FQXi 2012 Essay Contest "Which of Our Basic Physical Assumptions Are Wrong?"

The Theory of Infinite Hierarchical Nesting of Matter as the Source of New Ideas

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Abstract

With the help of the theory of infinite hierarchical nesting of matter the need for change in the theoretical foundations of the scientific world outlook is derived – in the philosophy; in the logic of thinking; in the system theory; in cosmology; in interrelation of matter levels; in describing the properties of matter carriers and the laws of their interaction; in the theory of gravitation; in the analysis of the mass origin; in the theory of relativity; in the theory of elementary particles; in thermodynamics and other fields of knowledge. The possible ways are described of overcoming the difficulties and challenges existing in a number of modern physical theories.

Introduction

Over the past 20 years, both in physics and in philosophy, new results were obtained related to the rapid development of the theory of infinite hierarchical nesting of matter. At the present time this theory claims to be the dominant scientific paradigm, affecting the whole science. The logical basis of the theory is syncretics or syncretic logic [1], which summarizes the metaphysical (formal) logic, dialectical logic and various kinds of multivalued logics. The philosophical basis of the theory of infinite hierarchical nesting of matter is the philosophy of carriers, and carriers, which are the essence and the fundamental principle of the world, are understood as any actual or possible objects and subjects, without exception. Each carrier is associated with energy, matter and information, and with other properties described by philosophical categories. With the help of logic new philosophical laws for carriers and their systems are formulated. Thus, the system theory is being developed. This makes easier the analysis of connections between the carriers of matter in cosmic systems, from the smallest particles to infinitely large stellar and metagalactic systems.

In physics, the theory of infinite hierarchical nesting of matter in order to describe the structure of the Universe introduces into consideration the similarity of matter levels, including SPΦ symmetry of the similarity of physical laws at the basic matter levels, presents the scale dimension as the fifth dimension of spacetime, substantiates the Le Sage's theory of gravitation as the physical mechanism for the emergence of gravitation at all levels of matter and strong gravitation at the level of atoms and elementary particles. Applying the theory of similarity between the stellar and the atomic matter levels makes it possible to construct substantial models of elementary particles, as the alternative to the Standard Model. In particular, the internal structure of the neutron is assumed to be the same as the structure of the neutron star.

Among various predictions of the theory of infinite hierarchical nesting of matter are the existence of new particles (including praons and nuons) as the basis of dark matter; the denial of the Big Bang; the absence of black holes; the concept of quarks as quasiparticles; the concept of the electron spin as a dynamical effect, which arises only at the moment of the electron transition from one atomic energy level to another; the complex multicomponent structure of different types of neutrinos.

Infinite Hierarchical Nesting of Matter

In the Theory of Infinite Hierarchical Nesting of Matter all the substance of the Universe can be divided to parts and arranged at separate scale levels, where this substance is included in the composition of the corresponding cosmic objects [2], [3], [4]. There are basic and intermediate levels of matter. The basic levels include the atomic and stellar-planetary matter levels, between which the intermediate levels are located. The matter levels the objects of which are smaller than the elementary particles, or larger than the visible Universe, are now inaccessible for research and are studied by theoretical methods.

The intermediate matter levels between the atomic and stellar systems include: molecular complexes; cosmic dust; micrometeorites; small meteorites; meteorites and comets; large meteorites and comets; asteroids, comets and minor moons of planets; large asteroids, moons and small planets. In the transition from stars to the Metagalaxy there are the following intermediate levels of matter: massive stars – star clusters – dwarf galaxies; dwarf galaxies – normal galaxies; massive galaxies – superclusters of galaxies; superclusters of galaxies – normal metagalaxies.

The feature of the matter levels is that the objects at these levels form groups separate from each other, which allows us to distinguish one level of matter from another. If in the coordinate system OXY we lay along the axis OX the sizes of the objects, and along the axis OY – the concentration of these objects in cosmic space, we shall find that the cosmic objects are distributed in groups so that between the groups there are almost no objects. Another feature is that on the scale axis of sizes the matter levels are located equidistant on the logarithmic scale. This means that the sizes and masses of objects at the levels of matter increase exponentially. In this case, the ratios of sizes and masses for the objects of two adjacent intermediate levels are equal to the corresponding ratios for other adjacent levels of matter. Denoting these ratios as the coefficients of similarity in sizes and mass, by means of repeated multiplication by these coefficients we can find the sizes and masses of objects at any level of matter, and predict the parameters of those objects that are out of the reach of measurement instruments.

The coefficients of similarity between the atoms and planetary systems can be conveniently found at the example of the *hydrogen system* consisting of the central body (the nucleus of the hydrogen atom, the main-sequence star of the lowest mass) and the moon (the electron, the planet - the analogue of the electron) [3]. These coefficients, obtained by dividing the corresponding values by each other, are shown in Table 1. For the coefficient of similarity in mass we obtain, for example: $\Phi_0 = \frac{M_{ps}}{M_p}$.

Table 1. The parameters and similarity coefficients for the hydrogen system

Mass, kg	The radius of the orbit, m	The velocity in the orbit, m/s
Planetary System		
$M_{ps} = 1.11 \cdot 10^{29}$	$R_F = 2.88 \cdot 10^{12}$	$V_p = 1.6 \cdot 10^3$
Hydrogen atom		
$M_p = 1.67 \cdot 10^{-27}$	$R_B = 5.3 \cdot 10^{-11}$	$V_e = 2.19 \cdot 10^6$
The similarity coefficients		
$\Phi_0 = 6.654 \cdot 10^{55}$	$P_0 = 5.437 \cdot 10^{22}$	$S_0 = 7.34 \cdot 10^{-4}$

Between the levels of atoms and main-sequence stars there are 9 intermediate levels of matter, from the level of molecular complexes to the level of low-massive planets.

The evolution of main sequence stars occurs in such a way that over time they become white dwarfs and neutron stars. The planets around stars have another fate – they slowly lose the orbital angular momentum, approach their stars, and finally disintegrate under the influence of gravitational forces. The metal and magnetized cores of planets are the basis of the material

forming the discs around neutron stars. At the level of stars, the closest to the nucleons in their properties are the neutron stars, and the discs around the stars are similar to electron discs in the atom. Since the nucleons and the neutron stars are considered analogues, then their evolution must be analogous. This means that before the formation of nucleons the substance first must be gathered by some force of attraction into the objects, similar in their properties to the main sequence stars. The mass of these objects must exceed the mass of nucleons as the mass of some main-sequence stars exceeds the mass of neutron stars. We can assume further transformation of substance within these objects, which is similar to thermonuclear reactions in the interior of stars. The result must be the formation of neutrons in the same way as in a supernova explosion a neutron star is born. Then, in the process of beta decay of neutrons, the protons and electrons appear, atoms and molecules are formed, the substance is created. This pattern can be repeated at all the basic levels of matter, the number of which in the Universe can be infinite. In this case the formation of particles, substance and matter at the highest levels of matter does not require the Big Bang and is the repetition of the evolution at the lowest levels of matter.

Table 2 shows the coefficients of similarity between the basic levels of matter for such objects as the proton and the neutron star. The radius of the proton in Table 2 corresponds to the results of the experiments and can be found theoretically in the self-consistent model [5]. The speed of light is considered as the characteristic velocity of the substance inside the proton, since the rest energy of the proton is equal to the absolute value of the total energy (the binding energy of the substance).

Table 2. The parameters and similarity coefficients for neutron stars and nucleons

Mass, kg	Radius, m	Characteristic velocity, m/s
The neutron star		
$M_s = 2.7 \cdot 10^{30}$	$R_s = 1.2 \cdot 10^{4}$	$C_s = 6.8 \cdot 10^{7}$
Proton		
$M_p = 1.67 \cdot 10^{-27}$	$R_p = 8.7 \cdot 10^{-16}$	$c = 2.99 \cdot 10^{8}$
The similarity coefficients		
$\Phi = 1.614 \cdot 10^{57}$	$P = 1.379 \cdot 10^{19}$	$S = 2.3 \cdot 10^{-1}$

The coefficients of similarity are an important tool for describing the similarity of matter levels and allow us to compare the properties of objects at different levels of matter. Just as with meter, kilogram, and second we can express all the mechanical units of physical variables, with the values Φ, P, S according to the theory of dimensions we can find other coefficients of similarity. For example, the coefficient of similarity in time can be obtained by the formula: $\Pi = \frac{P}{S}$. For the similarity of nucleons and neutron stars $\Pi = 5.99 \cdot 10^{19}$, which allows us to estimate the corresponding period of the nucleon rotation τ_n through the rotation period $\tau_s = 0.0013959$ seconds of the most rapidly rotating pulsar PSR J1748-2446ad: $\tau_n = \frac{\tau_s}{\Pi} = 2.33 \cdot 10^{-23}$ seconds.

Another example is the calculation of the *stellar Planck constant*, characterizing the rotation at the level of stars. Taking as the basis the reduced Planck constant (Dirac constant) $\hbar$, for the objects of the type of neutron stars, we find: $\hbar_s = \hbar \Phi P S = 5.4 \cdot 10^{41}$ J·s. Using the coefficients of similarity and other standard physical constants, we can calculate the corresponding *stellar constants* for the level of stars, as well as for the level of matter, the objects of which make up the nucleon substance. Suppose, in particular, that as the neutron star contains $\Phi = 1.614 \cdot 10^{57}$

nucleons, so nucleons contain the same number of particles called "praons" [6]. Then the praon mass equals $M_{pr} = \frac{M_p}{\Phi} = 1.03 \cdot 10^{-84}$ kg and the praon radius equals $R_{pr} = \frac{R_p}{P} = 6.3 \cdot 10^{-35}$ m.

From the scenario of the evolution of the substance particles described above, it follows that at the level of elementary particles the particles must exist, which are similar by their properties to such stars as white dwarfs. In article [7] such particles are called "nuons". The radii of these particles must be within $4 \cdot 10^{-13} - 1.1 \cdot 10^{-12}$ m, and the masses do not exceed the masses of nucleons. According to calculations the share of the nucleon substance in the visible Universe equals 61 % of the total mass, and 39 % of the mass is in the form nuons. Nuons are mostly concentrated in the outer and less dense parts of galaxies, because with the high substance density the probability increases of the interaction of nuons with nucleons with the subsequent decay of nuons (just as white dwarfs decay in collisions with much denser neutron stars). Thus, nuons form the basis of dark matter, the action of which is noticeably manifested in galaxies.

Due to their large size relative to nucleons, nuons scatter the electromagnetic waves that pass in the space. This leads to the following. Firstly, the wave energy decreases exponentially with respect to the distance traveled by them, which is expressed as the redshift of the spectra of distant galaxies. Secondly, due to the scattering of photons by nuons the number of the photons reaching the observer on the Earth decreases. As a result, the energy of supernovae outbursts will seem less for the outbursts that occur further from the observer. Thirdly, the interaction of the electromagnetic emission with nuons leads to thermalisation of the emission, its transformation in the emission typical of the black body. This emission has the temperature of 2,725 K and is known as the microwave background radiation. If we assume that these effects are caused by nuons, then there is no need to explain the Hubble law by the Universe expansion and to consider the Big Bang model.

Another objection to the Big Bang model is the inability of appearing in the Theory of Infinite Hierarchical Nesting of Matter of singularities and black holes as objects, absorbing any substance and not giving anything out [3], [8]. If black holes exist, then they exist at all the basic levels of matter. Then the black holes at the lowest levels of matter would have absorbed any emission of particles and quanta since the time at these levels of matter flows faster. This would lead to the absence of emission from the objects of the lower levels of matter, which is the source of gravitons at the highest levels of matter, and to the absence of gravitation in our world, which is not observed [9]. The substance density of black holes of stellar masses must exceed the density of nucleons, so nucleons must be crushed by gravitation. However, as it is stated in article [10], the maximum possible gravitational pressure from gravitons of the value $4 \cdot 10^{34}$ Pa is not sufficient, if we take into account the repulsive forces of the nucleons from each other. As a result, the substance can be compressed by gravitation only to the state of neutron stars. Neither nucleons, nor neutron stars turn into black holes, since they have strong electromagnetic and gravitational fields around them. Due to these fields the expulsion of the excess mass occurs, so that the critical increase of the mass, leading to the formation of black holes, does not occur. Even collisions of elementary particles with nucleons at superhigh energies, do not produce black holes. But if black holes and singularities are not possible, then we can not assume according to the Big Bang model that the Universe was formed as a result of the explosion of the singularity, in which the substance was in an extremely dense and hot state.

The logical development of the Theory of Infinite Hierarchical Nesting of Matter was the discovering of the scale dimension [11]. The scale dimension is considered as the fifth dimension of spacetime. In fact, it reveals as a special spatial dimension that allows to determine the location of the object on the scale axis and to assess the level of matter, to which the object belongs. If the scale axis is directed toward increasing of the size, then during the motion along the axis the observer will move from one matter level to another and observe larger objects. However, we can introduce such principle of relativity, that the observer and his instruments would change their properties (sizes, masses, characteristic speeds) while moving along a scale

axis in order to ensure that the observer could not see during his motion any changes in the surrounding objects. For this the conditions of SPΦ symmetry must be satisfied [3]. These conditions consist in the fact that the properties of the instruments of the observer during the transition from matter level 1 to matter level 2 must change in direct proportion to the similarity coefficients between these levels $S_{12}, P_{12}, \Phi_{12}$. In this case, when observer is moving with the measuring instruments along the scale axis, the properties of the objects and the properties of the measuring instruments are synchronously changing. This scale principle of relativity at the same time means that for local observers at any basic level of matter the physical laws have the same form.

The Theory of Infinite Hierarchical Nesting of Matter is applicable not only to the carriers of matter in physics and chemistry, but is suitable for the carriers of life, for various living creatures and organisms [1], [12]. It turns out that living creatures, from tiny prions to whales, can be located at the same levels of matter, as inanimate objects. Each level of living matter has a certain range of masses and sizes of the living beings which belong to this level, and the coefficients of similarity in masses and sizes between the adjacent levels are the same. All living beings from prions to the largest mammals fit into five levels of matter, at the sixth level there are communities of living organisms and biocoenoses. Interestingly, that moving from one matter level to another the features of living beings significantly change, their organization or structure, new organs appear, the complexity of organisms increases. Another conclusion is that the animate and inanimate in the Universe are mutually complementary opposites that can not exist without each other. In this case the main difference between the animate and inanimate is supposedly that inside the animate the inner source of order is hidden, which rules the living organism, and apparently this source of order is generated by living beings at the lowest levels of matter.

Gravitation

Despite the fact that general relativity is a generally accepted theory of gravitation, it has a fundamental drawback – it lacks the stress-energy tensor of the gravitational field. As a result, the gravitational field is described indirectly, through the metric tensor and the principle of equivalence. In order to overcome this drawback within the special theory of relativity the Lorentz-invariant theory of gravitation (LITG) was developed, in which the stress-energy tensor of the gravitational field is presented in the explicit form [3], [8], [9]. LITG predicts the existence of the torsion field as the relativistic supplement to the gravitational field. In its nature the gravitational torsion field is completely analogous to the magnetic field in electrodynamics, while the gravitational acceleration is the strength of the gravitational field and is written similarly to the strength of the electric field. In the general theory of relativity the action of the torsion field is presented as gravitomagnetic force. Due to the torsion field in LITG the effect of gravitational induction was discovered [6]. The next step was the formulation of LITG in the general covariant form suitable for use in curved spacetime. So the covariant theory of gravitation (CTG) appeared.

In contrast to the general theory of relativity, in CTG the theory was divided into three relatively independent parts. One of them describes the principle of relativity in curved spacetime, while another describes the gravitational field, and the third part specifies the interaction of the substance and fields. Therefore in CTG three different equations must be simultaneously solved – to find the metric, to determine the gravitational field (and to determine the electromagnetic field, if it is present) and the equation of motion of particles (bodies) and the wave quanta in the available fields. Since CTG is an axiomatically constructed theory [6], it is possible to compare CTG with the general theory of relativity and to axiomatize the general theory of relativity itself [13]. Besides CTG was derived from the principle of least action [14]. Further analysis led to Hamiltonian, which in the framework of CTG specifies the relativistic energy of the system [15].

Among the obtained results is determining of the four-dimensional operator of proper-time-derivative, of the generalized 4-velocity and 4-vector of Hamiltonian. Besides, identification of the action function is made as of the function, with the help of which the relativistic time dilation effect is calculated. In the derivation of the equation for the metric from the principle of least action the physical meaning of the cosmological constant Λ was found, which follows from the relation: $\frac{c^4\Lambda}{8\pi\gamma\beta} = \rho_0' c^2$, where γ is the gravitational constant, c is the speed of light, β is the coefficient of the order of unity which depends on the properties of the reference frame. This relation states that there is a connection between the cosmological constant Λ and the energy density $\rho_0' c^2$ of the system's substance when this substance is divided into small parts, scattered at infinity, and there it is motionless. In this case, the density ρ_0' is the average substance density, which does not contain the contribution from the mass-energy of the gravitational field, which is zero at infinity. For such a large system as the observable Universe, ρ_0' corresponds by the order of magnitude to the average density of the visible substance of the Universe.

Within the framework of CTG the problem is studied of mass as the measure of the body's inertia, taking into account the contribution of the mass-energy of the proper gravitational (electromagnetic) field of the body to the mass [16], [17], [18]. The main conclusion is that if there is the scattered substance with the total mass m' of all the particles of the substance, then in case of the collapse of this substance into a gravitationally bound object the mass of this object M must be greater than m'. In other words, the mass-energy of the gravitational field increases the mass of the body the more, the denser is the body. The increase of the mass occurs due to the work of the gravitational field. This conclusion is opposite to the results of the general theory of relativity, where the body mass decreases due to the action of the field.

In the Theory of Infinite Hierarchical Nesting of Matter it is assumed that the mechanism of gravitation is described by the Le Sage's theory of gravitation. Numerous fluxes of gravitons permeate the space in all directions, and if there are any two bodies, they will be attracted to each other due to the effect of shielding of the graviton fluxes falling on these bodies. The validity of this approach is confirmed in article [10], in which the Newton law of gravitation is deduced, and the gravitational constant is expressed through the characteristics of the graviton fluxes. Here the energy density of the graviton fluxes $4\cdot10^{34}$ J/m^3, the power of the energy flux of gravitons through unit area from unit solid angle 10^{42} W/(sr·m^2), the cross section of interaction of gravitons with the nucleon form of the substance $7\cdot10^{-50}$ m^2 were found.

The relation between the Le Sage's theory of gravitation and the covariant theory of gravitation is expressed by the fact that the gravitational potential ψ, the gradient of which specifies the gravitational field strength $\boldsymbol{G}$, is proportional to the difference between the energy density of graviton fluxes at infinity far from the bodies and the energy density of graviton fluxes near the body, where the gravitational potential is determined. This leads to the Newton formula for the gravitational force $F = \frac{\gamma M_1 M_2}{R^2}$, where γ is the gravitational constant, M_1 and M_2 are the masses of the attracting bodies, R is the distance between the centers of the bodies. Outside the single stationary body at the distance r the potential is equal to $\psi = -\frac{\gamma M}{r}$ and the acceleration has the form: $\boldsymbol{G} = -\nabla\psi = -\frac{\gamma M \mathbf{r}}{r^3}$. Inside the body the gravitational acceleration depends on the density of the body substance ρ by the formula: $\nabla\cdot\boldsymbol{G} = -4\pi\gamma\rho$. If we now consider the moving body and make the Lorentz transformations for all the physical quantities, the gravitational torsion field $\boldsymbol{\Omega}$ will appear, and the Lorentz-invariant equations for the fields $\boldsymbol{G}$ and $\boldsymbol{\Omega}$ will be similar to the Maxwell equations for the electric field $\boldsymbol{E}$ and the magnetic field $\boldsymbol{B}$.

According to the Theory of Infinite Hierarchical Nesting of Matter at each basic level of matter there is its own form of gravitation. At the level of stars and planets we have the ordinary gravitation and at the atomic matter level the main force of gravitation is assumed to be strong gravitation. Under the influence of gravitation at each basic level of matter the densest and stablest objects appear, the substance of which is in equilibrium with the external pressure from the fluxes of gravitons and with the internal pressure of the repulsion of the substance particles from each other. At the level of stars such objects are neutron stars, and at the level of elementary particles – nucleons, the lifetime of which is very large. From these objects, which can carry the electrical charge and have a strong magnetic field and the greatest gravitational acceleration near the surface, there is the largest emission of energetic particles and wave quanta. Even larger emission tales place during the formation of such objects, the example of this is the formation of a neutron star with emission of a huge flux of neutrinos. It is assumed that all types of emission, which emerged at lower levels of matter, become gravitons for the objects of higher levels of matter. According to calculations based on the analysis of the density of the emitted energy, the gravitons for the ordinary gravitation must be the emissions produced by the particles at the praon level of matter or even at a lower level of matter [19]. For the electric interaction of charged bodies the dynamic model was found similar to the Le Sage's theory [6], when in the fluxes of gravitons there are charged particles affecting the charges of bodies. Thus it is possible to explain the existence of cosmic objects and fields by the fact that fluxes of gravitons create the densest objects such as nucleons and neutron stars, which in turn generate fluxes of particles and emissions, becoming gravitons for the highest levels of matter.

To calculate the strong gravitational constant, acting at the level of elementary particles, two methods are used [3]. In the first of them the similarity coefficients between neutron stars and nucleons are used from Table 2. With their help, according to the theory of dimensions the ordinary gravitational constant γ is converted into the strong gravitational constant: $\Gamma = \gamma \frac{\Phi}{PS^2}$.

In the second method, the electrical force of attraction between the electron and the proton in the hydrogen atom at the Bohr radius R_B is equated to the force from strong gravitation. It follows:

$$\frac{e^2}{4\pi\varepsilon_0 R_B^2} = \frac{\Gamma M_p M_e}{R_B^2}, \qquad \Gamma = \frac{e^2}{4\pi\varepsilon_0 M_p M_e} = 1.514 \cdot 10^{29} \ \mathrm{m^3 \cdot kg^{-1} \cdot s^{-2}},$$

where e is the elementary charge, ε_0 is the vacuum permittivity, M_p and M_e are the masses of the proton and the electron, respectively.

As the universal force of attraction, strong gravitation must act between any elementary particles, irrespective of whether they are hadrons or leptons. Due to the strong gravitation the substance of elementary particles must be bound, the atomic nuclei are formed as clusters of protons and neutrons, as well as atoms and molecules. As the sizes of interacting objects increase in the transition from the atomic to the stellar levels of matter, the strong gravitation between the particles is converted into the ordinary gravitation between the bodies.

Theory of relativity

Besides the theory of gravitation, the theory of relativity has undergone significant change. The disadvantage of the special theory of relativity is combination of two different axioms. If the axiom of the applicability of the principle of relativity is acceptable from the standpoint of physics, then the axiom of the constancy of the speed of light in inertial reference frames seems more a convention than an axiom, which has its own physical meaning. In this regard, in 2002 on the axiomatic basis the *extended special theory of relativity* (ESTR) has been developed, which contains five axioms [8]. The difference of ESTR from special theory of relativity is that instead

of the axiom of the constancy of the speed of light the axiom of the existence of an isotropic reference frame is used, in which the speed of light propagation is equal in all directions and does not depend on the speed of the light emitter. Despite the different axiomatics, in ESTR all the formulas of the special theory of relativity are derived, as well as the postulate of the constancy of the speed of light for all inertial observers. In this case the constancy of the speed of light is a conditional concept, which is the consequence of the procedure of space-time measurements, when the electromagnetic wave during the measurements must pass a closed path in space and return to the starting point.

In special theory of relativity all inertial reference frames are equal so that the introduction of the ether, which specifies the preferred reference frame, seems unnecessary. However, ESTR implies such a preferred coordinate system, in which the speed of light is isotropic. In this case it is logical to assume that in the isotropic reference frame the ether is isotropic, which is associated with the propagation of electromagnetic quanta in it. Such ether can be conceived as the fluxes of gravitons propagating in all directions. Under gravitons tiny particles are meant, including charged particles like those found in cosmic rays of high energies. The graviton composition can include such particles as neutrinos and photons. As shown above, gravitons are formed at the lowest levels of matter. The ether of this kind is discrete, consisting of separate gravitons, and quasicontinuous, due to the multiplicity of gravitons. According to [3], [10], if the system of bodies is moving at a constant velocity, the force of gravitation does not depend on the velocity, which leads to the principle of relativity and the motion by inertia. Since the graviton ether passes also inside the material bodies, where the speed of light depends on the properties of the substance, then the ether can be revealed through its influence on the propagation of electromagnetic waves inside these bodies, if these bodies move differently relative to the isotropic reference frame.

The further development of the theory is the metric theory of relativity (MTR), which includes as a particular case the special theory of relativity and ESTR, and also substitutes the principle of general relativity in that part which concerns the transformation of physical quantities from one frame to another [6] [13]. MTR is built on the axiomatic basis and implies the dependence of the spacetime metric on the properties of the test particles and waves, by which the metric is measured. In contrast to the general theory of relativity, in MTR the gravitational field of the body is the source of mass-energy in determining the metric. Another difference of MTR is that instead of the equivalence principle (the equivalence of inertial and gravitational masses, the forces of any kind, and the gravitational forces) the principle of local equivalence of the energy-momentum is used: "In the accelerated reference frame the metric depends locally not on the type of acting force causing this acceleration, but on the configuration of this force in spacetime of the reference frame, determined by the stress-energy tensor".

Elementary particles

In our opinion, the absence of substantial, real physical models of the structure of elementary particles significantly inhibits the development of the theory of these particles. These models of particles can be constructed with the help of the Theory of Infinite Hierarchical Nesting of Matter [3]. From the similarity of the atomic and stellar levels of matter it follows that the neutron corresponds to the neutron star, the proton is similar in its properties to the magnetar, the pion is similar to the neutron star of the minimum mass, and the analogue of the muon at the level of stars is the white dwarf. In the *substantial model of neutron*, this particle has in its center the positive charge and its shell is negatively charged, which allows us to explain the opposite direction of the magnetic moment of the neutron relative to the spin [6, § 11]. From this the instability of the neutron follows leading to beta decay. The proton is described in the *substantial model of proton* as the analogue of magnetar, a neutron star with the strong magnetic field and electric charge. It is assumed that magnetars blow away protons and atomic nuclei by their electric fields, turning these particles into cosmic rays of high energies.

In the substantial model nucleons consist of praons as neutron stars consist of neutrons and a certain number of protons and electrons. In this case, knowing only the mass, charge and magnetic moment of the proton, and taking into account the strong gravitation as the main force at the level of elementary particles, in accordance with the experimental data we can calculate the radius of the proton, the density of its substance in the center and the maximum angular velocity [5], [20]. Due to substantial models of nucleons, it became possible to describe the specific mechanisms of interaction of elementary particles with neutrinos, as well as to understand the internal structure of neutrinos and the nature of weak interaction. With the help of strong gravitation and the torsion field in the *gravitational model of strong interaction* we can describe the strong interaction between nucleons in atomic nuclei, to construct the models of the simplest nuclei, to find the balance of forces and the distance between the nucleons in the deuteron, to explain the dependence of the specific binding energy of the nucleus on the mass of the nucleus [6, § 10].

The impossibility to obtain the quarks in the free state means that the quarks are quasiparticles, i.e. the states of the substance inside hadrons. The substantial models of nucleons allow us to construct the *model of quark quasiparticles* and to reduce the six known quarks to different combinations of the two states of the nucleon substance, α – phase and β – phase. Since all hadrons are considered to be composed of quarks, it follows that each particle contains the corresponding quantity of α – phase and β – phase of the substance, specifying the mass, charge and magnetic moment of particles [6, § 12]. At the example of the interaction of pions with nucleons it is shown that the peculiarities of emergence and the properties of resonances can be explained through the interaction of particles by means of strong gravitation, torsion field and electromagnetic forces. Thus, instead of quarks and gluons introduced by quantum chromodynamics it becomes possible to consider the emergence and the structure of elementary particles in the classical way, with the help of the substantial models of particles. The weak point of the approach of chromodynamics is seen in the fact that it can not explain what particles the quarks themselves are composed of – since can these particles be the last bricks of matter?

From the Theory of Infinite Hierarchical Nesting of Matter and the *substantial model of electron* it follows that the electron in the atom must be in the form of a flat disc, and at the level of stars such discs around the neutron stars are called discons. In this picture it is possible to understand the nature of the electron spin – the spin emerges at the moment of transition of the electron from one energy state to another, after which it disappears [6, § 14]. The spin of the electron and the corresponding magnetic moment have dynamic nature, while the spin is that part of the total angular momentum of rotation of the electron substance, which is caused by the rotation of the electron disc as a whole around the nucleus. The other main part of the total angular momentum arises from the orbital rotation of the electron substance around the center of inertia of the disc. The analysis of various phenomena with electrons in the atom – the model of the helium atom with two electrons, the magnetic moments, the multiplicity, the Lamb shift, magnetomechanical effects, etc., conform well to the proposed model of the electron.

Conclusion

Due to the Theory of Infinite Hierarchical Nesting of Matter it became possible to find the alternative explanations in cases when the standard theories clearly fail. For example, the main problem of the general theory of relativity is the absence of the stress-energy tensor of the gravitational field (which is the consequence of the representation of the gravitational force by indirect geometrical methods, that is through the metric tensor, instead of direct description of the physical force), in quantum chromodynamics one of the numerous problems is the confinement of quarks, in quantum mechanics the spin of the electron can not be explained, in cosmology the Big Bang model contradicts the philosophy of physics (the whole infinite Universe can not be formed due to the explosion of an infinitely small singularity, since it requires a pre-compression of matter to form this singularity spending fantastically large energy,

which appeared no one knows where from). In [21] it is concluded: "The current paradigm of physical knowledge is obsolete and is subject to inevitable replacement based on the transition to substantial theoretical models of a deeper level".

The Theory of Infinite Hierarchical Nesting of Matter also had influence on a number of theoretical models in physics. For example, the electrokinetic model of emergence of the magnetic fields in planets and stars appeared [6, § 15], in which the mechanism of generation of the magnetic field differs significantly from the known but controversial model of magnetic dynamo. Another example is the development of the electron-ionic model of ball lightning [22], [23], as well as of the bead lightning [6, § 1]. At the stellar level of matter the *discreteness of stellar parameters* and the *quantization of parameters of cosmic systems* are discovered, as the consequence of penetration of the quantum ideas in the physics of cosmic bodies.

References

1. Fedosin S.G. Osnovy sinkretiki: filosofiia nositeleĭ . – Moskva: Editorial URSS, 2003, 464 pages. ISBN 5-354-00375-X.
2. Robert L. Oldershaw. Self-Similar Cosmological Model: Introduction and Empirical Tests. International Journal of Theoretical Physics,1989, Vol. 28, No. 6, 669–694.
3. Fedosin S.G. Fizika i filosofiia podobiia ot preonov do metagalaktik. – Perm' : S.G. Fedosin, 1999, 544 pages. ISBN 5-8131-0012-1.
4. Sukhonos S. I. Scale harmony of the Universe. – Moskva: Sofia, 2000, 312 pages. ISBN 5-89117-096-5. (in Russian).
5. Fedosin S.G. The radius of the proton in the self-consistent model. vixra.org, 03 August 2012.
6. Fedosin S.G. Fizicheskie teorii i beskonechnaia vlozhennost' materii. – Perm' : S.G. Fedosin, 2009–2012, 858 pages, Tabl. 21, Fig.41, Ref. 293. ISBN 978-5-9901951-1-0. English version: § 1 , § 10 , § 11 , § 12, § 14 , § 15.
7. Fedosin S.G. Cosmic Red Shift, Microwave Background, and New Particles. Galilean Electrodynamics, Spring 2012, Vol. 23, Special Issues No. 1, P. 3–13.
8. Fedosin S.G. Sovremennye problemy fiziki: v poiskakh novykh printsipov. – Moskva.: Editorial URSS, 2002, 192 pages. ISBN 5-8360-0435-8.
9. Fedosin S.G. Electromagnetic and Gravitational Pictures of the World. Apeiron, 2007, Vol. 14, No. 4, P. 385–413.
10. Fedosin S.G. Model of Gravitational Interaction in the Concept of Gravitons. Journal of Vectorial Relativity, March 2009, Vol. 4, No. 1, P.1–24.
11. Fedosin S.G. Scale Dimension as the Fifth Dimension of Spacetime. accepted by Turkish Journal of Physics.
12. Fedosin S.G. Nositeli zhizni: proiskhozhdenie i ėvoliutsiia. – S.-Peterburg : Dmitriĭ Bulanin, 2007, 104 pages. ISBN 978-5-86007-556-6.
13. Fedosin S.G. The General Theory of Relativity, Metric Theory of Relativity and Covariant Theory of Gravitation: Axiomatization and Critical Analysis. vixra.org, 26 Mar 2011.
14. Fedosin S.G. The Principle of Least Action in Covariant Theory of Gravitation. Hadronic Journal, February 2012, Vol. 35, No. 1, P. 35–70.
15. Fedosin S.G. The Hamiltonian in covariant theory of gravitation. vixra.org, 22 May 2012.
16. Fedosin S.G. Mass, Momentum and Energy of Gravitational Field. Journal of Vectorial Relativity, September 2008, Vol. 3, No. 3, P.30–35.
17. Fedosin S.G. Energy, Momentum, Mass and Velocity of Moving Body. vixra.org, 13 Jun 2011.
18. Fedosin S.G. The Principle of Proportionality of Mass and Energy: New Version. vixra.org, 13 Jul 2011.
19. Comments to the book: Fedosin S.G. Fizicheskie teorii i beskonechnaia vlozhennost' materii. – Perm, 2009, 844 pages. ISBN 978-5-9901951-1-0. (in Russian).

20. Fedosin S.G. and Kim A.S. The Moment of Momentum and the Proton Radius. Russian Physics Journal, 2002, Vol. 45, P. 534–538.
21. Fedosin S.G. Problems of fundamental physics and possible ways of their solution. Soznanie i phizicheskay realnost'. (Russian Journal "Cognition and physical reality"), Vol. 9, No. 2, 2004, P. 34–42.
22. Fedosin S.G., Kim A.S. The Physical Theory of Ball Lightning. Applied Physics (Russian Journal) , No. 1, 2001, P. 69 – 87.
23. Sergei G. Fedosin, Anatolii S. Kim. Electron-Ionic Model of Ball Lightening . Journal of new energy, 2001, Vol. 6, No. 1, P. 11–18.