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Detailed Elaboration and General Model of the Electron Treatment of Surfaces of Charged Plasmoids (from Atomic Nuclei to White Dwarves, Neutron Stars, and Galactic Cores). Self-Condensation (Self-Constriction) and Classification of Charged Plasma Structures—Plasmoids. Part II. Analysis, Classification, and Analytic Description of Plasma Structures Observed in Experiments and Nature. The Shock Waves of Electric Fields in Stars

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Abstract—Einstein's idea concerning the mass–energy equivalence is confirmed in a new form. The equivalence manifests itself in similar functionality in the processes of the pulsations (focusing and rebounding) of the "excessive" energy in the generalized Kepler 2D problem and the "excessive" mass in the Vysikaylo–Chandrasekhar 3D problem on the accumulation and dissipation of the de Broglie waves in quantum stars (the pulsing accretion of quantum stars) with mass more than that of Chandrasekhar (~1.46 masses of the sun). A new mechanism (type) of a thermonuclear reactor at the surface of charged quantum stars and dense cores of normal stars and planets is proposed. The acceleration of electrons to MeV energies in the synergistic electric fields of uncompensated charged particles in the nuclei of giant plasmoids—quantum stars—and their transmutation into neutrons in the surface layer in the reactions with protons is the basis for such a mechanism. The problems concerning the stabilization of neutrons in relation to the β-disintegration of the neutrons on the surface of neutron stars and the keeping of high energy electrons in any CD structures with condensed media with a Fermi gas or a Fermi liquid have been solved.

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INTRODUCTION

The general questions of the origination, evolution, and prolonged existence of metastable convective charged plasma structures—plasmoids—squeezed through the dynamic pressure of the free high energy electrons, quantum-mechanically pressed out of the plasmoid, or coming into being on the charged plasmoid surface due to the peripheral ionization have been considered in the first part of this work [1]. As a few free electrons leave the charged 3D structure, they create an extended coulomb potential 3D well for the electrons remaining in the charged structure and free from a certain atomic nucleus of the electrons. These free electrons, staying in a charged structure, are localized in this structure by the coulomb potential of the whole charged structure. The local freedom of the electrons and the absence of freedom on a global scale lead to the diffusion and convection processes of the structure self-organization. As has been mentioned in [1], these charged plasmoids having common properties caused by a weak (or even strong as in the atomic nucleus) violation of neutrality, may have dimensions from an atomic nucleus to a galactic core or a cluster of galaxies. If the violation of neutrality is properly considered in these spheres of natural sciences, as is done in atomic physics, an enormous number of paradoxes (such as the disagreement of experimental observations with theories and neglecting some important processes) can be solved.

In astrophysics, some research workers started with the absolute neutrality of all the objects and then pseudoscientifically, as the author thinks, continued to investigate the phenomena, clearly pointing to the paradoxes determined just by the violation of neutrality. To explain these paradoxes, they should put away the condition of the absolute neutrality, investigate the

asymptotic paradoxes caused by the violation of neutrality, and not invent antigravitation, A-members, or something else. Within the framework of absolute neutrality, it is impossible to solve the problem of the stabilization of a neutron star's surface in relation to the neutron disintegration (β-disintegration) and penetration of the generated proton into a neutron star. An absolutely uncharged white dwarf cannot contain electrons with energy of about 1 MeV; it is forced fee as the average de Broglie wave length for a white dwarf is about 10^{-13} m. The astrophysicists who assume the absolute neutrality of space structures think that the universe's antigravitation is a new physical phenomenon discovered through the astronomic observations at distances of 5–8 billion light years. They cannot understand how charged galaxies or collapsing material can bounce from the ionic lattices (the ion electron shells or internal atom electron shells) self-formed at the compression. They suppose that only antigravitation manifests itself as space repulsion by the far galaxies with the repulsion being stronger than the mutual gravitational attraction of the galaxies. They believe this is the reason that the general cosmological extension takes place with acceleration. They think that the antigravitation is created not by the charged galaxies or any other natural bodies but by some previously unknown form of energy–mass called some dark energy–mass. 70–80% of the whole universe energy–mass is accounted for by the dark energy/mass. The astrophysicists believe that, at the macroscopic level, the dark energy is described as a peculiar continuous medium filling the whole universe space; this medium has some positive density and negative pressure. The physical nature of the dark energy and its microscopic structure are not known, being one of the most acute problems of the science at present. Here, we could put the matter to rest and wait for news from the astrophysical heaven.

Nevertheless, some research workers hitherto try to combine the investigations of the gravitational forces and electromagnetic ones. The history of the science is also the history of the correction of some errors in the science. Before proceeding to a certain discussion and solving the paradoxes associated with the life activity of charged structures, I am going to classify the known dissipative structures.

THE TURING DISSIPATIVE DIFFUSION STRUCTURES

It is believed that two-dimensional self-organizing dissipative diffusion structures were discovered by the mathematician Turing in 1952 [2]. In these dissipative structures, the 2D structurization of the medium in plane 2D space and in time is determined by the characteristic frequencies of the reactions and some diffusion processes mutually prescribing the geometric dimensions of the self-forming dissipative structures. The numerical simulation of such nonuniform two-dimensional nonlinear processes of the generation, destruction, and diffusion transfer of components in time has been carried out under the guidance of I. Prigozhin in Brussels. The Turing numerical model, including the reactions between several components with different diffusion coefficients studied by him, is thus called the "Brusselator" (Brussels). For the structures in continuous media, I. Prigozhin has also introduced the term of "dissipative" (scattering energy) structures [3].

However, it should be recognized that Kolmogorov and his coworkers, who studied the one-dimensional model of reaction–diffusion in [4] to describe the movement of the front of some microorganisms reproduction, are the first investigators of one-dimensional dissipative diffusion (distributed in ID space) structures. This model of Kolmogorov with his coworkers has been used to simulate the nonlocal processes at the burning of explosive materials, at the self-organization of plankton structures in biology, and many other branches of science. Some works concerning the experimental (Yu.V. Volkov) and theoretical (E.P. Velikhov and A.M. Dykhne [5]) investigations of the diffusion ionization waves in plasma were performed later in 1965. These works amount to estimating expression (1) without any rigorous substantiation, as was done in [4], for example. Relation (1) can be applied to estimate the corresponding rates of the nonlinear diffusion–ionization waves. Thus, in [5], in agreement with [4], there is obtained the value of the propagation velocity for a steady plasma (ionization–diffusion) front with ionization:

$$V_D = 2(D\nu)^{0.5}, \quad (1)$$

where D is the effective diffusion coefficient, and ν is the characteristic frequency of the plasma concentration growth [5] (or other diffusing and propagating material [4]). The coefficient of the classic ambipolar Schottky diffusion is usually used as an effective diffusion coefficient D to estimate the transfer processes in plasma [6]. However, as was proved in [7], even in some simple plasma (consisting of electrons and positively charged ions, all of a kind) at high pressures $P \geq 5$ Torr, depending on the plasma parameters, the ambipolar diffusion can be determined by the violation of neutrality (Poisson diffusion caused by ∇E) or by the persistence of ions and electrons (Euler diffusion caused by $V\nabla$, where V is the dynamic pressure of the electrons and ions).

The presence of several components of the charged particles (for instance, of the electrons and positively charged ions) in plasma leads to the following (Fig. 1) classification of the ionizing ambipolar nonlinear diffusion waves [7]:

—ionizing ambipolar diffusion waves (Schottky waves),

—Poisson waves, and

—Euler waves.

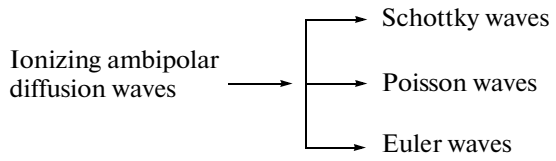

Fig. 1. The pattern of fractalization (classified by Vysikaylo) of ambipolar diffusion ionization waves in gas discharge plasma [7].

VYSIKAYLO CONVECTIVE CUMULATIVE–DISSIPATIVE STRUCTURES

The generation of electric fields in plasma and the 3D structurization of them in 4D space–time exercises a decisive influence on the convective self-organization of the charged plasmoids–plasma structures, i.e., not only on the ambipolar diffusion smearing and structurization of them but also on the convective ambipolar movement directed to the cumulation (self-focusing) of the energy–mass–impulse flows (EMIF). Consequently, there exist and develop not only the Turing–Prigozhin–Kolmogorov diffusive dissipative structures in plasma but also Vysikaylo convective cumulative-dissipative structures [1, 8] with 4D pulsation (standing and running strata), high ionization at the periphery of the charged 3D structure, and other properties in the 4D space–time [1, 8]. This self-organization, as is mentioned in [1], is mainly determined by the difference in the inertia characteristics of the electrons (with the mass m_e) and the ions (with the mass $M_i \gg m_e$). The convective flows are determined by the nonlinear effects as well. For instance, for the mobilities of the electrons and ions, which are different depending on the electric field (the parameter E/N), there appears an ambipolar drift in plasma. Due to the different dependence of the mobilities on E/N, the nonuniform plasma polarizes and drifts to one of the electrodes (depending on the discharge parameters). The velocity of the plasma's ambipolar drift in nitrogen is directed from the cathode to the anode and amounts to 70 m/c (according to the experimental observations and analytical calculations) [9] (see Fig. 2 [1]). The asymmetry of the profiles before and after the perturbed region of the positive plasma column by a fast electron beam recorded in [10] (see Fig. 2 [1]) proved demonstratively the presence in nitrogen plasma of the ambipolar drift determined by the different dependence of the mobilities of the electrons and ions on the parameter E/N. In turn, this makes possible the formation of the convective cumulative-dissipative (CD) structures with the limited cumulation of EMIF (see Fig. 2 [1]). Any interaction of the complex CD systems in any continuous media leads to the concordance of them through the focus (cumulation) of EMIF, which can unite, and to the dispersion (dissipation) after the interaction of the flows, which cannot unite into a general complex (combined of some parts) dynamic structure or a system of them. The processes of integration and focusing (or cumulation) are always accompanied by the processes of dispersion–dissipation. This is the reason for the dualism of the processes of cumulation and dissipation in Vysikaylo CD structures and the self-organizing in some continuous mediums. This duality and its fractality (ramification, nesting, dentritness, and even androgyny; see part 3 of this work) thread the mutual organization of the charged material particles (electrons and protons) and energy everywhere (both in space in the form of some distance-separated strata, in which their parts perform opposite functions, and in time, as the pulsations of plasma CD structures). With the pulsation, the CD-structure extension bears some dissipative functional load and the convergence to the center at the collapse bears some cumulative one. The description of the dual CD structures (determined by the opposite processes of cumulation and dissipation) is a complicated 4D problem on the boundary of eclecticism (the mechanical combination of some incompatible things—antipodes: cumulation and dissipation). Restriction of

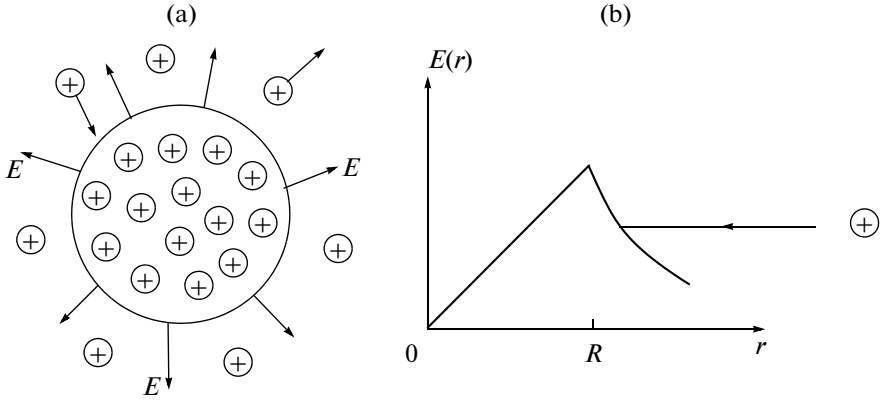

Fig. 2. The model (a) of a charged gravitating plasmoid of radius (R) as a supra-atom's nucleus (used in [1]). The profile (b) with the jump (shock wave) of the electric field $E(r)$ in the charged spherical structure presented in Fig. 2a. The gravitation attracts, and the coulomb potential repulses a charged particle or a small charged part of the plasmoid.

the unlimited cumulation in the CD structures occurs because of the generation or enhancement of new degrees of freedom in the course of the cumulation. For example, rotation breaks the unlimited cumulation [11]. We live thanks to the revolution of the Earth around the Sun or due to the presence of the moment momentum (MM) of the Earth relative to the Sun. This phenomenon has been clearly studied and presented in the Kepler problem [12] and is solved trivially through the introduction of the centrifugal potential or centrifugal mirrors reflecting the converging EMIF with the moment momentum into the coordinate system rotating with the Earth. The Kepler problem is solved in [12] in a general way both for the gravitational and electric fields. All the phenomena observed in gravitational electric fields have their analogs in gravitational phenomena [1]. If the total energy of a body revolving in a certain orbit around an attracting center is equal to the minimum one possible at the given moment momentum, the body revolves in a circular orbit. If the total energy is larger than the minimum one possible at the given moment momentum, the body revolves in an elliptic orbit; thus, it pulses radially between two mirrors: the centrifugal and gravitational or the coulomb one. These are Kepler pulsars. They pulse because of the excess of the total energy of a particle (planet) in an elliptic orbit. The problem concerning magnetic mirrors (probkotrons) is solved in a similar way with allowance for the centrifugal potential of a charged particle. In this case, with the total energy of a revolving particle growing, its circular motions also transform into radial pulsation. This pulsar can be called a pulsar of Artsimovich or O. Lavrent'ev (who wrote a letter to L.P. Beriya about the possibility to use magnetic traps in order to solve the problem of thermonuclear synthesis). The translational kinetic energy transforms into the rotation in such a pulsar with an orthogonal rotation plane. We are going to study the disturbance of the unlimited cumulation because of the violation of neutrality or the generation of Coulomb mirrors reflecting the converging (cumulating) convective flows in outer space CD structures. We will show that Vysikaylo radial coulomb pulsars with an excessive mass are possible. The idea of A. Einstein concerning the equivalence of mass and energy will be confirmed in a new capacity. This equivalence manifests itself in the similar functionality in the processes of pulsations (focusing and bouncing) of the "excessive" energy within the generalized Kepler 2D problem and the "excessive" mass in the Vysikaylo–Chandrasekhar 3D problem on the cumulation and dissipation of de Broglie waves in quantum stars (the pulsing accretion of quantum stars with the generation of coulomb mirrors reflecting the cumulating mass from the star's center) with their mass more than the Chandrasekhar one (~1.46 of the Sun's mass) but less than some neutron stars' mass (~2.5 of the Sun's mass).

THE EDDINGTON NUMBER, THE DIRAC NUMBER, AND THE VYSIKAYLO PARAMETERS DETERMINING THE CRITICAL DEGREES OF THE VIOLATION OF THE NEUTRALITY OF THE CUMULATIVE-DISSIPATIVE STRUCTURES IN OUTER SPACE

In 1928, Einstein advanced a hypothesis that the adhesive force not allowing an electron to disintegrate is of gravitational nature; the development of a unified theory of electromagnetic and gravitational fields was the final purpose of his approach. The enormous inventiveness and mathematical art of many physicists such as Einstein, Schrödinger, Eddington, Dirac and others have been shown unfortunately without any satisfactory results. Max Born thought [12] that the cause of those failures lied in the difference of the degrees of forces corresponding to two kinds of fields. For example, for two similar particles with the masses m and the charges e, the relation of the electric potential Ke^2/r to the gravitational one Gm^2/r is Ke^2/Gm^2, thus giving for an electron a gigantic value of 4×10^{42}. As the gravitation forces and coulomb forces in the space change in a similar way, this value—4×10^{42}—precisely corresponds to the relation of the coulomb forces to the gravitational ones anywhere. Beginning in 1928, Eddington bravely attempted to interpret this great dimensionless value as a property of the whole universe; however, his tries turned to be unconvincing for the scientific community. Hereinafter, we call it the Eddington number. (A negative result is always useful as well). The main objection to such theories is the following: we know many different elementary particles with corresponding fields of a specific kind. Thus, Born believed [12] that it was useless to be restricted only to electromagnetic and gravitational fields, though they are important from the standpoint of practice—the foundation of knowledge. If we are speaking about the whole universe with its diversity and richness, the classic idea is undoubtedly right. In the thirties, P. Dirac took further steps and noticed that, by this great value, there is measured the relation of the electric force acting between an electron and proton to the gravitational force between them: Ke^2/Gm_pm_e, 2×10^{39}. Here, m_p, m_e are the masses of the proton and electron, respectively.

However, by 1928, the gravitation forces had actually been studied only for the interaction of some massive bodies containing an enormous number of elementary particles. For elementary particles, the forces of gravitation were not investigated, and the practical uselessness of such comparisons was obvious at that time. Therefore, in [1] and in this work, the problem is greatly narrowed from the whole universe to the dimensions of the visible galaxies, ordinary stars, plasma bunches, dust particles, and planets and their atmospheres. Not the interaction potentials but the gravitation forces and coulomb forces in the objects

with their actual sizes in the range from 10^{26} to 10^{-15} m are compared in the new problem. The final purpose of the problem solved in this work is the development of a unified theory of the interaction between the electromagnetic field (under certain conditions electric without magnetic) and the gravitational one not for elementary particles but for the real massive objects of outer space and their parts (galaxy centers, galactic clusters, pulsars, quasars, planets, their atmospheres, transitory layers, jumps of spatial charge, other parameters of static and dynamic kinds, etc.) being complex cumulative–dissipative structures or their regular coulomb systems—plasma CD crystals (without any dust). In gravitating bodies, the mass is determined not by the mass of the electrons but by that of the nucleons, being the basis of some ordinary nuclear material of which there is built any planet, star, galaxy, galactic cluster, etc. It may be that Born did not know that the whole observable matter in the universe and in all the visible galaxies consists mainly of hydrogen. Only one nucleon, namely a proton, is in the hydrogen nucleus. It is assumed that the whole visible universe consists of 90% protons and electrons. The masses of the nucleons are 1836 times larger than the masses of the electrons in all the visible galaxies. This is known definitely thanks to astronomy. In this problem, the author [1] does not come into contradiction with the statement on the inadequacy of such theories told by Born. Let us study the following result in detail. By the laws of Coulomb and Newton, we should compare the quantities of the electric forces $K(\alpha_{i1}Ne)(n\alpha_{i2}e)/R^2$ and the gravitational forces $G(Nm_\mathrm{p})(m_\mathrm{p}n)/R^2$ in the universe's gravitating objects, for example, with the charge distributed arbitrary along the radius when comparing the gravitation forces and the electric forces of repulsion (Fig. 2). Here, α_{i1} is the degree of uncompensation of the proton spatial charge in the CD structure, for instance, in a star; N is the total number of nucleons in the structure sphere of radius R; α_{i2} is the degree of uncompensation of the proton spatial charge in the studied volume, for example, on a star's surface at the distance R from its center; and n is the particle density in this volume. Within such an approach, the numbers of Eddington and Dirac are modified into the following number:

$$Ke^2/Gm_e^2 = 4\times10^{42} \to Ke^2/Gm_\mathrm{e}m_\mathrm{p} = 2\times10^{39} \to K\alpha_{i1}\alpha_{i2}e^2/Gm_\mathrm{p}^2 = 1. \quad (1)$$

The parameters α_{i1} and α_{i2} will be called the Vysikaylo parameters.

PRERQUISITES FOR VYSIKAYLO INSTABILITY

Unlike Eddington and Dirac (with the numbers 4×10^{42} and 2×10^{39}), the author in (1) took the last relation as 1 and obtained the condition for the equality of the forces of gravitation and the coulomb forces of repulsion at the corresponding degree of the violation of neutrality (VN) of the matter coming to the attractor, for example, for a charged space structure (a star, etc.) (Fig. 2). The condition of the equality of the gravitation forces and coulomb forces leads to the instability of a star, a galaxy, a system of them, or the visible universe, which is analogous to rotational instability. The instability appearing for the space CD structures due to the violation of their neutrality in the general case we are going to call the Vysikaylo–Eddington instability for the sake of convenient classification. Condition (1) allows one to determine that

$$((\alpha_{i1}\alpha_{i2})^{0.5})^* = \alpha_i^* = 0.9\times10^{-18}, \quad (2)$$

where α_i^* is the critical degree of VN of the gravitating charged body material when the body stops compressing under the action of the gravitation forces and at $(\alpha_{i1}\alpha_{i2})^{0.5} > \alpha_i^*$ as in the case of the rotational instability (there begins to be thrown out pieces of the charged plasma in the form of a plasma wind or star one, a solar wind, some other wind, or even winds). The difference from the rotational instability consists in the reflection of the charged pieces by the whole surface of the charged star (Fig. 2). Winds differ by the content of various materials. The plasma wind's composition is determined by the number of parameters of the dynamic kind (PDK), including the electric field's strength on the surface of the charged CD structure (Fig. 2). Weather forecasters will be able in the future to predict some hydrogen and helium winds from the nearest neutron star according to the parameter α_{i1}. α_i^* is the dimensionless number that will be called the Vysikaylo limit and is to a high accuracy 0.9×10^{-18} for any space CD structures consisting of any chemical elements or materials. By analogy with the numbers of Eddington and Dirac, we can introduce the Vysikaylo number $\Psi_\mathrm{V} = 1/(\alpha_i^*)^2 = 1.2\times10^{36}$ corresponding to the relation between the coulomb forces and the gravitation forces if we assume that the gravitating material consists only of one kind of nucleons—protons or a proton (Fig. 2).

The Vysikaylo dynamic kind parameter—$\alpha_i = (\alpha_{i1}\alpha_{i2})^{0.5}$—determines in outer space the transition in the CD structures from gravitational compression to coulomb disintegration or even the sputtering and recession of the charged material. In this context, this parameter is not a property of the whole universe but of all the actual charged gravitating objects or the objects cumulating owing to the gravitation. The parameter α_i is determined by two parameters: α_{i1}, the parameter of the VN of the structure as a whole, and α_{i2}, the parameter of the VN of the element chosen in the charged CD structure and examined from the standpoint of the coulomb instability. The element

may have a value of $\alpha_{i2} = 1, 1/2, 1/3$, or less. In the case of $\alpha_{i2} = 1$, the Vysikaylo–Eddington instability begins for such a mass with the VN parameter for the whole star at $\alpha_{i1} \geq 0.81 \times 10^{-36}$. At these values of α_{i1} and α_{i2}, the value of α_i reaches the Vysikaylo limit.

THE VYSIKAYLO–EDDINGTON INSTABILITY FOR POSITIVE IONS, A CHARGED STELLER WIND, AND ITS CLASSIFICATION

The Coulomb instability (of Vysikaylo–Eddington) first begins for protons as PDK α_{i2} for them is the greatest (1). The values $\alpha_{i2} = 2$ and 10 are impracticable, as the cumulation of only protons into the atomic nuclei is impossible. For an atomic nucleus with 10 protons and 10 neutrons, PDK $\alpha_{i2} = 1/2$. As the interaction of the charged structures results from the interaction of their charges, then, with allowance for the fact that, for the hydrogen atomic nucleus, $\alpha_{i2} = 1$, we obtain the value $\alpha_{i1} \approx 10^{-36}$ from the reflection condition for protons $(\alpha_{i1}\alpha_{i2})^{0.5} \approx \alpha_i^*$. For the Vysikaylo PDK for a star reaching the value $\alpha_{i1} = 0.8 \times 10^{-36}$, there arises of itself some reflecting coulomb "mirror" for protons, and a free way to the surface of the charged star or into its interior will be for a while closed, as the star is charged and the repulsion coulomb forces dominate over the gravitational attraction of protons. The protons are retarded by the electric field of the charged star. For a star with the mass of the Sun, there is necessary the charge $Q = 0.8 \times 10^{-36} \times 1.2 \times 10^{57} \times 1.6 \times 10^{-19}$ C, which is about 150 Coulomb. Here, $N = 1.2 \times 10^{57}$ is the number of nucleons in a star with the mass of the Sun. This "mirror" has less effect on the nuclei of helium and other heavier elements. As the author believes, the positive charge of stars and the coulomb instability for protons are responsible for the overwhelming number of protons (up to 90%) experimentally recorded in all EMIF of the universe. The possible range of PDK α_{i2} for the elements cumulating on the attractor becomes clear and is $1 \geq \alpha_{i2} \geq 0$. The alteration of the PDK of ordinary space gravitating stationary objects ranges from $\alpha_{i1} \approx 10^{-18}$ to 0. Assuming that, in outer space, there exist some unique quasi-stationary CD structures with surface tensions caused by the squeezing by the high-energy electrons [1] or by the meson fields or muon ones on their surface and the filling by a charge, as in the atomic nuclei up to $Z = (1/2$ or $1/3)$ A (where A is the number of nucleons), it is possible to solve all the problems on the recession of galaxies (antigravitation) for which $\alpha_{i2} < 10^{-18}$. It is conceivable that such rapid and accelerating recession of galaxies discovered by astrophysicists is actually another piece of circumstantial evidence that the Newtonian particles cumulate in the galaxies with the charged objects of the visible universe also forming there. It is not caused by a mysterious antigravitation, some latent energy, or dark mass. If the electric fields caused by the charge separation (including the quantum-mechanical one [1]) are beforehand assumed to be invisible in space and their powerful action is ascribed to a latent mass, this observable phenomenon will be greatly mysterious indeed. Let us consider the processes of the cumulation of classic (Newtonian) particles within the uniform universe.

MULTIFACED THEORIES OF THE VISIBLE UNIVERSE. LUSTER AND POVERTY OF THE BIG BANG THEORY WITHOUT CONSIDERING THE NEW DEGREES OF FREEDOM

It is well known that the average material density in the visible universe is small ($\sim 10^{-26}$ kg/m^3 [13–15]), corresponding to the density of the number of hydrogen atoms in an amount of 5–6 per 1 m^3. If the universe was absolutely homogeneous, man could not observe anything in it. Where can you find a man with a density of $\sim 10^{-26}$ kg/m^3?

Why do we see the Sun, stars, planets, our hands, feet, and so on as parts and wholes? This is caused by the focusing ("self-condensation") of the material into such visible space CD structures! Only the cumulation of the material (atoms and molecules) in the universe allows us to see the world where we live. With the Newtonian particles cumulating into an attractor, the potential energy of the single particles decreases. Hence, in order that these classic particles form a cumulative structure, part of the energy should be taken away from some particles, thus locking them into a common potential (gravitational or coulomb) well, or spread some "glue" on them, or put them into a shell with the surface tension of a toy (rubber) balloon kind (Fig. 5 in [1]). Other particles that left the cumulative structure should be given these excesses of kinetic and potential energy, making them free, invisible, hidden, scattered, or "dark," while also repulsing the gravitational attractors from each other. With the classic particles interacting with each other, energy transfers of itself. Thus, gravitating particles acting jointly, i.e., synergetically, on the one hand, form an attractor (a potential well) and, on the other hand, a dissipative current of high energy particles is produced of them from the attractor. The particles are focused in space due to the gravitation. A part of them dissipate in the space around the structure owing to the interaction with each other and receiving some kinetic energy from other particles sufficient to overcome the forces of the general gravitational field.

If the cumulative forming processes permitting one to see something invisible before are intensified, then, according to the energy conservation law, the processes of dissipation (dispersion) of energy and particles separating from the attractor should correspond-

ingly enhance too. In this case, the systems of the visualized attractors can run away from each other. As EMIF cumulates into a CD structure and the critical values of the dynamic kind parameters are reached, there happens the visualization of the CD structures–attractors. The particles dissipating from the structure are dispersed and usually are not visualized or are visualized far from the attractor in the form of a new attractor running away from the old one. Thus, the cumulation of the mass in stars and galaxies observed in space means the pumping by the energy of the invisible (dispersed, dark, hidden, or peripheral) mass carrying with itself some potential energy from the CD structure. In this case, the outer medium—the space—appears as a refrigerator for the condensing classic (Newtonian) particles of the material; complex systems can be attracted or suddenly scattered for some "mysterious" reasons.

Reasoning from the energy conservation laws and the moment of impulse, we can make a conclusion that the presence of the high energy particle flows dissipating into space and close by the energy and mass to the focusing mass flows can cause the excitation of the substantial forces pushing apart any attractors. Let us estimate the latent energy given by the gravitating particles forming the visualized attractors (the visible material within the universe).

For the gravitationally bound rotating system with the total visible mass M and the characteristic dimension R (the average distance of the elements from the system's mass center can be taken as R), the total energy is $E = E_k + U_g < 0$. Here, E_k is the kinetic energy, and U_g is the gravitational energy. The dynamic balance of the rotating visible CD structure is determined by the focusing forces and the centrifugal forces $\nu^2 \approx GM/R$. Here, ν is the velocity of the rotation. Hence, it follows that $E_k = -1/2U_g$. This relation also follows from the virial theorem for mechanical systems [16]. The relationship associating the potential energy with the kinetic one is actually valid for the localized gravitationally bound system of classic particles forming a CD structure. However, this relationship takes no account of the dissipated (thus hidden) material, its mass, and energy. The mass of the material dissipated but yet included into the peripheral region of the attractor can be estimated by the behavior of the whole attractor, but it is almost impossible to estimate the total energy with allowance for the hidden high energy dissipated mass, as its density is small. However, according to the energy conservation law and our estimations, only the amount of the energy transferred to the hidden mass by the visible mass is $\sim -1/2U_g$. Hence, the energy of the hidden mass is more than twice as large as that of the visible mass (visualized in the form of the space cumulative-dissipative structures). Thus, if we proceed from the initial homogeneity of the boundless universe, the latent energy amounts to ≥75% of the total energy of the whole visible universe, and the visible matter energy constituents ≤25%. The interaction between the CD structures is determined not only by the gravitation but by some other forces, for instance, by the mutual pressure (latent energy) of the dispersed (dark) material around each cumulative structure of the real matter able to be visualized.

We have arrived logically at the notions of the hidden and dark mass and the latent energy in the homogeneous boundless universe, while examining the cumulative Newtonian processes. Due to the duality of the processes of cumulation and dissipation of even Newtonian particles, we have arrived at the possibility of the generation of the forces causing the recession of gravitational attractors. Nobody needs to explode a single point to understand the very core of the recession of the Newtonian galaxies. The degree of the particle cumulation in stars by density is $\alpha = \rho_s/\rho_v \sim 10^{29} - 10^{43}$. Here, $\rho_s \sim 10^3 - 10^{17}$ kg/m^3 is the density of stars, and $\rho_v \approx 10^{-26}$ kg/m^3 is the mean mass density in the visible universe (with the characteristic dimension $L \sim 10^{26}$ m). The observed matter is densely focused into the stars, galaxies, and planets in relation to the density of outer space. It becomes obvious that the hidden mass and latent energy dissipated in outer space can be multifold larger than the visible mass and energy.

However, new degrees of freedom (NDF) are excited in the case of the cumulation of the energy and mass. New degrees of freedom hinder the further cumulation, but at the same time there are generated new forces of cumulation. As there is necessary some energy to excite NDF, the energy cumulation happens simultaneously with the excitement of the new cumulation forces. The effect of the coulomb forces on the mass cumulation into structures in space is hardly studied in astrophysics. The forces of the hidden mass pressure and the coulomb forces may be responsible for the recession of the Coulomb–Newtonian galaxies and the establishment of such enormous distances between the stars. Thus, what was at the beginning of the universe? The big bang of a point with infinite mass or the cumulation of the initially homogeneous mass of material in space continuing now under the control of the gravitation, inertia, and electromagnetic forces?

The recession of the galaxies within the visible universe at a certain velocity has been discovered by Hubble. In the last ten years, the world community of astrophysicists found that the galaxies recede with some acceleration! Knowing a short biography of the visible universe (With an age of 13.7 billion years; the size of the observable part of the universe of 13.7 billion light years, that is, ~10^{26} m; and the average density ~10^{-26} kg/m^3, hence, the mass of the visible universe is at present ~10^{50} t) and neglecting the problem of MM, it is possible to obtain an infinite density and, respectively, an infinite mass of the universe at the moment of its birth. Really, what can the enormous

potential energy of the visible universe compressed into a point transform into but not its own mass? Rotation and inertia are not considered in this model. It is in complete agreement with Einstein's principle of the equivalence of the material's energy and mass. This brings up the following question: Who has given us this infinite quantity of material and with the compulsory zero MM at a given point if before the universe originated nothing was? Nothing initially was (even the creator), and then it appears and so much. It is so strange, for instance, more than 10^{90} tons and not at the beginning of the retraction. We begin to count directly from a singularity; it is infinitely much (everything diverges and converges in infinities, and many astrophysicists have been deeply involved in this research). Suddenly after the big bang everything begins to rotate, for instance, in spiral galaxies. Before the bang, nothing could rotate, as it was impossible to force into a point (a structure of 10^{-33} cm radius) even a rotating Galaxy without a quasi-Cooper cyclone. As for the universe, it is out of the question! The functioning of a quasi-Cooper cyclone, the model of which has been formulated by Ph.I. Vysikaylo, means that the material is by the angular momentum carried out of the cumulating structure into space [17]. If time was inverted and the rotation was considered, then with the material's cumulation the whole energy was in the rotation and, according to [11, 17], the minimum radius of the material's rotation is $r_{\min} \approx (N^2/2E)^{0.5}$. Here, N is the moment momentum reduced to the mass, and E is the material's kinetic energy reduced to its mass. If there is no God, who could put into a single point so infinite a mass and, after the explosion of this trotyl, rotate it in the form of spiral galaxies and distribute it along the visible universe so uniformly? Astrophysicists never wanted to formulate this question in such a way, and now they do not want to do it either; that is why they are deeply involved in the big bang theory and ignore the new degrees of freedom—the rotation, the violation of neutrality, and the corresponding generation of the magnetic field. They found the relict radiation forecasted by Gamov and stand with serious faces before a universe of 10^{-33} cm radius. To explain the accelerated recession of the galaxies, they blow them with acceleration by hidden matter and latent energy. Their calculations have also shown that the latent energy amounts to more than 73%, and the hidden mass ranges from 23 to 90% and even more.

There is no past before the explosion of their point. The modern theory of the big bang supplies us with such a "dialectic" conception. This deadlock becomes obvious with the examination of the periodic and aperiodic motion in the region of the attractor of a simple and invaluable rotating liquid ring of E.I. Zababakhin [11]. The author believes that the convergence of the universe into a point is an absolutely improbable process fully contradicting the theory of probability and all the laws of physics, mathematics, and normal logic recognizing the cause-and-effect relationship.

On the hypothesis concerning the cumulation of the material formerly uniformly distributed in the universe, the author has substantiated the presence of the hidden material mass and the energy in space and obtained an estimation of the energy in the hidden matter (≥75%) and of the mass (more than 50%). The recognition of the real big bang is equivalent to the acknowledgement of a god who should permanently correct the previously cumulating flows about the point and continuously move away the excessive MM at the point where there would be located the future center—the attractor of the whole visible universe. However, where, how far, and what had he stored while removing the MM? How can one take away the MM without removing the mass and energy from this point? Consequently, there were many points. Then, why was this single point so important if it was not the only one? The convergence and the following divergence of the energy–mass–impulse flows by the CD theory could occur in any way. The theory of the big bang of a single point has been created by the idealists who neglect the principle of the moment momentum conservation. A simple CD theory based on the ideas of E.I. Zababakhin and Kepler makes clear the crux of the matter in this case as well. Yes, the convergence is possible, but to a certain level. Yes, the visible universe is extending by the laws that are not studied yet. This is the reason for the development of a theory of the multifaced universe. The dark material storms in it (23%) and the dark energy especially beats up with the quantity of it being very large (73%). And this theory calls to mind the universe of Kandinskii (an abstraction on canvas).

We are not going to estimate the mutual pressure on the galaxies of the high energy dark (hidden) material leaving the galaxies in the case of the cumulation of the particles remaining in the galaxies. Though from the general considerations it should be rather large, and, under the action of the pressure of this material with the hidden mass and energy several times exceeding the energy and the mass of the galaxies, the galaxies can recede, thus demonstrating the dualism of the processes of cumulation and dissipation on this level as well. In this case, the Einstein Λ-member has an actual physical meaning; it is not introduced formally, as in [4], and without the clarification of the physical process blowing the universe (making the galaxies recede with acceleration). Previous to investigating the universe by analogy with a charged atomic nucleus and an electron shell, there should be defined and studied the mechanism of the quantum-mechanical pressing out of electrons out of massive stars. This problem means the analysis of the initial Newtonian material collapsing into a white dwarf or neutron star partly or completely transmuted into some gas or even metal (iron). Here, it should be distinguished the huge number of possible processes of the generation of new levels of

freedom and Newtonian (or Eddington) stars collapsing into quantum dwarves. With the collapse, there can take place the reflection of the collapsing mass from protons in the case if the star's mass continues to consist of hydrogen plasma ionized by the pressure. If thermonuclear reactions happened in a star and it has helium or heavier (for instance, carbon) plasma as its basis, it is necessary now to consider the reflection of the collapsing flows from the internal shells of ions. This is the reason that the spectrum of pulsing white dwarves and neutron stars can be most diverse. The formation of crystal lattices in quantum stars occurs similarly to the generation of normal crystals and demands knowledge of the fundamentals of quantum mechanics applied in the quantum-mechanical description of condensed crystal media. The author intends to carry out more complete examinations of these analogs (Fig. 5a, [1]) caused by the coulomb squeezing of ion lattices in crystals and quantum stars in part 4 of this work. In this part, only the estimations of the dynamic (pulsing) cumulative phenomena in dense quantum stars of the macroworld, similar to the cumulative jets from cathode spots [8] in the mesoworld, will be performed.

THE PERTURBATION THEORY TO DESCRIBE THE CHARGED NUCLEI OF QUANTUM STARS AND COULOMB PULSARS

Of special interest are the details of the cumulation of energy and mass into superdense cumulative–dissipative structures—quantum stars (white, brown, and other stars; neutron stars; and black holes) and atomic nuclei. The supercumulation of the particles in such structures takes place unlike the cumulation of normal Newtonian particles. The steady cumulation and dissipation, i.e., focusing and reflection from different "mirrors," are observed in stationary cumulative–dissipative structures. Inertial (or centrifugal) potentials, which are responsible for the motion in an elliptic orbit in the 2D problem of Kepler, Euler, or Lagrange or the pulsation in a magnetic trap (in probkotrons) in the 3D problem (presented by O. Lavrent'ev and in the articles and monographs by Artsimovich and Kadomtsev et al.) on the thermonuclear fusion in probkotrons, can act as reflecting mirrors. The role of the inertial mirrors is not properly represented in the problems on turbulence in the works by Kolmogorov and Obukhov et al. For example, inertial (or centrifugal) mirrors are important in the case of the formation of the eye of a cyclone and the whole cumulative–dissipative turbulent architecture of it [17]; they are absent in the classic models of turbulence. As a result, there is no dual interaction between the cumulating and dissipating whirlpools. Quantum mirrors do not permit a low energy electron to fall on a proton or the atomic nucleus. An atom is formed as a result of the coulomb cumulation and quantum dissipation. Now it does not seem possible to accurately consider these dual phenomena of cumulation and dissipation from the standpoint of the dynamic formation of cumulative–dissipative structures and to describe in detail the architecture of the de Broglie wave cumulation in all these structures, but we should try. The coulomb mirrors associated with the self-focusing of a spatial charge can be described quantitatively using the fact of a small violation of neutrality stopping the gravitational collapse of stars.

CALCULATION OF THE PARAMETERS OF A DINAMIC JUMP WITH THE VIOLATION OF NEUTRALITY (THE SHOCK WAVE OF THE ELECTRIC FIELD) FOR DENSE (QUANTUM) STARS

It is a rather complicated problem to prove the formation, existence, and steadiness of the stationary or dynamic jump of the normal pressure or discharging. The characteristic dimension of the stationary jump with VN is determined by the characteristic dimension of VN. The VN dimension is self-determined by the necessity of the concordance through the jump of the medium's parameters before the jump with the star's plasma parameters after the jump [1]. For the dense stars, the condition of the existence of a stationary jump with the spatial charge on the boundary of the degenerated electron gas or the ideal gas of the star coincides with the condition of the hydrostatic equilibrium of the star as a whole. Describing the dynamic jumps, we use the energy conservation laws. With the star's collapse and the formation of the dynamic jump of the electric field, we assume that the total potential energy of the gravitation $\sim GM^2/R$ (it is considered that the star compresses to the radius R from the much larger radius $R_0 \gg$ R) transfers into the energy of this jump capacitor with the spatial charge bilayer. A substantial NN happens at a small change of the radius of the compressed star, i.e., with the change of the radius from $R + h$ to R, where h is the characteristic dimension (of the layer of electrons incapable of remaining inside the collapsing star because of their large wave lengths) of the dynamic jump with VN and $R \gg h$. The capacitor energy is the following:

$$E_c = K(\alpha_{i1}Ne)^2(1/R - 1/(R+h)). \quad (3)$$

Here, N is the number of the nucleons in the area limited by the jump. The effective quantity h, where the energy of the nucleons transfers into the energy of the electrons, we estimate according to the perturbation theory from the condition of the smallness of α_{i1} and, consequently, of the number of the electrons not entering region 1 (Fig. 3), that is, from the condition $\Delta V/V = \alpha_{i1}$. Hence,

$$h \approx \alpha_{i1}R/3. \quad (4)$$

From the equality for the gravitation energy $\Delta rGM^2/R^2$ and the capacitor energy (assuming $\Delta r \approx R$), we obtain for the hydrogen plasma

$$\alpha_{i1} \approx 1.35 \times 10^{-12}. \quad (5)$$

With the VN parameter reaching $\alpha_{i1} \approx 1.35 \times 10^{-12}$, the total kinetic energy of the radial convergence of the nucleons transfers into the bilayer coulomb energy, and the star's collapse fully stops because of the counteraction of the inertia forces of the coulomb repulsion forces of the now positively charged nucleus. Then, under the action of the coulomb forces, there begins the spraying of the star's nucleons reflected from the quantum-coulomb mirror (Fig. 3, region 1) and the heating by the synergetic electric field of the charged part of the star's electrons converging into the center of the star as they are heated in this field. However, the nucleons have been reflected from the coulomb "mirror" and dissipate back into space. The value α_{i1} for the dynamic jump (5) is 10^6 times greater than the value $\alpha_i^* = 0.9 \times 10^{-18}$ for the hydrostatic jump (the value of α_i^* for the hydrostatic jump follows from (2)). Then, with the given characteristic radius of the dense star (R) and its mass (the total number of the nucleons N), all the other parameters of the dynamic bilayer are determined: the electric field strength $E(R) = K\alpha_{i1}Ne/R^2$ and the characteristic thickness $h \approx \alpha_{i1}R/3$ of the bilayer (region 2, Fig. 3).

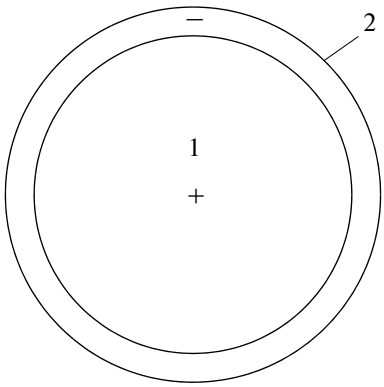

Fig. 3. The diagram of a spherical capacitor associated with the quantum-mechanical separation of the charges of electrons and protons in the case of the collapse of a star into a quantum star [1]. It is observed in the following regions: 1—the degenerated positively charged material; 2—a layer of negative charge with electrons not entering into the region of the nucleon collapse.

THE SHOCK WAVES OF THE ELECTRIC FIELD (HYDRODYNAMIC JUMPS WITH THE VIOLATION OF NEUTRALITY) IN WHITE DWARVES: A NEW TYPE OF THE FIRST KIND OF THERMONUCLEAR REACTOR

Prescribing the white dwarf parameters and the amplitude of the oscillation equal to the star's radius, one can calculate the parameters of the dynamic jump of the spatial charge in such a pulsing dwarf with the density close to the density of a white dwarf. For a white dwarf with $R_W \approx 10^7$ m and $N_W = 1.2 \times 10^{57}$ ps., we obtain from (4) $h \approx 5 \times 10^{-6}$ m and $E(R) = K\alpha_{i1}Ne/R^2 \approx 2.3 \times 10^{22}$ V/m. The equivalent mass density of the electric field energy $\varepsilon\varepsilon_0 E^2/c^2$ on the charged star's surface is close to the mass density inside the atomic nucleus. Here, c is the velocity of light. The energy received by the electron or proton having got through such a layer of the spatial charge will be enormous $\sim 10^{17}$ eV. Any reactions, including the neutralization of material and the creation of material from the electric field, can proceed in the CD structures in such a field. Thermonuclear reactions can proceed in such a layer and its periphery that can for a brief moment involve some substantial areas of the pulsing dwarf. This new author's model implies the main point of the Vysikaylo thermonuclear reactor claimed in [1]. It is a major problem to describe how the electron energy is sputtered at the dynamic jump dimensions $\sim 10^{-5}$ m. Yet, it may be suggested that the transfer of the electrons and the acceleration of them to a quantum star's nucleus take place in a similar way as in lightning and electric cords [1, 8]. These electric CD processes in their infancy we can also observe on the Earth. The electron energy in lightning attains 3 MeV, and the lightning's (CD structure) length can amount to two kilometers (and the blue jets may range from 40 to 90 km) on the Earth; in these jets, the energy of the electrons may be much more than dozens of MeV. These are not electrons generated by space rays. These are electrons provided with the energy of the electric field of the whole positively charged multikilometer CD structure (see part 3).

With star EMIF converging to the attractor's center, the retardation by the coulomb forces (because of the quantum-mechanical pressing of the electrons out of the compressing material) will be many times steeper than when centrifugal forces are excited. This will result in a sharper jump of the convergence rate in the region of the limiting minimum radius of the star than in the problems of Zababakhin and Kepler (see Fig. 4, curve 4, and Fig. 10 in [16]). After the dynamic jump at the dimensions of about 10^{-5} m after the coulomb retardation, the convergence rate changes its sign, and a sharp coulomb acceleration of the scattering star mass begins in the reverse (to the collapse) direction. After 10^{-5} m is passed, there occurs some inertial scattering of the whole star's mass (now a neutral one), huge coulomb inflation when the still positively charged mass begins to scatter, the slower inertial scattering of the fully neutral mass, then the stopping of it due to the gravitation forces and a stately gravitational collapse, i.e., returning to a new coulomb "mir-

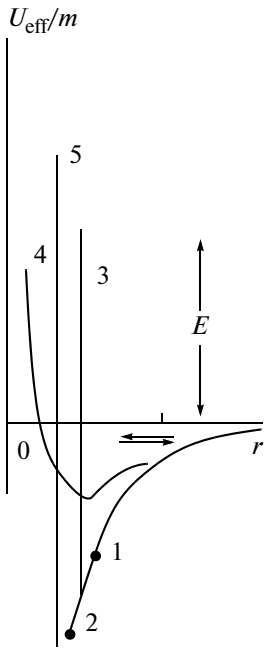

Fig. 4. The effective reduced potential with allowance for the coulomb barrier. The points correspond to the compression density in quantum dwarves: 1—white dwarf; 2—neutron star. Further downward—a nuclear star and a black hole. Between points 1 and 2, there is observed hydrostatically unstable quantum stars-dwar pulsars with mass more than the Chandrasekhar limit. It is shown by the arrows the directions of the radial pulsation of the quantum star mass in the potential well between the coulomb (3) and gravitational barriers. The role of the centrifugal potential (4) for quantum stars is considered negligible.

ror" with a bright brief flash within the range of gamma radiation. On extension, not the whole pulsing dwarf mass will return; some part of it will be carried away by the stellar wind. As some part of the mass will be removed at the pulsations, the convergence–divergence energy will decrease. The flash's duration and the corresponding cascade of reactions caused by the heating of the electrons in the electric field appear suddenly and have a hierarchy of characteristic times in the range from $t = h/V_R \sim 2 \times 10^{-12}$ s, where V_R is the maximum rate of the star's surface convergence with the white dwarf's density ($V_R = (2GM/R)^{1/2} \sim 5 \times 10^6$ m/s) and $t = T = 10^4/(\rho/\rho_\odot)^{0.5}$ [s^{-1}] ~ 2 min (the period of the pulsations of the mass (white dwarf)) [18, 19]. Here, $\rho_\odot$ is the average density of the Sun, and ρ is the average density of the white dwarf. According to this model, the continuous brief flashes from the sky signal the change of the inflation phenomena in the CD structures with the density more or close to the density of white dwarves.

What can we find in the case of jumps with VN (in the shock waves of the electric field) on a star with density close to neutron stars? Knowing the characteristic values of the radii of white dwarves with the mass of the Sun $R_W \approx 10^7$ m, in which the gravitational pressure is balanced (of the formed crystal ion lattice) by the pressure of the degenerating electron gas, prescribing their chemical composition in the form of helium, we can estimate a neutron star's parameters from the well known relation $\lambda_e/\lambda_n = m_n/m_e = 1838$. As the number of electrons falling on the nucleon in helium is 0.5, the relation of the radii of a white dwarf and a neutron star in accordance with the above mentioned $R_W/R_N = 0.5 \times 1838 \approx 919$. Hence, a neutron star's radius is $R_N \approx 10^7$ m/919 $\approx 10^4$ m. Prescribing a white dwarf's density as $\rho_W \sim 5 \times 10^8$ kg/m^3, we calculate the characteristic density of a neutron star $\rho_N \approx \sim 3.9 \times 10^{17}$ kg/m^3. Whence, $\rho_N/\rho_W = (4 \times 10^{17}$ kg/m$^3)/(5 \times 10^8$ kg/m$^3) \approx 10^9$.

THE SHOCK WAVES OF THE ELECTRIC FIELD (DYNAMIC JUMPS WITH THE VIOLATION OF NEUTRALITY) IN NEUTRON STARS: A NEW TYPE OF THE SECOND KIND OF THERMONUCLEAR REACTOR

Neutron stars, due to the β-disintegration of the neutrons to protons, electrons, and neutrinos on their surfaces, cannot exist without enormous electric fields returning the electrons into the depths of such stars to neutralize the protons. Only huge electric fields on the surfaces of quantum stars can stabilize the reactions of the neutron β-disintegration, as in normal atomic nuclei. In astrophysics, the problem of the stabilization of neutrons on the surface of neutron stars is completely neglected, as the problem of returning high energy electrons capable to leave a dwarf of any color owing to their kinetic energy.

Let us calculate the parameters of the dynamic jump (the shock wave of the electric field) for a neutron star with the mass $M \approx 1.5M_\odot$—the mass of the Sun. According to (5), the VN parameter in the dynamic jump $\alpha_{i1} = 1.35 \times 10^{-12}$ corresponding to the star pulsations with the characteristic pulsation range equal to the star's radius ($R = 1.5 \times 10^4$ m). For such a level of VN, by (4) we obtain the characteristic dimension of the layer with VN:

$$h \sim R\alpha_{i1}/3 \approx 7 \times 10^{-9} \text{ m}. \quad (6)$$

The maximum value for the parameter α_{i1} in a neutron star, as in any other pulsar, is achieved at the minimum value of the star's radius and for a very short time. As $h_W/h_N = R_W/R_N \approx 919$, consequently, the retardation of the star's collapse by the coulomb forces in a neutron star will be many times (919) sharper than in white dwarves and enormously more rapid than with the generation of centrifugal forces. This results in an abrupt velocity jump in the region of the limiting minimum radius and the formation of a vertical coulomb barrier sharply ascending (Fig. 4, curve 5). The electric

field's strength in the dynamic jump of the neutron star is

$$E(R) = K\alpha_{i1}Ne/R^2 \approx 1.6 \times 10^{28}\ \text{V/m}, \qquad (7)$$

being more than $(919)^2$ times larger than the electric field strength in the shock wave of the electric field (dynamic jump) of a pulsar with the density close to a white dwarf. The electric fields in the corona of a pulsing quantum star with the average density more than the density of a white dwarf can work any "miracles" at its surface with some material and with each other or the vacuum. The mass density of the electric energy appearing for a moment on the surface of the consolidating nucleus $\varepsilon\varepsilon_0 E^2(\text{R})/c^2 = (K\alpha_{i1}Ne/cR^2)^2$ is more than 10^{10} times larger than the mass density in an atomic nucleus. This is the result of the synergetic field of the charges of the uncompensated protons. The energies of the electrons and protons within the dynamic jump of such a neutron star may amount to a value of 1.1×10^{20} eV, which is 919 times more than the energy of the dynamic jump of a white dwarf. Such electrons penetrate the star. In this case, it is possible to register three radiation pulses corresponding to the generation of the dynamic jump (the pulse and the respective afterpulse) and the radial coming of the electrons out of the star inside a cumulative jet in the course of a neutral star's collapse, when everything less dense is pressed out as a result of the quantum-mechanical squeezing out of the particles with the large de Broglie wave lengths.

After the coulomb retardation of the whole converging mass of a neutron star due to the generation of the dynamic jump with the spatial charge of the electrons with dimension about 10^{-8} m, the convergence rate changes its sign, and there begins an abrupt coulomb acceleration of the charged mass of the star, already scattering from its center (Fig. 4, straight line 5). Then, after the jump with VN with the characteristic dimension $h \sim 10^{-8}$ disappears, there follows now inertial scattering of the whole star's mass retarded by the forces of gravitation. Consequently, it is initially an enormous inflation, a stately return to the new gravitational collapse and then with the acceleration to the coulomb "mirror" with a bright brief flash (with the duration of all the cascade elements in the range from 10^{-16} s: $t = h/V_\text{R}$, where V_R is the maximum velocity of the star's surface convergence to $t = T = 10^4/(\rho/\rho_\odot)^{0.5}\ [\text{c}^{-1}] \approx 10^{-3}$ s) with the huge temperature of the electrons heated in the vast synergetic electric field of the protons noncompensated only at the level of $\alpha_{i1} \approx 10^{-12}$. The continuous and very brief flashes (with some afterpulse caused by the passage of the accelerated electrons through the star) coming from the sky signal the change of the inflation events within the polarized space CD structures (Fig. 4, straight line 5) with the density close to the density in the atomic nuclei. There should be expected not only plasma wind from neutron charged stars (when some normal material arrives on them) but also the charged wind of protons, as in the case of the wind from charged white dwarves. The pulsations of neutron stars and the formation of the dynamic jumps of the spatial charge (the electric field shock waves modifying the Newtonian substance into a quantum plasmoid or a Fermi–Dirac one [1]) may explain the presence in our galaxy of the cosmic rays with energy of $\sim 10^{20}$ eV.

It is surprising there is a very small thickness of the quantum-coulomb "mirror" for hydrodynamic neutron stars: only 10^{-8} m in the dynamic jump, sweeping the electrons to the quantum star's surface. The characteristic time of such a jump's existence is 10^{-16} s. Though there is nothing to be surprised at. These are dimensions and times in atoms and atomic nuclei, i.e., nano- and femtometric sizes. Rutherford in his works began to study femtostructures and started to create foundations to develop femtotechnologies. Only on the basis of his works, have we managed to describe the hydrodynamic jumps with VN in white dwarves and neutron stars and to elucidate the principle of operation of the Vysikaylo pulsing thermonuclear reactors in quantum stars (pulsars). In this case, the model of dense stars, as that of a supra-atoms, turned to be close to the atom model, as proved in Rutherford's experiments (Figs. 5 and 6 in [1]). Thus, we have proved that the pulsing surface of a neutron star forms a jump with VN (the electric field shock wave) separating the normal material, in which the number of the neutrons and protons in the atomic nuclei is almost equal, from the star's neutron material, where the amount of the neutrons is overwhelming (Figs. 3, 4 and Fig. 6 in [1]).

THE LIMITING ENERGIES OF COSMIC RAYS FROM QUANTUM STARS WITH ELECTRIC FIELD SHOCK WAVES: THE CHARGED JETS FROM QUANTUM STARS

It is thought that, in the case of the generation of black holes (BH), no substance can penetrate into space from them. The event horizon of a nonrotating (Schwarzschild) BH is situated at the so-called gravitational radius [18]: $R_\text{g} = 2GM/c^2 \approx 3$ (km) $(M/M_\odot)$. Relations (6) and (7) have been obtained for a neutron star of mass $1.5M_\odot$ (the Sun's mass). The mass of quantum stars capable of ejecting charged particles into outer space is limited to 3–4 Sun masses. If relations (6) and (7) are readjusted for all these masses, we shall obtain the maximum possible energies of the cosmic rays from quantum stars within the range $(2–3) \times 10^{20}$ eV (If the coulomb disintegration is taken into account, these values change many times).

The electrons are the lightest gas, and, with the temperature rising, they are the first to dissipate into space from Newtonian stars and nebulas. In the case of dense quantum stars, the cold electrons (with low kinetic energy), as quantum substances, are pressed out of the quantum structures into outer space, as they

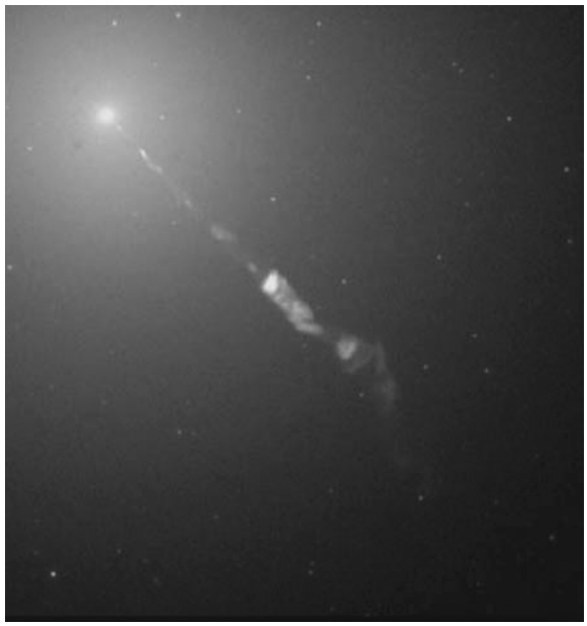

Fig. 5. The central region of galaxy M87 with an active core. The jet's size is 1.5 kps. The Hubble telescope (NASA). The jet's stratification is visualized.

are spatial (an enormous relative volume is accounted for by them) [1]. Therefore, the effective dimensions of the molecules, atoms, and ions are characterized by the de Broglie wave length of the external electron and decrease considerably as these quantum objects are ionized. The high energy electrons from quantum stars are held hard: (1) by the electric field generated by the positive spatial charge of the structures, and (2) by the electron shell squeezing the nucleons in the quantum structures with the degenerated electron gas or liquid. This takes place in a similar way as the squeezing of two protons in the positively charged ion of a hydrogen molecule (Fig. 5a [1]). Some negligible charge is sufficient to stop the pressing the electrons out of Newtonian structures. However, it is a mistake to think that the VN in the space plasma structures affects nothing. The asymptotic paradoxes associated with VN have been discussed in [1] and are being considered in this part (part 2) of the work. For the charged structures in the gas-discharge plasma, the spatial charge forms an electric field profile, more heating the electrons of the charged structure shell in comparison with the ions and nucleons [1]. As a result, there appear some arcs, lightning, and other nonequilibrium cumulative–dissipative structures [1] with the lateral dimensions much less than the longitudinal ones self-focused by the radial electric fields. Thus, in lightning (a positively charged CD structure), the dagger-shape parameter $\zeta = D/L \sim 10^{-4}$ or 10^{-4} (here, D is the lightning's diameter ~0.1 m, and L is the lightning's length ~1 km). Notice that the dagger-shape parameter in neutral flows is usually not more than 0.1 and only in the charged self-focusing structures ζ is many times less. In the structure presented in Fig. 5, the value of ζ is $\sim 10^{-2}$ (for the visible areas). This fact shows that, by the dagger-shape parameter, we are probably dealing in galaxy M 87 with a huge (1.5 kps) coulomb positively charged CD structure—a jet similar to the lightning or CD structures in Figs. 1–4 [1] ($\zeta \sim 10^{-3}$ for lightning). The self-cumulation of the positively charged CD structure by the focusing electrons is described in [1] (Fig. 5a [1]). The distinction of the charged CD structures from the gravitational structures is in the much more powerful self-focusing of the cylindrical charged flows [1]. In Fig. 5, it is seen that the stratification of the jet from the region of galaxy M 87 is as in the case of beaded lightning (Fig. 1 in [1]). It appears that, in charged space structures, as in the mesoworld (Fig. 1 in [1]), there can form Vysikaylo–Euler cumulation–libration points [1] when the jet is charged positively (or Lagrange libration points when the jet is none the less neutral).

Astronomers have calculated the mass of the black hole in the center of galaxy M 87. The monster mass turned out to be 6.6 billion times the Sun's mass. The greater the black hole, it generates a larger gravitation field and makes the stars revolve quicker. Using the 8-meter telescope of the Gemeni observatory on Hawaii, a team of American astronomers have measured the velocities of some stars in the central part of galaxy M 87, where one of the most probable locations of a black hole is. At the mean, the velocities turned out to be 500 km/s, being more than twice as much as the velocities of the stars in the Milky Way's center. The computed black hole's mass is striking. In comparison with it, the black hole in our galaxy's center looks innocent—it is only 4 million times as massive as the Sun. The black hole event horizon is 20 billion kilometers, that is, 4 times larger than Neptune's orbit and 3 times larger than Pluto's orbit. The conclusion is that such a hole can swallow our whole solar system. Evidently, such events happened not once during the history of that monster. The M 87 galaxy is situated relatively not far from us—at a distance of 50 million light years within the Virgo constellation. This is one of the largest galaxies in the universe. It is 2–3 trillion times as massive as the Sun. M 87 has another name—Virgo A. It has long been known as a powerful source of gamma and radio radiation. As early as 1918, astronomers discovered some luminous gas jets spurting with near-light velocity from the galactic center thousands of light years. An extremely compact object in the center of M 87, being most likely a black hole, is responsible for those violent processes. At present, the black hole in galaxy M 87 is the biggest one among those the mass of which is measured accurately enough. Is it the most massive? Certainly not. Astrophysicists are going to continue the measurements of black holes, and the next object has a mass estimated now as 18 billion solar masses. It is situated over-

whelmingly farther in the center of a galaxy at a distance of 3.5 billion light years.

The function of a positively charged jet (a trunk from the BN in M 87) can consist in speeding the electrons focused into a jet (within this accelerator, linear for the electrons, see Fig. 5) up to the energies sufficient for the electrons to penetrate into the inner part of the BH and the following compensation of the BH's spatial charge and throwing a part of the BH's protons through this trunk out of the limits of the event horizon of the nonrotating (Schwarzschild) BH. It is quite impossible to explain this paradox in detail in the context of the neutral models of BHs.

Some other paradoxes often appear when the members with higher derivatives are excluded: this takes place in the case of the processes with viscosity and the processes with the violation of viscosity and with inertance. Astrophysicists prefer to be concerned with dark forces, material, and energy but not with asymptotic paradoxes caused by the violation of neutrality of the cosmic medium.

CONCLUSIONS

Thus, not only Turing–Kolmogorov–Prigozhin diffusive dissipative structures [2–4] but also Vysikaylo convective cumulative–dissipative structures (CDS) with limited cumulation of the energy–mass–impulse flows [1, 8–10, 17, 19–21, 24] exist in nature. The dualism of the processes of the cumulation and dissipation is often ignored by the investigators. Some of them see only dissociation (recession, the big bang, the Turing–Kolmogorov–Prigozhin diffusive synergetics), while others see only cumulation and do not notice dissipation (Bezant, Raleigh, Lavrent'ev, Pokrovskii, Nigmatulin, et al.). E.I. Zababakhin appears to be the first to pay attention to the reasons for the destruction of unlimited cumulation, when new degrees of freedom (NDF) are enhanced or the generation of centrifugal "mirrors." The community does not always understand that the process of unlimited cumulation is invariably dual. Thus, a deep insight into the dual processes in the pulsing (nonhydrostatic) CDS is set forth even in the Bible, the thesis on a time to gather stones together and a time to cast away stones. However, a general idea on the essence of the nonhydrostatic CDS (in particular, of pulsars) so far eludes even the leading astrophysicists with perfect knowledge of the laws in the Kepler problem but not accepting the fact of the formation of coulomb "mirrors" in the case of the collapse of mass into quantum stars.

The analysis of the motion of the bodies (some point ones and a rotating converging liquid ring [11]) within the central field of force allows the author to conclude that there exist hydrostatic and pulsing CD structures in nature. In the hydrostatic structures, the forces acting on a body are always balanced out by each other, and the interference of them leads to the rest, uniform and rectilinear revolution of the body strictly in a circle. The structures with excess energy (or mass that may be present as an equivalent of energy) belong to the second type. In them, the balance is essentially determined not only by the forces acting on the body but also by the body's mass and its acceleration. In these nonhydrostatic structures, the external forces could not be balanced by each other and interfere (only three together) with the inertial member am, where a is the acceleration of the body, and m is its mass. These things seemed to be apparent, but it is because of the incomprehension of the reason for the existence of pulsars with some mean density many times larger than the density of white dwarves some notions on neutron stars only with "flashlights" (narrow rays) have appeared [18]. Perhaps, some pulsars are caused by the magnetic traps or "mirrors" generating these flashlights (rays), but the radial pulsation of the mass of dense quantum stars (with the generation of coulomb "mirrors") should certainly manifest itself in the Cosmos as well! This process with the collapse of normal Newtonian stars corresponds to the dynamic formation of coulomb crystal ion supralattices with a Fermi gas around them. Hydrostatic coulomb lattices with a Fermi gas of electrons are realized in base metals and thus in hydrostatic white dwarves and hydrostatic neutron stars. Only the model proposed by the author explains the stability of neutron stars in relation to the β-disintegration of the neutrons on the surface of neutron stars and the stability of white dwarves in relation to the carry over of the high energy electrons with the kinetic energy of ≈1 MeV from the surface of any dwarves but not formal invocations that the degenerated electron gas hinders the further compression of an absolutely neutral star. Something should hold this gas with great kinetic energy much more than the potential energy of an electron at infinity from a quantum star. In all these cases, some standing shock wave of the electric field is generated on the surface of the charged CD structure (Figs. 2 and 5 [1]) maintaining in the star the electron gas with the mean kinetic energy much greater than the potential gravitational energy of the electrons. It should be noted that precisely the state of the charge of a black hole permits a proton beam to escape from its grasp when the atomic nuclei of the Newtonian stars are disintegrated and the neutrons are absorbed by the black hole. This is the explanation for the proton jet presented in Fig. 5. On the other hand, the electrons are focused into this positively charged "trunk"; pick up speed in the linear accelerator up to the velocities of light; penetrate into the depths of the BH; and thus save it (positively charged) from a coulomb explosion with a bright splash or catastrophic burst, which can destroy mice and men on the Earth. In quantum stars, as in atomic nuclei, the enormous kinetic energy of the electrons is focused by the shock waves of the electric

field, and, in black holes, this energy is billions of times more.

The classification of possible CD processes and the revelation of the cascades of them is the most important subject in order to understand the dynamics of complex CD systems and the whole universe. The investigation of the analogs in the physics of CD structures permits both one to generalize and verify models, knowledge, and even paradigms within a wide sphere of natural sciences. The Rutherford atom model and the Euler model on the generation of the libration–cumulation points between attractors are undoubtedly great discoveries favoring the quick advance of mankind towards knowledge of different worlds from femtodimensions up to the dimensions of galaxies and galactic clusters.

Astrophysicists always believed that their science could not be separated from physics and that there is no sharp boundary between them. However, in nuclear physics, there was long ago found out the phenomenon of the spatial charge cumulation in the atomic nucleus (with the atomic nucleus drop model being completely on par with the model of the crystal lattice formation, for instance, in metals). We know it from the experiments carried out by Rutherford. As for the astrophysicists, they do not inform us on the phenomena of the cumulation of charge, the electric field in quantum stars, and the formation of different (by nuclear composition) supracrystal lattices under the control of gravitation forces, as well as the formation of the electric field shock waves (jumps with the spatial charge) appearing at the interference of gravitation forces, inertia, and coulomb forces, though there long ago existed some indirect indicators of spatial charge cumulation—the generation of magnetic fields at the rotating CD structures of the Cosmos; various kinds of the "mysterious" winds (from the Sun and other stars), the true reasons for which are hitherto unknown; the cosmic rays consisting of positively charged atomic nuclei with an enormous energy up to $\sim 10^{20}$ eV; and the accelerated recession of galaxies (which are possibly charged by a positive charge). The concentration of stars is noticed in the arms of spiral galaxies.

The rotation revealing the cumulation and dissipation and structurally favoring at the cumulation the overflow of energy from all the degrees of freedom into rotation and pulsations is not the only true indicator of the cumulation and structural spiral turbulence with the hierarchic cascades of structures with the energy–mass–impulse flows and the selection of particles by their energy and density. The violation of neutrality is the same indicator of cumulation. We have shown that, as in the case of rotation, under certain conditions, there is possible the formation of jumps of spatial charge (the electric field shock waves discovered by Rutherford in atomic nuclei, by Gunn in semiconductors, and by Vysikaylo in gas-discharge plasma; see for greater detail [1]) and the overflow of all types of energy into electric energy (of the electric field) when the violation of neutrality is very small but its role in the organization of a structure is great. Precisely weak violation of neutrality at the level of 10^{-36} stops the gravitational cumulation of protons into stars (and even into black holes) and causes the generation of proton and ion winds from stars and even from black holes (Fig. 5). The violation of neutrality even at the level of 10^{-18} leads to the suppression of gravitation forces; the formation in quantum stars of huge ion lattices squeezed, as in metals, by a layer of degenerated electrons (Fig. 3); the possible recession of galaxies; and, at the level of 10^{-12}, to the formation of cosmic rays with energy up to 10^{20} eV and more; etc.

The simultaneous excitation in the complex hierarchic dynamic systems of rotation, pulsations, selection by energy and density, and the violation of neutrality leads to the generation of the third degree of freedom—the magnetic field. Thus, there is no need to invent any "mysterious" magnetic dynamo; there should be involved the interference of rotation and the violation of neutrality. The author states that the presence of a magnetic field is an indirect tenable indicator of the violation of neutrality and rotation and, consequently, of cumulation. The new degrees of freedom and similarity of the architecture of the cumulation, structural turbulence, and generation of "mirrors" reflecting the energy–mass–impulse converging flows in complex dynamic systems will be considered in some forthcoming works stemming from this paper.

Based on the experimental and theoretical investigations, the author argues against the general conclusion made by E.I. Zababakhin [11]: "in spite of the instability of the cumulation in continuous media, it remains to be a very useful idealization allowing one to obtain accurate solutions and pointing out how to attain practical aims but without counting on the self-focusing." It is the self-focusing of substance, energy, and external force and the reflection of the converging flows from one or another "mirror" appearing with the generation of the new degrees of freedom that are proved to be the basis for the formation of the cumulative–dissipative convective structures (discovered and studied by the author) with the limited [1, 8, 17, 19, 20] and even nonlimited [21] cumulation of the ψ_n-fanction of the electrons captured by the different cavities for the electron de Broglie waves. The cumulation in the nanoworld, mesoworld, and macroworld of the universe is the same and is performed by the most powerful coulomb forces. Three different kinds of cumulation by the coulomb forces have been studied in [1, 8, 17, 19–21]. The first kind is the common direct attraction between unlike charges discovered by Coulomb. With the quantum essence of the particles in dense stars, this kind results in the quantum-mechanical replacement of the electrons towards the quantum structure's periphery and the generation of

the second kind of cumulation—the generation of the surface tension or coulomb squeezing of the positively charged quantum CD structures by the high energy sharing or degenerated electrons (Fig. 3 and Figs. 1–5 in [1]). In this case, the degenerated electron Fermi gas and Fermi liquid do not stop the material's collapse as erroneously believed astrophysicists [18] but vice versa compress the inner parts of any polarized plasmoid through its surface tension (Fig. 3). With the polarized squeezing of the inner parts of the plasmoid structurize, an ion crystal forms in them, and now the external electron shells of the ions and the ion lattice restrain the further compression of the polarized material. In this case, the external pressure of the degenerated Fermi gas is established equal to the pressure restrained by the ion lattice or the external electron shells, and the degenerated electron de Broglie wave lengths on the average coincide with the mean de Broglie wave lengths of the ions and nucleons forming the ion lattice (this will be considered in detail in part 4 of the work). The third kind of the electron cumulation happens due to the formation of the Vysikaylo–Euler cumulation–libration points [1, 20] between two positively charged structures, being associated with the remote action of the coulomb potentials and the protruding soft walls focusing the flows of the electrons between the charged plasmoids precisely at this point (Figs. 1–3 [1]). The system of Vysikaylo—Euler libration points between charged plasmoids can form a plasma CD channel (Figs. 1 and 4 [1] or Fig. 5). As follows from experiments, the cumulation architecture is almost the same for any characteristic dimensions (Figs. 1–4 [1] and Fig. 5).

Due to the cumulation, there occurs an excitement of new degrees of freedom in CD structures (NDF—rotation, ionization, the excitement of the electron degrees of freedom, the violation of neutrality, etc.). The Vysikaylo cumulative–dissipative structures differ essentially from the diffusive structures discovered by Turing [2] by the ability to cumulate energy and to excite NDF. This especially shows up in dense stars (Fig. 5) and cathode spots [8] in which cumulative jets of positive ions are formed. These jets in the cathode spots perforate and break metal cathodes [8]. Here, Turing's models based only on the diffusive processes are irrelevant. There cannot take place any such phenomena within the Turing structures in principle as they dissipate energy. The processes of the external force cumulation were not considered in the works by Raleigh, Gooderley, Landau, Pokrovskii, M.A. Lavrent'ev, and Stanyukovich; they analyzed the cumulation of energy, impulses, and mass as a dynamic (inertial) process without any external force. In 1971, Kavai Naoto was the first to draw the static cumulation of some external force. This drawing of a concentric press and hence the static cumulation of an external force were described by Zababakhin in 1974 (see for more detail in [11]). The demolition of the unlimited cumulation because of the NDF enhancement (with the cumulation there takes place the reinforcement of the "mirrors" reflecting the converging energy–mass–impulse flows) was described in [11] by the example of the inertial and centrifugal "mirrors." (The centrifugal mirrors operate in 2D space, and the coulomb mirrors, as we have shown, work in 3D geometry [1, 8, 17, 19–21]). The discovery of the Vysikaylo cumulative–dissipative structures with the limited cumulation of the energy–mass–impulse flows is not traced in the works of the listed authors, as well as the fundamental work by Zel'dovich and Raizer [22] (see chapter 12 dedicated to some automodel processes in gas dynamics). In monograph [23], G.I. Barenblatt considered the problems on the strong explosion (the Taylor–Neiman problem) and the strong collapse (the Gooderley problem) as mirror problems, but, in this monograph, also cumulation is considered as an independent problem separated from dissipation. In [23], the synthesis (interference) of the cumulative and dissipative processes in one CD structure was investigated. The synthesis of the cumulative and dissipative processes with the formation of the generalized points, lines, and surfaces of libration (cumulation) of Vysikaylo–Euler has been considered only in works [1, 8, 17, 19–21, 24] dedicated to the cumulation architecture in dissipative structures. In monograph [24], there has been carried out the generalization of the Kepler problem on the motion of bodies within a central attracting force field [16]; the Zababakhin problem on a rotating converging shell [11]; the Lavrent'ev–Artsimovich problem; and, in particular, the problem on magnetic mirrors—probkotrons [25]. The work by Lagrange (1772) is undoubtedly the primary source for such generalizations. He has shown that the mass previously distributed in the form of a continuous medium within the region of two attractors revolving around some common mass center can focus (cumulate) within the area of some triangular libration points. The cumulation of the celestial medium is performed by the force potentials. Thus, in 1772, there was analytically predicted a family of asteroids (Trojans) within Jupiter's region. The discovery of Trojans in the vicinity of the triangular points of libration within the Sun–Jupiter system happened only in 1906. This phenomenon, discovered by Lagrange, may be considered as the first example of the discovery of the "self" cumulation of energy–mass–impulse flows into CD structures in a continuous celestial medium determined by the nonlinear self-organization of the external force and inertial fields from several gravitational attractors in a rotating system. The author states that similar a cumulation of mass, impulse, and energy (but now by electric fields) is performed anywhere by charged structures. The author thinks that similar cumulation by the electric potentials of mass, impulse, and energy is performed everywhere into charged or polarized structures. This is the answer to an enigma of the common surface tension observed in ordinary liquids (this subject is beyond the scope of this work).

The cumulation, as well as the dissipation (of energy, mass, impulse, charge, the electric field strength, etc.), is a general property of any continuous media causing the formation of the nonuniform cumulative–dissipative structures in dissipative media. The absolute neutrality of plasma is a myth limiting the description of an enormous number of "mysterious" phenomena in the micro-, meso-, and macroworld. The author states and proves in his works that precisely the self-organizing synergetic electric fields of the uncompensated charge of a huge number of ions (more inertial than electrons) determine the cumulative phenomena in plasma in laboratories (within cathode spots, Faraday dark spaces, strata, arcs, and electric cords [1, 8]), in the atmosphere (in lightning, blue jets, and giant jets), in the ionosphere (in sprites and elves), and in the Cosmos (in quantum stars and, apparently, in galaxies).

As the de Broglie wave length of an electron is much more than the de Broglie wave length of a nucleon or an atomic nucleus, with the temperature of them being the same, in the case of the material's condensation into quantum structures (in which the degeneration of the sharing electron gas takes place), there should inevitably happen the violation of neutrality, the formation of an ion lattice with almost zero kinetic energy of the nucleons, and the generation of huge peripheral electric fields heating the electrons up to tremendous kinetic energies corresponding to the kinetic energy of a Fermi gas. A part of the high energy electrons out of the ion lattice focus the plasmoid through the coulomb squeezing, thus appearing as the dynamic surface tension. The electric fields are effective catalyst elements for thermonuclear reactions, resulting in the neutralization of the material compressed by the gravitation on their surface squeezed by the electric field shock wave.

One should study and simulate the cumulative phenomena and self-organization of the electric synergetic fields in plasma (in plasmoids) and other continuous media on the basis of the fundamental works of Euler, Lagrange, Lomonosov, Taylor, Pokrovskii, Lavrent'ev, Zababakhin, Zel'dovich, and the Gauss law (not only of Turing and Prigozhin). One should not concern himself with some "pseudoscience" and artificially draw Turing–Prigozhin diffusion models for obviously convective cumulative phenomena with return couplings. It must be emphasized once more that the cumulative phenomena are associated with the characteristics of the medium itself and the property of the synergetic (joint for an enormous number of ions) fields to modify some neutral medium into a medium with a distributed spatial charge. The importance of the processes of cumulation and dissipation changes not in the very center of the attractor but within the region of the corona of one or another parameter determining a jump or potential barrier—a "mirror." We should carefully and thoroughly study the cascade processes of cumulation (focusing, implosion, collapse, accretion, etc.) and always the attending processes of dissipation of energy–mass–impulse flows in the complex hierarchic force fields generated by CD structures, including the force fields of the mass inertia. The author [24] was the first to prove that the rotation in the case of the cumulation of the energy–mass–impulse flows gradually captures not only the energy of the radial converging of the flows, which was established in [11], but any energy of the focusing system, including the steam condensation energy, the chemical energy generating heat, and the potential energy of the fields cumulating the rotating flows (pressure drop, temperature drop, thermonuclear energy generating heat, etc.) and even the potential energy of the falling flows within the external (of the attractor) force field orthogonal to the rotation plane [24]. The self-coordination of the energy–mass–impulse flows continuously entering the attractor zone and the flows already leaving this zone due to the reflection from the inertial "mirrors" unambiguously means the formation of stratified (with the rotation being spiral) rotating structures. In these structures, the cyclonic focusing flows coordinate their motion with the anticyclonic convective flows already thrown out of the attractor zone by the inertial forces [24]. The generalized "quasi-Cooper" CD structures in the meso- and macroworld form and develop in such a way. The coordination of the converging flows and those ones leaving the attractor zone within the attractor's eye region leads to the formation of pulsing spiral structures—the jumps of the dynamic parameters. Such structures can be observed everywhere: from the femto- to the macroworld. The author ranks these structures as 3-D structural cumulative–dissipative turbulence. These are ordinary cyclones, spiral galaxies, whirlpools with spiral arms, and other convection-wave structures [24].

In this work, on the basis of the interference of the cumulative processes caused by the gravitation and dissipative processes determined by the quantum properties of the particles with the half-integral spin and coulomb forces, there is confirmed in a new capacity Einstein's idea concerning the equivalence of mass and energy showing up as a similar functionality in the processes of the pulsations of the "excessive" energy in the generalized Kepler problem and the "excessive" mass in the Vysikaylo–Chandrasekhar problem on quantum (now being charged with the collapse and now neutralized with the extension) stars (hydrodynamic charged dwarves—pulsars). As a result, there is proposed some configuration of a new Vysikaylo thermonuclear reactor operating with synergetic (joint) electric fields generated for a brief moment in pulsars (nonhydrostatic quantum stars). Three indirect indicators of cumulation are mentioned in the paper: (1) the rotation, (2) the violation of neutrality, and (3) the generation of a magnetic field appearing with the rotation and the violation of neutrality. Two of them (the rotation and the violation of

neutrality) have been thoroughly investigated in [24] and in this work.

It should be concluded that the world around us is to a large extent one whole, self-coordinated and not only local processes of birth and dearth (with 0D geometry) govern in it but also the long-range synergetic electromagnetic and gravitational fields and intricately interfering in space and time nonlocal dual 2D and 3D processes of cumulation and dissipation causing radial pulsations of energy and mass in the hydrodynamic cumulative–dissipative structures, now neutral now polarizing, or charged CD structures.

REFERENCES

1. Vysikaylo, Ph.I., Detailed Elaboration and General Model of the Electron Treatment of Surfaces of Charged Plasmoids (from Atomic Nuclei to White Dwarves, Neutron Stars and Galactic Cores): Self-Condensation (Self-Constriction) and Classification of Charged Plasma Structures—Plasmoids. Part I. General Analysis of the Convective Cumulative-Dissipative Processes Caused by the Violation of Neutrality: Metastable Charged Plasmoids and Plasma Lenses, *Surf. Eng. Appl. Electrochem*, 2012, vol. 48, no. 1, pp. 11–21.
2. Turing, A.M., The Chemical Basis of the Morphogenesis, *Proc. Roy. Soc. B.*, 1952, vol. 273, pp. 37–71.
3. Prigozhin, I. and Stengers, I., *Vremya, khaos, kvant. K resheniyu paradoksa vremeni* (Time, Chaos, Quantum. On the Solution of the Clock Paradox), Moscow: Editorial URSS, 2003.
4. Kolmogorov, A.N., Petrovskii, I.G., and Piskunov, N.S., Investigation of the Equation of Diffusion Associated with the Substance Amount Growth and Application of it to Some Biological Problem, *Bull. MGU. Math. Mech.*, 1937, vol. 1, no. 6, pp. 1–26.
5. Velikhov, E.P. and Dykhne, A.M., Nonequilibrium Ionization Wave in Gas, *Trudy VII Mezhdunarodnogo simpoziuma po ionizatsionnym yavleniyam v gazakh* (Proc. VII Int. Symposium on Ionization Phenomena in Gases), Belgrad, 1965, p. 11.
6. Schottky, W., Diffusions Theorie der positive Saule, *Phys. Zeit.*, 1924, vol. 25, pp. 635–640.
7. Vysikaylo, Ph.I., Kuz'min, M.I., and Chekalin, B.V., Solution of the Gromeka–Lumb Equations on Perturbation Theory, *Matem. Mod.*, 2006, vol. 18, no. 12, pp. 52–66.
8. Vysikaylo, Ph.I., Electric Field Cumulation in Dissipative Structures of Gas–Discharge Plasmas, *Zh. Eksp. Teor. Fiz.*, 2004, vol. 98, no. 5, pp. 936–944.
9. Vysikaylo, Ph.I., Jumps of Parameters of the Non-Uniform Plasma Colliding with the Current, Caused by the Violation of Neutrality, *Fiz. Plasmy,* 1985, vol. 11, no. 10, pp. 1256–1261.
10. Babichev, V.N., Vysikaylo, Ph.I., Pis'mennyi, V.D., et al., Experimental Investigation of Ambipolar Drift of Plasma Agitated by a Bunch of Quick electrons, *Dokl. AN SSSR. Fiz.*, 1987, vol. 297, no. 4, pp. 833–836.
11. Zababakhin, E.I. and Zababakhin, I.E., *Yavleniya neogranichennoi kumulyatsii* (Phenomena of the Unlimited Cumulation), Moscow: Nauka, 1988.
12. Born, M., *Atomic Physics*, London: Blackie, 1935.
13. Chernin, A.D., *Zvezdy i fizika* (Stars and Physics), Moscow: Nauka, 1984.
14. Chernin, A.D., Dark Energy and the Universe Antigravitation, *Usp. Fiz. Nauk,* 2008, vol. 178, no. 3, pp. 267–300.
15. Lukash, V.N. and Rubakov, V.A., Dark Energy: Myths and Reality, *Usp. Fiz. Nauk*, 2008, vol. 178, no. 3, pp. 301–308.
16. Landau, L.D. and Lifshits, E.M., *Teoreticheskaya fizika* (Theoretical Physics), vol. 1 of *Mekhanika* (Mechanics), Moscow: FIZMATLIT, 2007.
17. Vysikaylo, Ph.I., Instability of the Focusing Mass, *Sbornik trudov Mezhdunarodnoi konferentsii MSS-09 "Transformatsiya voln, kogerentnye struktury i turbulentnost'"* (Proc. Int. Conf. MSS-09 "Transformation of Waves, Coherent Structures and Turbulence"), Moscow: LENARD, 2009.
18. Zasov, A.V. and Postnov, K.A., *Obshchaya astrofizika* (General Astrophysics), Fryazino: Vek 2, 2006.
19. Vysikaylo, Ph.I., Self-Organizing Jumps with Spatial Charge in Femto-, Nano-, Meso- and Macro-Structures. Physical Electronics, *Materialy V Vserossiiskoi konferentsii FE-2008* (Proc. V All-Russia Conf. FE-2008), Makhachkala: IPTs DGU, 2008, pp. 14–18.
20. Vysikaylo, Ph.I., The Analytic Calculation of Ionization-Drift Waves, (3D-Strata) of Nanosecond Discharges: the Determination of the Cathode Drop in Nanosecond Discharges According to the Number of Visualized Plasma Structures, *Surf. Eng. Appl. Electrochem.*, 2011, vol. 47, no. 2, pp. 139–144.
21. Vysikaylo, Ph.I., Cumulation of de Broglie Waves of Electrons, Endoions and Endoelectrons of Fullerenes, and Resonances in the Properties of Nanocomposite Materials with Spatial Charge Layers, *Surf. Eng. Appl. Electrochem.*, 2010, vol. 46, no. 6, pp. 547–557.
22. Zel'dovich, Ya.B. and Raizer, Yu.P., *Fizika udarnykh voln i vysokotemperaturnykh gidrodinamicheskikh yavlenii* (Physics of Shock Waves and High Temperature Hydrodynamic Phenomena), Moscow: Nauka, 1966.
23. Barenblatt, G.I., *Avtomodel'nye yavleniya—analiz razmernostei i skeiling* (Automodel Phenomena—the Analysis of Dimensions and Scaling), Dolgoprudnyi: Izdatel'skii dom "Intellekt", 2009.
24. Vysikaylo, Ph.I., *Arkhitektura kumulyatsii v dissipativnykh strukturakh* (Architecture of Cumulation in Dissipative Structures), Moscow: MFTI, 2009.
25. Artsimovich, L.A., *Elementarnaya fizika plazmy* (Fundamental Physics of Plasma), Moscow: Atomizdat, 1966.