constants, which leads to the fact that the gravitational constant in the macrocosm is greater than the constant in the microworld, by a factor 1.00011582 times. At the same time the ratio of the square roots of the dielectric permittivities of the physical vacuum for the external and internal circular currents of the structure the proton is also equal to 1.00 011 583…

The TFF shows how spinor and vector fields arise from the scalar field from natural mathematics, and at the same time, the physical and mathematical meaning of the Dirac spinor equation becomes clear. It is shown that the Higgs effect is a natural consequence of the equations of the theory.

In the framework of the TFF theory, a new step was taken towards the knowledge of the nature of gravity : more specifically, a "vacuum theory of gravitation" (VTG) was developed, which for the first time when it was made possible to calculate a theoretical numerical value of the constant of gravity, and to relate it to other world constants.

Gravitation in TFF is the result of a change in the nature of the interaction of a given body with the vacuum due to the influence on this interaction of another body.
Gravitational forces in VTG arise only as a result of screening of the vacuum constraints, which always act on any particle. However, when a very large number of particles are accumulated, a certain part of the EPVs can be "squeezed out" and, therefore, there is a certain weakening of the vacuum tension forces.

This leads to the following conclusion:
At a particle concentration close to the density of a proton-antiproton vacuum (of the order of 10^{39} cm^{-3}), the forces of the gravitational interaction will be substantially reduced, which will lead to a mass defect and thus, an energy release. This property is one of the sources of the internal energy of stars and planets. The above concentration of particles is characteristic of neutron stars: further compression is apparently either impossible, or it would require explanations beyond the limits of TFF.

Thus, we come to the conclusion that it is impossible to form "black holes" in the macroworld. This process is a direct consequence of this leading phenomenon in the micro-, not in the macrocosm !

The general relativity assumes an expanding universe, which, at least qualitatively, explains the metagalactic redshift.

The VTG admits, but does not require the expansion / contraction of the universe, predicting the existence of a new phenomenon, which can be properly called the "gravitational friction". This process accompanies the process of photons' propagation in a vacuum.

To understand the essence of this phenomenon, we need to briefly describe the process of the photon's formation, which is formulated in the TFF.

According to the theory, the propagation of light is considered as a displacement in the vacuum of the process of excitation of EPVs, as the creation of each photon is regarded as an elementary act of excitation of EPV.
In the TFF, unexcited EHVs in the macroworld are not observable. When the EPS is excited, a pair of virtual particles appears which is perceived as a photon, if this pair is not under the influence of a field that constantly maintains this excitation, but is exposed to an alternating or pulsed field. In these latter cases, the excitation process will propagate from one EPV to another, which will be perceived as the propagation of light.
Thus, the propagation of light is accompanied by a process of successive excitation of vacuum particles – i.e. the formation and annihilation of photons while retaining their number in a free vacuum.
This process leads to an irreparable loss at every act of exciting the EPV, of a very small but finite quantity of energy, in order to overcome the gravitational forces. Such "gravitational friction" is this accompanying the process of light propagation in a vacuum, and is amenable to the TFF's theory and calculations.

The contribution of this "gravitational friction" to the metagalactic redshift, according to the TFF theory, can be estimated theoretically not only qualitatively, but also quantitatively with a satisfactory agreement with observations (not only in order of magnitude, but with an accuracy compatible to the measurement of metagalactic distances).

The mathematical apparatus of the DFT makes it possible to calculate the numerical values of all the world constants with an error of only 3-4 units of the 10th digit without adjustable parameters, both dimensionless and, paradoxically, dimensional constants from the NON-DIMENSIONAL CONSTANT found in the theory.

The last thing I would like to draw attention to :

According to generally accepted ideas, the atomic nuclei consist of Z protons and N neutrons, and their sum is equal to the number of nucleons in the nucleus A.

In contrast to this, according to TFF, the nucleus contains A protons and N negative "metons", which neutralize part of the positive charge of the nucleus. The "meton" is the metastable state of an electron inside the nucleus. The meton, like an electron, is a lepton and does not have a quark structure, that is, it is a "bare" elementary particle.
Metons don't exist in the free state, it is formed only as a result of a certain interaction of an electron with a proton. In this interaction, the electron is like "compressed".
The Compton wavelength of a meton is equal to 3 times the proton's Compton length ($3 \times \lambda_p$). Therefore, unlike an electron, it can be a part of the nucleus.
The neutron is thus regarded as a "composite" particle, consisting of a positively charged proton (which determines the mass of the particle) and a negatively charged light particle, the meton.
Consequently, in the nuclei of all atoms (except the nucleus of hydrogen, consisting of a single proton), there are A protons and N metons.
For an isotope of beryllium, for instance, having a mass number 9, the number of metons is equal to (9 - 4) = 5.
We put this number "5" at the bottom right of the element's symbol, when determining the isotopes, leaving the previous notations of the mass number on the top left, and the charge on the lower left.
In our example : ${}^{9}_{4}Be_{5}$.

According to the TFF, due to the motion, with ultrarelativistic velocities and precession, of the substructure's elements in elementary particles (in particular protons and electrons),their fundamental field acquires a pronounced anisotropy. This field is maximum on the instantaneous axis of rotation of the subparticles, and is minimal in the plane of rotation.
Elements of the substructure of the proton and the meton precess with a frequency of the order of 10^{18} Hz, and their instantaneous rotation axis, as a generator, describes in the space a conical surface : the anisotropy cone. The tangent of the angle between the generator of the cone and its axis of symmetry is:

- for a free proton : $tg\alpha_p = 2\sqrt{2}/9 = 0{,}314270$, hence $\alpha_p = 17{,}44635°$;

- for a free electron and a meton : $tg\alpha_e = 2\sqrt{2}/7 = 0{,}404061$, whence $\alpha_e = 22{,}00171°$.

When the proton is bounded with a meton in the nucleus, its anisotropy angle increases, and becomes practically equal to α_e.

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