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Vysikaylo's Cumulative-Dissipative Systems and their Configurator on the example of the Destruction of Asteroids by their Plasma Tail

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Abstract

Based on Vysikaylo's new paradigm of self-formation of androgynous cumulative-dissipative systems (CDS), we have proposed a mechanism that explains all phenomena observed in nature during lightning propagation and during the fall of the Chelyabinsk meteorite. These positively charged plasma CDS (+CDS), as we have established, are surrounded by Vysikaylo's incongruent shock waves of the electric field (VSW). We demonstrate that de Broglie waves of free electrons arising in the plasma tail behind the meteoroid behave similarly to electromagnetic waves in a laser. There, a cumulative jet of high-energy electrons (CJ) is formed, which breaks into the meteoroid, exploding it according to the Coulomb mechanism. The formation of VSW in the atmosphere is due to the peculiarities of the chemical kinetics of negative ions at the boundary of the plasma tail. The time of Vysikaylo-Poisson's structural turbulence, providing the formation of CJ in the plasma tail, was ≈ 1.5 s. We prove that de Broglie electron wave lasers with a cavity length of 30 km and a diameter of 18 m are realized in nature and can be described. This gives us grounds to use this mechanism to explain the joint organization of counter-flowing jets of protons from black holes and electrons directed into black holes. Thus, our cumulative-dissipative mechanism can explain the increase in the velocities of active neutron stars. We proposed and investigated a new 4D inertial-polarization-quantum cumulative-dissipative Vysikaylo's mechanism for fragmentation of meteoroids and asteroids (self-defense of the Earth from meteoroids) into simple ions and electrons. We proposed a mechanism for an external combustion engine with an efficiency of 50% and described in detail the Le Chatelier-Brown principle. In this paper, we present a new interdisciplinary approach that combines plasma physics, quantum theory, and atmospheric observations.

Keywords: Cumulative-Dissipative Systems; Entering and Runaway Electrons; Coulomb Explosion; Asteroid Fragmentation According to Vysikaylo.

Introduction

This year marks 12 years since "mysterious" destruction at an altitude of 23 km Chelyabinsk meteorite in 2013! The author (since 1985) offers to the scientific community and personally studies in detail a new (rather general) paradigm of physics, chemistry, biology, sociology and even economics [1-8]. This is the paradigm of self-formation, self-reinforcement and self-destruction of androgynous dual convective-cumulative-dissipative Vysikaylo's systems (CDS), which differ significantly from the diffusion-dissipative structures of Fisher-Kolmogorov-Turing-Prigogine. In diffusion-dissipative structures, the main processes are the processes of diffusion and the birth of elements of the environment, jointly organizing into diffusion-dissipative structures. Within the framework of mathematical models of dissipative structures, emergent events do not occur in them, the birth of new elements of the environment with new emergent properties, and, therefore, in principle, the generation of new degrees of freedom (NDF) does not occur. There is no energy resource for such processes of transformation of elements in such a model.

Energy resource for transformation of elements of the environment is implied in CDS. As a result of convective cumulation (self-focusing) of energy, mass and momentum flows (EMMF) from the external environment in the CDS, the birth, accumulation of energy in individual particles, their modification and even transmutation of elements of the environment occur [4-6]. Detailing of convective processes of cumulation of EMMF in CDS is a complex task [1-8]. In Vysikaylo's CDS, due to the co-organization of the opposite (dual) processes of 4D cumulation and 4D dissipation (release of activated elements into the environment), cumulation (generation) and strengthening of NDF can occur. Rotation has long been studied in the works of Euler, as NDF in gravitational attractors [8]. The co-organization of the opposite (dual) processes of 4D cumulation and 4D dissipation is a complex 8D dimensional problem that requires significant simplifications based on experimental observations of the formation and life activity of the 4D plasma cord behind the asteroid.

Newton was the first to apply a simplified approach to the description of gravitational cumulative phenomena, replacing the complex vortices of Descartes (Principia Philosophiae, 1644) with two gravitating points. Euler and Lagrange already understood that the problem of three gravitating bodies has no solution in the general case, and that phenomenology (simplifying the problem based on available experimental observations) should be used to understand the phenomena. Professors often consider such phenomenology to be speculative and do not treat it with due respect. They prefer to deal only with exact solutions of the Maxwell or Navier-Stokes equations. At the same time, they puff out their cheeks, turn up their noses with importance and for many years publish their nonsense about the charge of the Sun at 460 C (https://nnp.ucsd.edu/solar/), which does not undergo simple verification by experimental observations of the energies of protons in the region of the Earth's orbit. They do not understand that their models and equations do not take into account processes in which charged particles, when interacting in the cumulation region, can gain enormous energies (for example, in electron-electron collisions) and can move into the class of high-energy non-integrable particles that quickly leave, for example, +CDS. In plasma science, concepts of runaway electrons have appeared for over 100 years. Without taking into account runaway (non-integrable) electrons, it is impossible to determine the effective charge of the Sun and the entire heliosphere, as an example of +CDS.

In CDS, EMMF are modified (up to their physical or chemical transmutation) and then convective or diffusion ejection (emission) of CDS vital activity products occurs (Fig. 1). Using the heliosphere as an example, we investigated the hypothesis that stellar winds or cosmic rays are generated in positively charged stars (+CDS) and accelerated in their positively charged stellar spheres by electric field shock waves. Solar wind is a product of the vital activity of +CDS: the Sun and the entire heliosphere. The author formulated and investigated a new paradigm of synergetic (the science of the joint action of a huge number of particles): almost all systems around us with typical sizes from 10-15 to 1026 m are CDS. Based on Vysikaylo's new paradigm of self-formation of androgynous cumulative-dissipative systems, we proposed a mechanism that explains all phenomena observed in nature during the propagation of lightning [2], and all phenomena during the fall of the Chelyabinsk meteorite in the Russian Federation. The formation of +CDS is based on the structural co-organization of convective, diffusion, wave and opposite processes of cumulation (self-focusing) and dissipation of EMMF.

In this paper the author in details (on the basis of his paradigm) presents an unorthodox model explaining the fragmentation of meteoroids, in particular, the Chelyabinsk asteroid, in the Earth's atmosphere. The author proposes a new general mechanism based on the coherent behavior of de Broglie waves of electrons (like electromagnetic waves in a laser), cumulative-dissipative plasma systems (+CDS) and Coulomb explosions discovered by him. This model differs significantly from classical mechanical and aerodynamic models. The global goal of the author's work is to establish a general architecture of 4D cumulative and 4D dissipative processes co-organizing in CDS in various phenomena, from nuclear reactions, atmospheric plasma to interstellar lightning, using a generalized electrodynamic concept. The author offers bold ideas and tries to rethink long-observed and still "mysterious" phenomena using his new approach.

De Broglie suggested: "Particles can behave like waves". The author claims that the movement of free electrons in the plasma trail of the asteroid is similar to the movement of electromagnetic waves in a laser. As a result, a cumulative jet of high-energy electrons (CJ) occurs, which catches up with and explodes the asteroid. The time of Vysikaylo-Poisson's turbulent relaxation, which ensures the formation of CJ in the plasma tail behind the Chelyabinsk asteroid, was ≈ 1.5 s. These phenomena occur when the energetic threshold is reached. In the case of the Chelyabinsk asteroid, its energy was sufficient to form CJ that fragmented the asteroid when it hit from behind using a Coulomb explosion. We have calculated the velocities of meteoroids and asteroids necessary to generate such processes. We have proved that the virial theorem is performed in this process: half of the asteroid's total kinetic energy (converted into capacitor energy) is spent on creating a CJ catching up with the asteroid, and the other half is spent on ejecting positive ions along the plasma tail behind the meteoroid, in the direction opposite to its movement. The process of transforming the kinetic energy of the meteoroid into the energy of a radial capacitor and, during its breakdown, into the electric energy of a polarized electric cord - an analogue of linear lightning - is considered. Electrons escaping from the trail create a positive Coulomb barrier similar to that which occurs in ordinary lightning [2]. This barrier leads to radial self-focusing (cumulation) of the trail.

The general goal of my research is to prove: 1) when the parameters of impacts on the elements of the medium reach critical values, then in a continuous and not very continuous (Space) medium, the formation of Vysikaylo's cumulative-dissipative systems (CDS) occurs; 2) CDS have a fairly common architecture of cumulation of convective flows of energy, mass and momentum to the center of the CDS; 3) in this case, the processes of dissipation of flows transformed into CDS can be carried out both by convective ones with self-formation of various types of nozzles, and by diffusion processes [3]. In these structures, co-organization of 4D processes of cumulation and 4D dissipation of energy-mass-momentum flows occurs, while in the CDS there is an increase in rotation, violation of electroneutrality and generation

of an electromagnetic field [4]. Neutrons, atomic nuclei, atoms, molecules and their systems, a living cell of any organism, any animal and plant, lightning and tropical cyclones (bi-cyclones), toroidal rotation systems at libration points L1 between binary stars, including planets, stars, their systems, galaxies and their systems belong to CDS. The author proves that similar structural 3D cumulative and 3D dissipative phenomena are observed in positively charged structures with sizes from 10-15 to 1026 m [5,6]. These phenomena are accompanied by the formation of cumulative (electron) jets and oppositely directed flows (of positive ions). The duality of the flows of charged particles directed in opposite directions leads to a joint increase in the rotation of the opposite flows (with the fulfillment of the Helmholtz theorems) and their cumulation, according to Bernoulli's law. In such 8D cumulative-dissipative co-organization of opposite flows (in a bi-cyclone) lies the Vysikaylo's structural turbulence [4].

In order to achieve propulsion using a jet engine, various 3D forms of living organisms are used in nature. For example, the shape of fish leads to their longitudinal motion with a transverse movement of the tail. Here, fish have learned to apply the Navier-Stokes equation to translate orthogonal tail movements into longitudinal movement of the entire fish in water - a continuous medium. An octopus uses the formation of a jet stream for rapid movement. Here the octopus, by cumulating (compressing) the liquid inside its body, forms a cumulative jet from its organism. This is how a regular spherically symmetric rubber enema for microenemas with chamomile works. This is studied, in particular, by bionics. The movement of a jet aircraft is achieved by shifting the energy release in the combustion chamber of the fuel. In all these movements, a cumulative jet is formed due to the action of radial forces that form a cumulative jet. According to the given examples, the cumulation of energy-mass-momentum flows can occur in the form of three main types with: 1) spherical or conical (1/r2), 2) cylindrical (1/r) and 3) plane symmetries. The most effective cumulation is spherically symmetric.

The mechanism for the formation of a cumulative jet of high-energy electrons in lightning is analyzed in detail in [2,7,8]. Based on this, in this paper we have proposed and investigated for the first time a new 4D cumulative-dissipative inertial-polarization-wave mechanism for fragmentation of asteroid, meteoroid and comets. This mechanism is based on a similar behavior of electrons in pulsed lightning from negatively charged clouds [2]. The formation of a CJ in front of a pulsed lightning was studied in the experiments of Shenland [9]. A explanation for such behavior of lightning was first given in [2]. Based on the model [2] and the results of observations of the Chelyabinsk meteoroid, I developed a theoretical concept that explains all the accompanying processes. The role of the accelerator of the high-energy electron beam is performed by the plasma tail behind the asteroid. In lightning, this is similarly done by a self-focusing plasma positively charged cylinder, cumulating the energy, mass and momentum of charged particles [2]. The introduction of a beam of high-energy negatively charged electrons into the volume of the asteroid from behind leads to Coulomb spraying of the asteroid (to ions and electrons). Electrons are more mobile and leave the region of the Coulomb explosion. Thus, a positively charged plasmoid is formed in an electric field, the electrons of which are heated and the main part of the kinetic energy of the asteroid is converted into the energy of electrons and the energy of the electric capacitor formed due to the runaway of electrons. Due to the self-formation of the Vysikaylo's electric field shock waves surrounding and compressing the positively charged plasma tail, all products of the Coulomb explosion series are carried out along this resonator (tail) into the upper layers of the atmosphere. The mechanism of Vysikaylo's shock wave formation has been studied in detail from 1985 to the present [1-8].

Date and Methods Observations of Events Near Chelyabinsk

On 15 February 2013, NASA scientists reported that an explosion near Chelyabinsk. As is known [10], sensors installed on geostationary satellites operating in the interests of the US Department of Defense and Department of Energy can track both airborne nuclear explosions and measure the luminosity curves of fireballs burning up in the atmosphere. On 1 March 2013, NASA became aware of updated data on the total luminosity of the super-bolide, which amounted to E0 = 3.75 1014 J or 90 kt, from which, according to the empirical formula for the total energy of the explosion, follows E = 8.2508 E00.885, which is 440 kt. The speed of the fireball according to the same data at the moment of maximum brightness was 18.3 km/s, and the event occurred at an altitude of 23.3 km. The estimated mass and size of the meteoroid at a density of 3.6 t/m3 were 11,000 tons and a diameter of about 18 meters. NASA estimates that it is the largest known celestial body to hit Earth since the Tunguska meteorite fell in 1908. Where the bulk and energy of the meteoroid went is still a mystery to mechanical astrophysicists.

The accuracy of determining the energy of the Chelyabinsk meteorite explosion (February 15, 2013) depends on the method of evaluation and consideration of various factors. Scientific papers provide different estimates:

- According to NASA estimates - about 440 kilotons in TNT equivalent.
- According to RAS estimates - 100-200 kilotons.
- According to INASAN employees estimates - from 0.4 to 1.5 Mt in TNT equivalent.

To assess the phenomenon (energy and height of the explosion, Fig. 1), we select data provided by NASA.

Only Marat Akhmetvaleev, a nature lover of his region, and another photographer unknown to me managed to photograph and present to the public the unique details of this event (Fig. 1). Based on his photographs and our knowledge of the physics of the Vysikaylo's cumulative dissipative plasma systems (CDS), we will explain where the main part of the meteoroid went and how kinetic energy was dissipated in the atmosphere and ionosphere of the Earth. We detail the pulse-periodic mode of execution of the virial theorem.

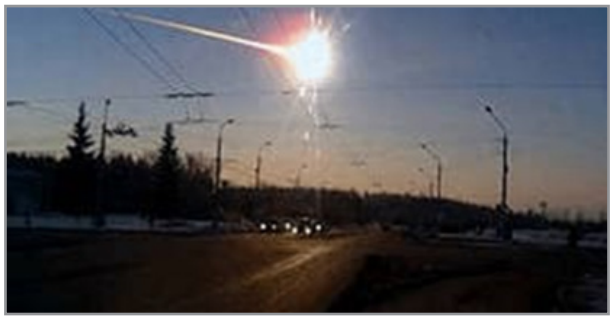

Figure 1: Photographic evidence of plasma cumulation in a meteoroid's wake. This is a photograph (Marat Akhmetvaleev, 2013) of the Coulomb explosion (see [8] for more details).

In photo 1 we see that the length of the plasma tail (L) significantly, by 1.5 times, exceeds the explosion height of 23 km, i.e. the length L ≈ 30 km. This indicates the existence of plasma for ~1.5 seconds after the passage of the meteoroid. The plasma does not dissipate as a neutral medium, but is focused by the forces of cylindrical cumulation, as in the case of linear cylindrical lightning. Of particular interest is the behavior of the meteoroid fragments (Fig. 1). They fly apart not only in different directions from the meteoroid, but also forward, accelerated by some force acting behind the meteoroid. This clearly indicates a new mechanism of meteoroid fragmentation. The speed of the meteoroid at the moment of its destruction is 18.3 km/s. This significantly exceeds the speed of any detonation waves of any explosives known to mankind. Therefore, such speeds can only occur in electron beams accelerating in an electric field following a meteoroid! These phenomena and interactions occur at the speed of light or close to this speed with an increase in the characteristic dimensions of positively charged Vysikaylo's cumulative-dissipative systems (+CDS) [2, 7, 8].

Several dozen witnesses reported that during the passage of the meteoroid, several minutes before the arrival of the shock wave, they heard a hissing sound similar to the sound of burning sparklers. This means that we are talking about the phenomenon of "electrophone ball lightning". This phenomenon can only be explained by the electromagnetic interaction of polarized charged system or the runaway electrons from +CDS such as lightning [2,8] (Fig. 1). These phenomena and interactions occur at the speed of light or close to it as the characteristic dimensions of these system increase.

A few days after the fall of the Chelyabinsk meteorite, there were reports of observations of anomalous noctilucent clouds at altitudes of 75-80 km. A similar phenomenon was observed in 1908 after the fall of the Tunguska meteorite. This time, ground observations of noctilucent clouds were confirmed by satellite data. Mechanical models cannot explain the release of water vapor from the meteoroid to such an altitude. As a result of the search for the remains of the meteorite, a mass was discovered that did not exceed 1 ton (~0.01% of the total mass of the meteoroid).

According to RIA News 03/21/2013, the Chelyabinsk fireball caused magnetic storms in the Earth's ionosphere, similar to storms that occur when solar wind penetrates into the Earth's ionosphere. According to IZMIRAN RF, the disturbances affected almost the entire ionosphere. Thus, fluctuations in the concentration of electrons in the F2 ionospheric layer (about 250 kilometers high) were recorded 5.5 h after the explosion at the ionospheric station in Yekaterinburg (Va = 10 m/s), 6 h later in Rostov-on-Don (Va = 79 m/s) and 7 h later in Moscow (Va = 60 m/s). The speed of longitudinal propagation of plasma disturbance along the trajectory of the meteoroid in the direction of Moscow (it was flying from Omsk) after its destruction is equal to 1,500 km/7 hours = 214 km/hour = 60 m/s. This speed is more than 4 times less than the speed of sound at altitudes from 20 to 500 km. This velocity corresponds well to the possible velocity of ambipolar drift in gas-plasma in breakdown fields [2]. Ambipolar drift in the plasma of an electropositive gas (using nitrogen as an example) has been well studied by the author and co-authors with an accuracy of up to 5% [11].

The disturbance zone was local—it was a long "tongue" moving westward, the width of which in the Yekaterinburg region was about 100 km, and on the Moscow-Rostov meridian was about 500-600 kilometers. Without considering the violation of electrical neutrality and the formation of cumulative oppositely directed jets of electrons and positive ions, none of the astrophysicists for 12 years could explain all these phenomena. Based on experimental observations, I prove that flows of charged particles in the atmosphere and ionosphere are created by electric fields due to the polarization of plasma in the wake of meteoroids and their speeds are determined by ambipolar drift [11]. The influence of magnetic fields is small compared to electric fields (by the parameter v/c).

Mechanical Models and Their Problems in Explaining the Phenomena of Meteoroid Destruction

The problem of the asteroid-comet threat has received considerable attention (in words). Scientific conferences are held, hundreds of articles and a number of books have been published see [12-19].

The state of the question of mechanical destruction of cosmic bodies upon entering the atmosphere in the times before the Chelyabinsk meteoroid was presented by the mechanic S.S. Grigoryan (Institute of Mechanics, Lomonosov Moscow State University, Moscow) in [16-18]. He made quantitative estimates of all the effects accompanying the motion of bodies in the atmosphere at cosmic speeds.

According to Bronshten [19]: "we still have a poor understanding of how the fragmentation process itself occurs. To clarify this issue, special experiments are needed...." And so we are presented with experiments of nature in the form of the Chelyabinsk meteoroid (Fig. 1).

Mechanics still do not have clear explanations for all the phenomena that were observed when the Chelyabinsk asteroid en-

tered the Earth's atmosphere. My research is based on electrical phenomena.

Comparison of Grigoryan's model (Fig. 2) with the photograph in Fig. 1 shows that:

- when a meteoroid disintegrates, its parts gain additional acceleration not only in the direction perpendicular to its velocity vector, but also in the direction of its motion. The meteoroid's velocity is 18.3 km/s. The propagation speed of detonation waves in explosives is significantly lower (less than 10 km/s). Within the framework of the mechanical model (Fig. 2), such behavior of the meteoroid explosion (Fig. 1) is inexplicable! To explain such behavior of the meteoroid's parts, something must be moving behind the meteoroid at speeds significantly exceeding the meteoroid's velocity (18.3 km/s). Only electrons can be such particles due to their low mass;
- the plasma tail (train) of the meteoroid in Fig. 1 clearly does not correspond to Grigoryan's mechanical model with an expanding tail (Fig. 2). All mechanical models fail to explain the clearly observed phenomenon of plasma cumulation in the meteoroid tail over 1.5 s (Fig. 1). According to the mechanical model, the characteristic size of the meteoroid tail should increase with the speed of the Mach shock wave (Fig. 2).
- Grigoryan's model does not take into account or discuss the virial theorem. According to this theorem, half of the meteoroid's potential energy should return to the region of its arrival. We describe this process in detail in the section "Introduction of asteroids and meteoroid bodies into the planet's atmosphere".

Comparison of photograph 1 with Fig. 2 shows the inadequacy of the Grigoryan's mechanical model to explain the photograph. Other modifications of his theory, including those made by Chernogor for other meteoroids [20,21], do not deserve close attention. His research led to the conclusion: "The role of the dust component of the plasma was insignificant" [21]. In his works, only Mach shock waves are considered. Mach shock waves compress bodies penetrating the Earth's atmosphere (Fig. 2), and thus destroy this body, acting on it from the front.

The author draws attention to the formation of Vysikaylo's shock waves of the electric field, leading to the action of CJ on such bodies from behind!

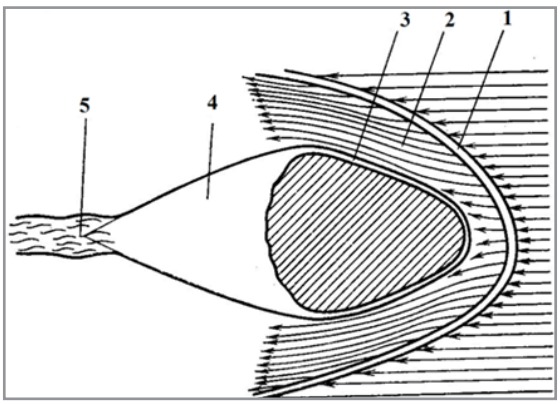

Figure 2: General 3D diagram of shock wave elements: 1 – shock wave front, 2 – shock (compressed) layer, 3 – boundary layer, 4 – stagnant zone, 5 – trail.

Vysikaylo's Classification of Shock Waves

In the modern world, there are three types of shock waves [3,22]:

- Mach's shock waves, also known as parameter jumps, in the field of gas dynamics. Their study began with his work of in 1881.
- magnetic field shock waves were described by R.Z. Sagdeev;
- shock waves of the electric field, described theoretically and experimentally in detail in [3,22-27]. Based on theoretical and experimental works on the study of Vysikaylo's shock waves of the electric field in gases, in this work we will formulate a model of Vysikaylo's incongruent shock waves in electronegative gases (air). These waves surrounded the plasma tail behind the Chelyabinsk asteroid and limited the radial expansion of the plasma and thus lead to the formation of a CJ, spraying the asteroid with a Coulomb explosion.

General Analysis of the Chelyabinsk's 2013 Meteoroid Phenomenon

According to NASA calculations, the Chelyabinsk meteoroid, about 18 meters in diameter and weighing 11,000 tons, entered the Earth's atmosphere at a speed of about 18.3 km/s and almost completely disappeared in the Earth's electronegative (air) atmosphere. The kinetic energy of the meteoroid is WM ≈ 2·1015 J. How was all this energy and mass of the meteoroid focused and where did they go? The destruction was a series of phenomena accompanied by the spread of shock waves and crackling sounds, creating the impression that someone was shooting at the meteoroid. This is also indicated by the features of the dispersion of the meteoroid parts in Fig. 1. The entire "West" does not have effective anti-missile defense against Russian supersonic missiles, the speed of which is only 2.7 km/s. And here the speed is 7 times higher (18.3 km/s). This is fast hypersonic (12.3 ÷ 30.7 km/s). Neither Russia nor Iran have achieved such speeds yet. This paper proposes a new mechanism for such missiles with 50% efficiency, but the author hopes that it will not be implemented for special purposes for another 20-30 years.

During this time, the elites of the USA, Russia and other countries will understand Hegel's law on the unity and struggle of opposites (and their mutual development and strengthening each other, not destruction), the generalized Lomonosov law (if the bankers' money has increased, then the people's children have

decreased in an equivalent amount) and will learn the generalized virial theorem for social CDS (it is necessary to share with the people equally, and not all (everything) to bankers and to their CDS). The cumulation and transmutation of capital in social CDS is subject to the same laws of CDS [28]. (Here in 2011 it is shown that there is no economy without politics! This book is an introduction to social statistical synergetics, which for the first time provides a method for the numerical analysis of many phenomena of accumulation, export and transmutation of human capital (potential, resource) into the personal wealth of oligarchs, bankers and officials. This is the author's first attempt to transfer economics from the field of humanities to the section of natural statistical sciences on cumulative-dissipative social systems, where money functions as the main field stimulating, multiplying and destroying human capital of states).

According to NASA estimates, 20% of the total energy of the meteoroid goes to radiation - 90 kt. This means that the energy of the meteoroid is used to destroy itself. The plasma tail not only wags the meteoroid (the dog), but also participates in its destruction. The mechanical model, in principle, cannot explain this phenomenon. The total energy received by air molecules due to collisions with a meteoroid during the entire flight of the meteoroid (before its destruction) does not exceed 8·106 J. Moreover, the energy received by one air molecule during a collision with a meteoroid is about 50 eV. This energy is sufficient for complete ionization and dissociation of all air molecules in the meteoroid's wake. In this case, the temperature of the electrons in the plasma tail of the meteoroid will be about 50-25 = 25 eV or 250÷300 thousand degrees. At this temperature, electrons leave the area of collision of air molecules with a meteoroid in a microsecond. Wake polarization occurs, in which a significant portion of the plasma energy in the wake of the meteoroid is retained in the form of potential Coulomb energy. Due to the polarization of the plasma in the meteoroid's wake, dynamic Coulomb surface tension is generated. This tension localizes energy in the plasma tail. This creates a cylindrically symmetrical tube of fully ionized plasma behind the meteoroid. The potential energy of a meteoroid at a small angle of entry into the Earth's gravitational field is no more than 1010 J. All these energies are significantly less than the kinetic energy of the meteoroid 2·1015 J and the radiation energy recorded by NASA - 4·1014 J. This means that the energy external to the meteoroid is not enough for such a glow, observed at the moment of its spraying. Thus, we, on the basis of the photograph in Fig.1, have proven that, according to the law of conservation of energy and the directions of explosion fragments in Fig.1, the mechanical model (Fig.2) in principle cannot explain such a spray of a meteoroid in all directions (at a speed greater than the speed of the meteoroid) (Fig.1).

General Analysis of Phenomena and Criticism of the Mechanical Model

We will consider in detail the problems of electrical phenomena indicated in [14]. In [14], many errors were made in the explanation, which we will dwell on in detail:

The appearance of noctilucent clouds at a height of 75 - 80 km after the destruction of the meteoroid was ignored in [14]. This was due to the lack of a decent model in mechanics for the cumulative transfer of positively charged ions to the upper layers of the atmosphere through a cylindrical plasma channel (Fig. 1). According to my model, they are dropped through a huge pipe that radially focuses the flows of positive ions to an altitude of 75-80 km.

The mechanism of obtaining an additional "mysterious" impulse by a number of meteoroid fragments in [14] is not explained. The additional "mysterious" impulse does not lead to the deceleration of all possible fragments in accordance with the action of the shock wave according to (Fig. 2), but to their powerful acceleration (see Fig. 1). The detonation velocity of octogen alone is 9.1 km/s, but this velocity is many times less than the meteoroid velocity. In plasma, only electrons have a velocity of more than 18 km/s. The author proves that it is the accelerating (runaway) electrons, which are formed into cumulative jets, overtaking the meteoroid by inertia, that cause all the recorded "mysterious" phenomena (Fig. 1).

In [14] it is not explained (ignored) the nature of the explosion that scattered parts of the meteoroid in different directions with enormous speeds, clearly exceeding the initial speed of the meteoroid as a whole (Fig. 1). Within the framework of the classical mechanical model, the meteoroid is compressed by the main shock wave from the front and sides (Fig. 2), and is not accelerated by it from behind! Such scattering of meteoroid fragments, as observed in Fig. 1, in principle cannot occur only due to compression of the meteoroid by the shock wave. To explain such an explosion (see Fig. 1), we formulated a new model of Coulomb initiation of fragmentation of the rear part of the meteoroid;

In [14] the characteristic time intervals are given: formation of turbulence (10-2 - 10-1 s), attachment of electrons to oxygen molecules and recombination with meteoric ions (10-2 - 10-1 s). The frequency of electron attachment to oxygen molecules is dissociative and is 4 orders of magnitude greater than that indicated in [14] and about 10-6 s. The lifetime of plasma in the meteoroid tail is 1.5 s. This clearly indicates the presence of not only dissipative (scattering) processes from the plasma tail, but also cumulative flows into the plasma tail, which cumulate energy, mass, momentum and angular momentum. The solution to this paradox is given in the section " Vysikaylo's incongruent shock wave of the electric field in the Earth's atmosphere and Vysikaylo-Poisson's turbulence".

in [14] the discussion of sudden, sometimes pulsating, local increase in the brightness of the bolide is ignored. I will quote the text from [29] in full: "At present, there is no gas-dynamic model of a bolide flare... Perhaps one of the causes of flares is fragmentation... The question of the nature of the flare can be resolved only by the joint efforts of observers and specialists in mathematical modeling."

The answers to these questions are based on the cumulation (self-focusing) of plasma flows and the formation of CJ [2,3, 7,8,11,22-27]). Here, a new cumulative-dissipative plasma-beam mechanism of Coulomb initiation and maintenance of cascade fragmentation of large meteoroids is proposed. The feedback mechanism is based on the phenomenon of coherence of de Broglie waves of electrons and ions in positively charged plasmoids in the electronegative atmosphere of the Earth. As a result of these phenomena, a beam of high-energy "runaway" electrons is formed, penetrating the meteoroid from behind.

This leads to a Coulomb explosion of a part of the meteoroid. At the first moment when electrons in CJ hit the meteoroid, it is weakly fragmented, since the energy concentrated in the air is insufficient. When the mechanism of acceleration of small parts of the meteoroid by CJ is turned on, they can move faster than the main meteoroid (Fig. 1). The cumulation of all the kinetic energy of powerful explosions of small meteoroid particles and its transformation into the energy of electrons falling into the meteoroid closes the feedback loop in the process of Coulomb fragmentation. This energy already corresponds to the density of the meteoroid and is ~ 200 eV per meteoroid atom. This leads to a catastrophic fragmentation of the meteoroid. Its parts explode and are completely ionized. By the virial theorem, ½ of the potential and internal energy of the plasma trail returns to the meteoroid, and the other half is ejected into the upper layers of the atmosphere through a channel with plasma self-focusing.

The presence of explosions of small fragments behind the meteoroid and the transformation of their energy into the energy of CJ electrons contributes to the further destruction of the meteoroid, changes in its trajectory and even the acceleration of its fall. According to this scheme, a self-organizing pulsed plasma jet engine with an efficiency of 50%, sparkling with radiation (Fig. 1), is formed behind the fast-moving object, dropping mass due to the fragmentation of the back side of the meteoroid;

In [14] the mechanisms that ensure the fulfillment of the virial theorem or Newton's third law in a continuous medium (air) when a meteoroid penetrates at a speed of about 10 km/s - 70 km/s into the Earth's atmosphere and "mysteriously" disappears before reaching the surface of the Earth have not been studied.

In explaining the electrophonic effect in [14], Gauss's theorem in 3D space is ignored. I am detailing point. The electrophonic effect is understood as the audibility of crackling sounds by a person at large distances from the meteoroid and long before the acoustic disturbance created by the body's movement reaches the observer. It is believed that the theory of this three-dimensional phenomenon, occurring at a speed close to the speed of light, has not been developed in detail [14]. The basics of this theory are presented in the work [2, 3, 7, 8, 22], based on coherent phenomena in the case of a violation of electrical neutrality in the meteoroid's trail. According to the erroneous ideas in [14] (based mainly on the mechanical model), there are two (I and II) probable mechanisms that can qualitatively explain the electrophonic effect that was observed by several eyewitnesses of the phenomenon in Chelyabinsk in 2013.

According to [14], when a cosmic body falls in the atmosphere, it becomes electrified. This causes a charge of the opposite sign to flow down from the Earth's surface. The process is accompanied by an acoustic effect. According to estimates in [14], the charge leakage begins at a field strength of about several kV/m, and in the case of the Chelyabinsk meteorite, the intensity reached 0.5–5 MV/m.

In this mechanism, the author [14] does not take into account that fields with an intensity of 0.5–5 MV/m are formed quasi-stationary only in the meteoroid area. I note that these fields at an altitude of 20 km are 50 times higher than the breakdown fields. Even with nanosecond discharges, the breakdown values of the E/N parameter can only be increased by 2 times to 150 Td. At distances L of about 20 km or more from the meteoroid, the electric fields from the meteoroid become negligibly small due to the geometric reduction coefficient following from the Gauss theorem, $\xi = (R/L)2 \approx 10\text{-}6$. There will be no “chirping” from these fields at distances L ~ 23 km (or more). In Moscow, there is the Lenin Institute of Higher Power Engineering, which has a setup that imitates lightning. There the electric field strength is of the same order (~3 MV/m), and its dimensions are about 10 m, but Moscow residents, even on the next street, do not experience any “chirping” in their ears.

According to [14]: "Electromagnetic waves of the sound range are transformed into sound due to the piezoelectric effect in objects surrounding the observer or in the person himself. At a frequency of f ~ 1 kHz, the electric field strength should be no less than hundreds of V/m. Such fields arise on the surface of the earth with a current strength in the trace of I = 5*104 A." Here in [14] there is a trace along which "mysterious" currents flow, which in principle cannot be in its initially neutral mechanistic model without consider the electrical imbalance in the trace. Such a sharp transition from a mechanical model to a cylindrical and electrodynamic model with currents looks somewhat strange when explaining the electrophonic effect. In mechanism II, author [14] relies on Tesla's frequency discharge and again sets the necessary condition for "chirping" - more than 100 V/m, which, in principle, is not realized according to the mechanical model at distances more than 23 km from the meteoroid due to the same geometric reduction coefficient $\xi \approx 10\text{-}6$. And in this case, author [14] does not take into account the size of the plasma positively charged tail of about 30 km, observed in Fig. 1.

During the Chelyabinsk meteorite, the electrophonic effect was observed at a distance of more than 23 kilometers. Two mechanisms proposed in [14] based on the neutral mechanical model do not explain the observed phenomenon due to the small spatial coefficient $\xi \approx 10\text{-}6$.

All two mechanisms of the electrophonic effect proposed by the author in [14] do not stand up to criticism. This always happens when the researcher does not understand the essence of the main phenomenon. Therefore, all the phenomena in [14] are not collected into a single picture. The author of [14] is forced to throw out some of the phenomena. He does not discuss and does not understand the phenomenon of periodic powerful fragmentation of the meteoroid, which is accompanied by explosions (as if someone is shooting at the meteoroid with a machine gun) and a simultaneous pulsed increase in the brightness of the glow of the fireball. In the work [14], the author does not mention this main problem of all mechanical models. They cannot explain the main pulse phenomena caused by detonation (shock) waves of electron gas in plasma in a positively charged trace of the meteoroid at 30 km. The speed of detonation waves of electron gas is several times greater than the speed of the meteoroid.

With the “arrival” of such amateurs of their region as Marat Akhmetvaleev(https://uraloved.ru/foto-marata-ahmetvaleeva?ysclid=lpig4qi5dl786130180) and others in the research field, the current state of the problem of the destruction of large cosmic bodies upon entering the Earth’s atmosphere has shone with renewed vigor (Fig. 1). This completely new phenome-

non falls outside the framework of the mechanical model. To describe the photographically recorded phenomena, we need to use synergetics (coherent processes) in plasma dynamics in the entire (30 km) tail of meteoroids or asteroids, see [8] and [2,3,7].

Coulomb Self-Focusing of a Plasma Trail

If the speed of the asteroid reaches 20 km/s, then the energy that the air molecules receive is approximately 50 eV. An energy of 50 eV per molecule is sufficient for complete dissociation and ionization of molecules and atoms. About 20 eV remain for each electron. The air (in the form of a plume) becomes an electropositive gas in which electrons are not attached to atoms. Electrons, as a more mobile gas, leave the plasma plume faster than positive ions. This is how the plasma is polarized behind the meteoroid and a potential Coulomb radial barrier for electrons is formed (Fig. 3). The radial potential blocking the movement of electrons in the radial direction increases logarithmically depending on the effective length of the cylindrical positively charged plasmoid. Outside the plasma trail, the electrons lose energy and stick to oxygen molecules. In this case, a layer of negative ions is formed, which move into the positively charged plasma trail at a significantly lower speed. Negative ions cumulate entering into the plasma trail with excited plasma are destroyed and electrons are released. This leads to the cumulation of the plasma tail. These electrons are affected by the 3D electric field of a positively charged cylindrical column. The radial component cumulates the electrons to the center of cumulation, and the longitudinal field behind the meteoroid accelerates them to catch up with the meteoroid. This further cumulates plasma in the tail behind the meteoroid. In the area limited by the positively charged cylindrical radial barrier with the Coulomb potential, not only all the kinetic energy received by the air molecules is concentrated, but also the kinetic energy of the meteoroid's parts during its gradual and then catastrophic destruction. The self-focusing plasma column with high conductivity participates in the 4D scattering of all the kinetic energy of the meteoroid. (The return of negative ions to the plasma tail of the meteoroid is carried out at the speed of the negative ions). Self-focusing of highly conductive plasma structures allows to extend relaxation processes hundreds of times (up to 1.5 seconds) and return half of the kinetic energy of the entire meteorite through a cylindrical plasma channel to the upper layers of the atmosphere and ionosphere. This explains the influence of the meteoroid tail on the parameters of the ionosphere and demonstrates a three-dimensional structural implementation of the virial theorem in a pulse-periodic process.

Coulomb self-focusing is observed in various plasma formations, from atoms and molecules to electric arcs, lightning, meteor trails and intergalactic lightning. In cylindrical systems, transverse electric fields effectively cumulate electrons toward the center. Longitudinal electric fields, although weaker but longer, form and accelerate cumulative flows in the plasma trail along the trajectory of the meteoroid. In a gas discharge or linear lightning, electrons move toward the anode by a similar principle. In a plasmoid limited by the Coulomb potential, electrons collide during complete ionization of atoms, transferring energy to the tail of the velocity distribution. The high energy of electrons leaving the plasmoid causes electrophonic effects when meteoroids enter the Earth's atmosphere.

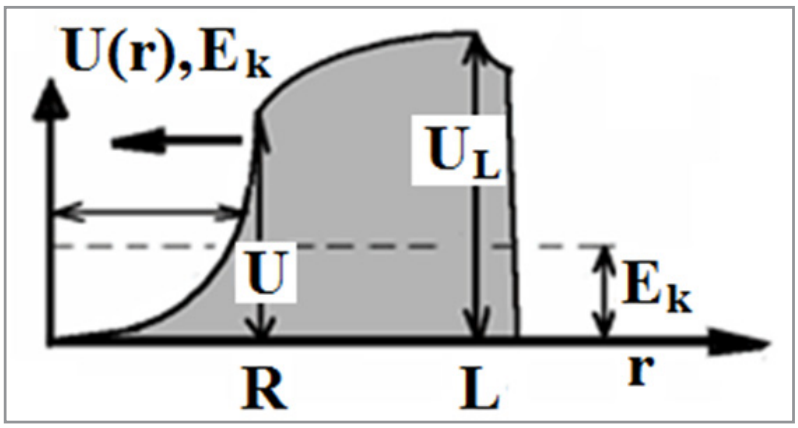

Figure 3: This is a potential barrier U(r) for electrons in a cylindrical plasmoid with a positive charge. The characteristic transverse size of the potential well in this case is greater than the radius of the system and is determined by its length (≈ L), and not by the radius (R).

Coulomb Mechanism of Meteoroid (asteroid) Fragmentation

The plasma tail behind the meteoroid transmutes the kinetic energy of the asteroid into the electric energy of the cylindrical capacitor. The positively charged cylindrical polarized tail grows linearly with the velocity of the asteroid. The radial capacitor is therefore broken through by a CJ. CJ behaves coherently, like laser radiation. Electrons catching up with the meteoroid periodically explode it and accelerate parts, including the asteroid itself. We estimated the parameters of the electron beam for lightning (~5 MeV) and the plasma tail of the Chelyabinsk asteroid (~100 GeV).

1/2 of the kinetic energy of the asteroid is spent on acceleration and destruction of fragments by the CJ, the other ½ is spent on the emission of positive ions into the upper layers of the atmosphere (up to 70-80 km) along the cylindrical trail. Our research explains all the phenomena observed during the destruction of the Chelyabinsk asteroid at an altitude of 23 km.

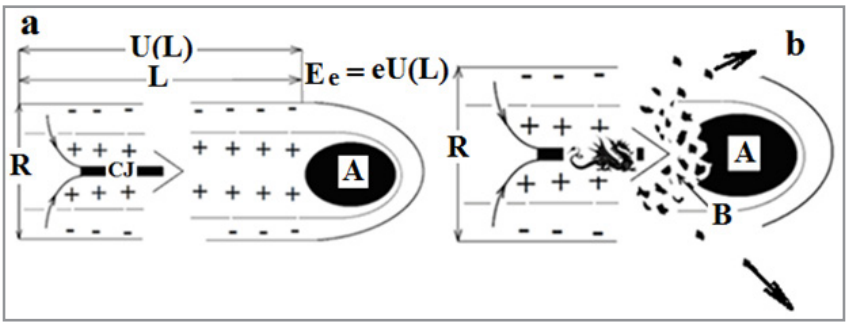

Figure 4: 2D diagram: a) in Vysikaylo's gun, the spatial charge (polarization) of the plasma behind a fast-moving object – A in the medium is divided. This division is indicated by the signs "+" and "-". A positively charged plasma column forms a CJ, transforming the energy of polarization (the energy of the asteroid) into the energy of the CJ; b) a new method of destruction of meteoric bodies based on the cumulative plasma mechanism of fractal fragmentation. This mechanism is triggered by Coulomb explosions. B - these are fragments that explode and create a jet thrust behind object A, simultaneously destroying it from behind.

Cumulative-Dissipative Systems

In nature, convective cumulation (focusing) processes were discovered long ago. Gravitational cumulation processes were studied by Newton, Kepler, Euler (1767), Lagrange (1772), Besant (1858), Rayleigh (1917), Guderli (1942, compression shock wave), Zababakhin (1965) and others. We are most interested in the studies of unlimited cumulation processes in the works of E I Zababakhin [30]. In the conclusion of this book, the authors (V A Simonenko) say that "despite the instability of cumulation in continuous media, it remains a very useful idealization that allows one to find exact solutions and indicates how to approach it in practice, without relying, however, on self-focusing" [30,31]. And now, more than 36 years have passed, and we are successfully solving the problems of self-focusing (cumulation) of electrons de Broglie waves in quantum resonators in the most "subtle experiments", both at the level of nanometer sizes, and also in the mesoworld of huge plasma trails behind meteorites penetrating the Earth's atmosphere. Atomism and the associated size limit indicated in the works of Zababakhin are already coming to the forefront and have even been overcome in nuclear physics [32]. But the definition given by Ya.B. Zeldovich to the concept of cumulation for continuous media remains a very useful and fairly general definition of this phenomenon, observed from the femtoworld of atomic nuclei to the world of stars and galaxies. "Cumulation, that is, the concentration of force, energy or other physical quantity in a small volume, is the most important phenomenon of nature," asserted Ya. B. Zeldovich in his preface to the book "Phenomena of Unlimited Cumulation" [30]. The definition of cumulation given by Ya. B. Zeldovich is the most successful, clear and at the same time quite complete definition of the phenomenon of self-focusing in natural, physical, social, political, economic and other phenomena and the Vysikaylo's CDS formed by them, which differ significantly from the dissipative structures of Prigogine-Turing-Kolmogorov-Fisher [2,3,7,8,11,22-27].

E I Zababakhin was the closest to the discovery of cumulative-dissipative systems (CDS), which differ significantly from Prigogine's dissipative structures (PDS). PDS are formed by diffusion and birth processes. CDS are formed by convective and diffusion processes of self-focusing of energy, mass and momentum flows. During cumulation, new degrees of freedom are excited: 1) rotation, 2) violation of electroneutrality and 3) generation of electromagnetic fields. CDS exist as a result of structural dissipation of a certain energy source and therefore belong to a new class of dissipative systems discovered by Vysikaylo [2,3,8,11,22-27].

Architecture and Super-Properties of the Vysikaylo's Cumulative-Dissipative Systems

CDS have long been observed in nature (Fig. 5a, b). However, these phenomena were considered paradoxical, since they had no explanation. We have dealt with these CDS self-focusing phenomena in experiments specially organized by Vysikaylo with a locally disturbed plasma by a beam of fast electrons. We analytically discovered and then experimentally photographed the self-formation of Vysikaylo's plasma nozzles and shock waves (Fig. 5c). As predicted analytically and numerically in our works, the length of the Vysikaylo's shock wave of the electric field depends significantly on the discharge current (Fig. 5c). In the photographs (Fig. 5c) we see that as the discharge current increases in the tube, a brightly glowing ellipsoid is formed with dynamic surface tension clearly cumulating the shock wave to its center. We observe similar self-focusing structures in Fig. 5a (bead lightning) and b (structured plasma jet in the region of the galaxy M 87. Only a proton stream (analogous to the solar wind from the positively charged Sun) could shoot out from the center of the M 87 galaxy, and electrons are focused and accelerated to light speeds around this structured stream. This is how Vysikaylo's CDS are formed in intergalactic lightning. This problem will be solved in more detail in a separate paper. The basic provisions of the theory of gravitational structures were presented in the works of Euler, Lagrange, Roche (Fig. 6). The Kepler problem has long been solved in the general case for the Coulomb and gravitational potentials. However, the discovery of cumulation and libration points in plasma between positively charged systems (Fig. 5) was discovered by me in 2009. Here we will analyze the architecture of the cumulation and dissipation processes in Vysikaylo's CDS based on Fig. 6. To do this, we will mentally fill the Roche lobe (cavity) of the Sun and Jupiter (Fig. 6) with ordinary dust and hit the dust (in the Roche lobe) to the left of the Sun with a large palm. The dust will move in the direction of the Roche lobe of Jupiter. After passing the dust particles through the region of the Sun, the equipotential will focus at the cumulation point L1. This means that the points discovered by Euler (1767) are not libration (Lagrange) points, but are in fact Euler's cumulation points [7]. After passing the cumulation point L1, dust flows from the solar Roche lobe penetrate into the Roche region of Jupiter and expand there.

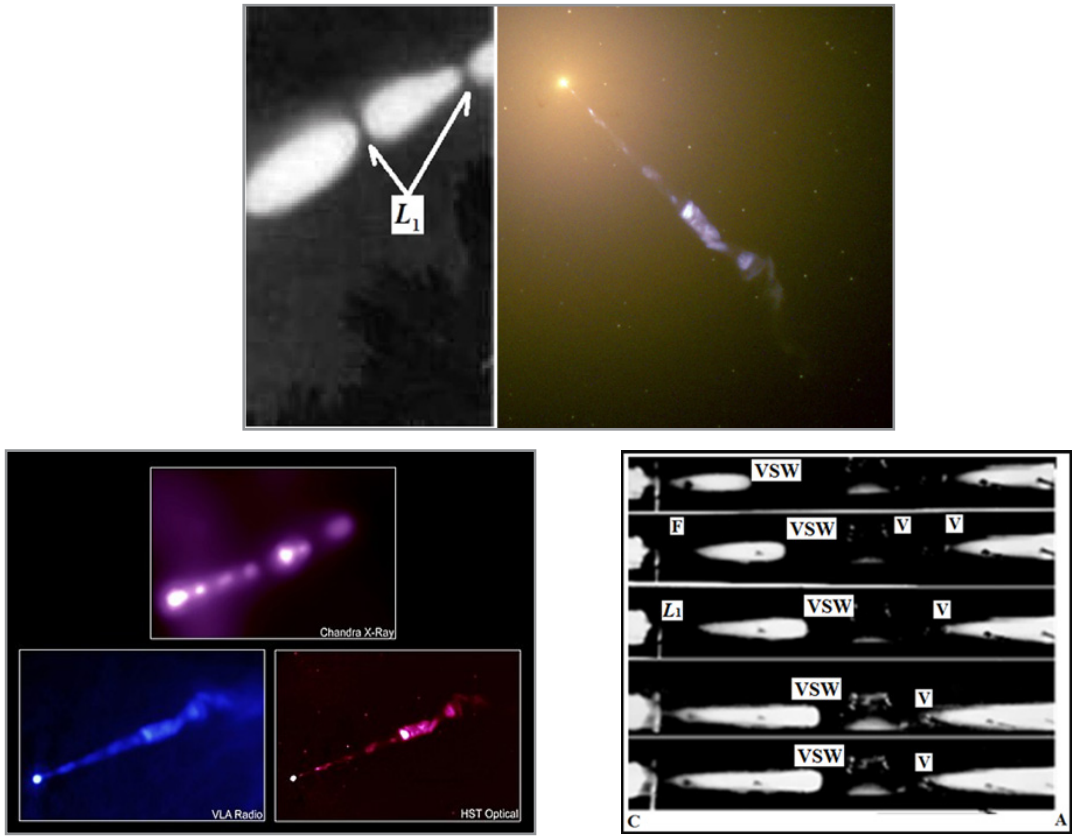

Figure 5: Photo of energy cumulation due to dynamic surface tension in plasmoids:
a) dotted lightning in the electronegative Earth's atmosphere. L1 – Vysikaylo's cumulation points [2,3,7];
b) The central region of the M 87 galaxy with an active nucleus. Jet size ~ 1.5 kpc. Hubble Telescope (NASA). We observe jet stratification and formation of cumulation regions;
c) Photographic evidence of formation of shock waves – VSW and Vysikaylo's plasma nozzles – V (in plasma with current) [1,3].

The formation of Vysikaylo's bicyclones, discovered in [4,7,33], can also be explained based on the Euler-Vysikaylo's model (Fig. 6). To do this, it is necessary to simultaneously hit the dust with large "palms" from opposite sides on the Roche lobes. In this case, dust from the Roche lobe of the Sun will penetrate into the Roche lobe of Jupiter, and dust from the Roche lobe of Jupiter will tend to get into the Roche lobe of the Sun. This problem of the frontal collision of dust flows from the Roche lobe of the Sun and Jupiter at the cumulation point L1 is solved in 4D space-time by generating rotation of these flows in opposite directions. Such bicyclones with constrictions in L1 are complete analogues of Cooper pairs discovered in the nanoworld, so the author called such bicyclones quasi-Cooper bicyclones. The idea of the joint organization of Cooper pairs led to the discovery of quasi-Cooper cyclones or Vysikaylo's bicyclones in the micro-, meso- and macroworlds. On this basis, the joint co-organization of cyclonic and anticyclonic flows into a single system, a bicyclone, was discovered. Double currents enhance each other's rotation and transform any kinetic and potential energy into rotation, distributing these energies equally between cyclonic and anticyclonic movements. The idea of such a joint organization of double convective (not diffusion) flows made it possible to discover Vysikaylo's structural turbulence and to explain and describe analytically all the phenomena observed during the formation of tropical cyclones [4,7,33] (these phenomena observed in nature are collected in the works of Erokhin and Artekha).

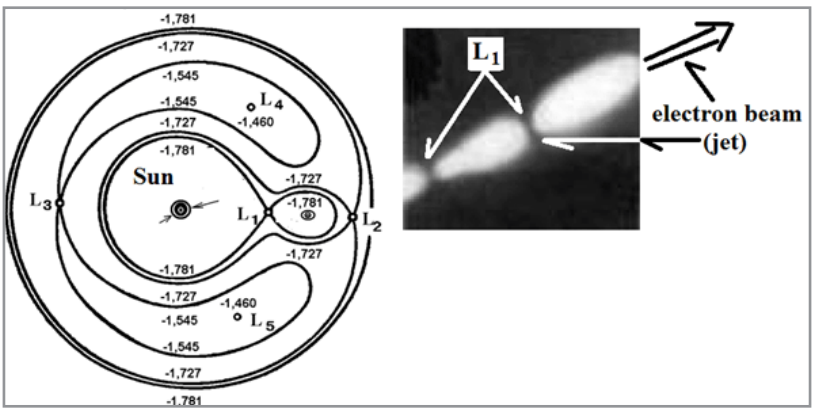

Figure 6: This is a 2D cross-sectional diagram of equipotential surface profiles (3D Roche' cavities) surrounding:

a) the gravitating system of two attractors (Sun and Jupiter), taking into account the centrifugal potential in the Euler problem of linear cumulation points L1-3 and triangular Lagrange libration points L4,5.,
b) this is the formation of Vysikaylo's cumulation points in a beaded lightning between the luminous positively charged cumulative-dissipative Vysikaylo's systems.

Similar phenomena of structural cumulation are observed at the cumulation (libration) point L1 when ordinary stars are consumed by quantum stars in stellar pairs [4,7,8,33] (the phenomena and paradoxes that arise are described in [34,35]. They still don't understand Vysikaylo's structural turbulence). The main achievement within the framework of the Vysikaylo's structural turbulence model was the description of the eye (eye) of a tropical cyclone, which is not described in the Rossby's models and other, as A A Vlasov said, inferior models. The second discovered property of structural turbulence or bicyclones is an increase in the cumulation of such a structure with an increase in rotation and an increase in rotation during cumulation [4,7,8,33].

Cumulation and Libration Points for Electrons Between Positively Charged Systems

Euler was the first to think about the interaction of gravitational and centrifugal potentials when he analyzed the two-dimensional motions of a small third body in the plane of rotation of two massive objects. His idea of cumulation points L1, which was already known to Newton, and the discovery of three linear cumulation points L1-3, arising from the influence of the centrifugal potential, were the result of the analysis on the line connecting the two massive bodies. Lagrange, developing this idea, derived the results of the analysis in the plane of rotation of Jupiter around the Sun, which led to the discovery of two triangular points L4 and L5. These classical discoveries allowed me to discover the libration and cumulation points of electrons around positively charged Coulomb centers.

The study of flows in 4D space-time revealed to me that the gradients of potentials: 1) gravitational, 2) Coulomb and 3) pressure form flows of energy, mass and momentum in a similar way. This allowed me to classify the points discovered by Euler in 1767 as cumulation points [7], and the points discovered by Lagrange in 1772 as libration points. Generalization of the works of Euler, Lagrange, Roche and other researchers of the system of gravitational attractors allowed me to explain a number of "puzzling" experiments, for example, the pulsed propagation of lightning in the experiments of Schonland (1937) (jets are formed in the same way, Figs. 3-6) and other paradoxes in gas-discharge plasma in laboratories, the ionosphere, the heliosphere and galaxies.

Research [1-8,11,22-27] led me to the creation of the generalized mathematical transposition method (GMTM). This method allows the transfer of mathematical models from well-studied areas of science to less explored areas. With the help of GMTM, knowledge of gravitational systems can be used to describe electrodynamic processes with violation of electrical neutrality, and vice versa. This opened up new possibilities for testing general theories in the natural sciences and making discoveries. The method is also applicable to hydrodynamic and quantum-mechanical phenomena. Thus, within the framework of synergetics, the science of the interaction of many elements, a new section devoted to CDS appeared [1-8,11, 22-27].

Vysikaylo's Perturbation Theory for Describing Phenomena in Plasma with Current

We have already explained all the phenomena that occurred when the Chelyabinsk meteoroid entered the Earth's atmosphere, based on experiments with lightning and plasma systems. When air molecules collide with a meteoroid, plasma is formed - a gas consisting of positive ions and electrons. We have developed a mathematical model to describe the transition layers in a non-uniform plasma with current. However, numerical modeling of such plasma causes difficulties due to the lack of experimental data on the rate of processes of plasma particle generation and transfer from the parameter E/N. According to Vysikaylo's perturbation theory [36,37], in the system of Poisson equations for the electric field and the transfer of ions and electrons, one can obtain one four-dimensional equation for the transfer of plasma parameters. This equation takes into account the smallness of the current of positive ions compared to the current of electrons:

$$n_e/\partial t - \partial[(l_{E0}/\mu_e)\nabla](\mu_e n_e)/\partial t + (j/e)\nabla(\mu_{+0}/\mu_{e0}) - \nabla\{(\mu_{+0}E_0/\mu_{e0})(l_{E0}\cdot\nabla)(\mu_{e0} n_e)\} = I_{+0} - R_{+0},$$

Here in the zeroth approximation of our perturbation theory, the drift velocity of electrons and ions is described by the relations: $V_{e0} = \mu_{e0}E_0$, $V_{+0} = \mu_{+0}E_0$, here are the mobility of electrons – μ_{e0} and ions – μ_{+0}, respectively, $l_{E0} = E_0/(4en_e)$ vectorized characteristic size of electric field strength change. Since the plasma in the trail is completely ionized, the length of the violation of electrical neutrality is small and a sharp jump is formed along the entire boundary of the luminous plasma trail (Vysikaylo's shock wave of the electric field) [1-3]. The four-dimensional Vysikaylo's equation is derived from the ion concentration equation $\partial n_+/\partial t + \mathrm{div}(n_+ V_i) = I_+ - R_+$, where the n_+ is replaced by $n_e - (l_{E0}\nabla)(n_e \mu_{e0})/\mu_{e0}$. This change takes into account the violation of electroneutrality described by the Poisson equation for the electric field. The second term in the equation, containing mixed derivatives with respect to time and space, has no analogues in hydrodynamics. The fourth term is similar to the diffusion one. In hydrodynamics, a similar transition from convective to diffusion transport is observed during the formation of shock waves discovered by Mach. The term due to the violation of electrical neutrality suggests the presence of shock waves of the electric field in the plasma. These waves form the dynamic surface tension of plasmoids ranging in size from 10 cm to 1.5 kpc (Fig. 5). Shock waves of the electric field in a gas discharge were discovered and visualized by Vysikaylo and his colleagues in 1985-1987. The second and fourth terms of the equation with mixed derivatives allow us to describe stationary and traveling shock waves of the electric field - strata (parameter E/N) both in a conventional gas discharge plasma and in the ionosphere and heliosphere, where global currents flow.

During discharge in pure nitrogen, the ambipolar drift in the positive plasma column reaches 70 m/s. It moves from areas with low values of the E/N parameter to high ones. This drift promotes plasma cumulation in the centers or lines [2,7,8]. In air, the ambipolar drift can exceed 100 m/s. As a result, the plasma self-focuses behind the meteoroid, causing disturbances to spread in the ionosphere at a speed of Va (according to RIA News 03/21/2013).

When a meteoroid moves through the atmosphere, it leaves behind a plasma trail. Highly energetic electrons leaving this trail create a positively charged column with electric forces acting on the positive ions moving away from the meteoroid and on the electrons moving toward the meteoroid. The radial Coulomb barrier (Fig. 3 and 4) prevents the flow of electrons from the plasma cylinder and thus focuses it radially. This plasma system, 30 to 80 kilometers in size, sprays the meteoroid substance, including water vapor, into the upper layers of the atmosphere in the form of positive ions. One of the indications of cylindrical plasma cumulation in the trail is the registration of noctilucent clouds at altitudes of up to 75 kilometers.

General Scheme of the Configurator of Vysikaylo's Androgynous

Cumulative-Dissipative Systems

In any +CDS, on one side, a gyne structure is formed, focusing electron flows (Fig.7). The gyne structure focuses electrons into its internal region, accelerating some of them with its internal electric field. The advancement of this part of the +CDS occurs in a continuous mode [2]. The electrons focused by the gyne structure and accelerated form a cumulative jet - CJ from the +CDS. Thus, on the other side of the +CDS, a cumulative jet (CJ) is formed. The CJ activates the external environment by preionizing it with high-energy electrons. Then, the next section of the +CDS is formed due to the ability of plasma systems to self-focusing. In this case, the advancement of the +CDS occurs into the region of the unactivated environment in a pulse-periodic mode [2].

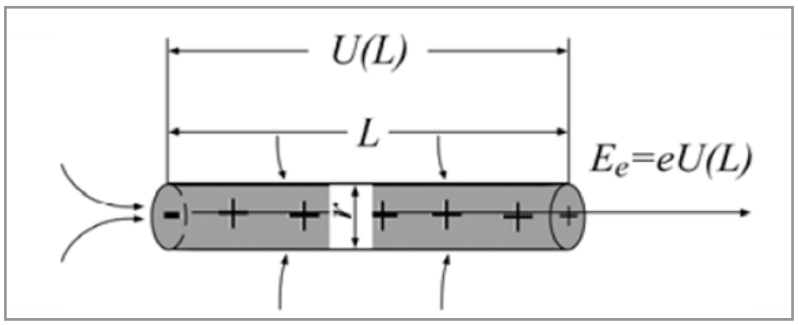

Figure 7: Plasma asymmetric andro-gynous linear (L >> r) +CDS, cumulating electrons in itself (their direction of movement is indicated by arrows) and forming from them a beam of high-energy electrons with energy. Ee ~ U(L). Plasma +CDS can grow into a continuous medium both to the right (forward with the androgynous part) and to the left side (forward with the gyno part). The beam of energetic electrons (andro structure) spreads only in one direction - against the field [2].

Discussion of Results

In this section we prove that a cylindrically symmetric plasma system extending for 30 km (the plasma hose behind the meteoroid (Fig. 1)) is formed as a result of ambipolar drift processes (the third term in (1)) and determines all previously "mysterious" phenomena during the entry of asteroids and meteoroids into the Earth's atmosphere. According to our theoretical and experimental studies, this type of ambipolar drift (caused by different dependences of the electron and positive ion mobilities) is directed from small values of the parameter E/N to the region of large values of this parameter. In the case of a limited (droplet model) plasma positively charged system, the ambipolar drift is directed toward the self-forming boundary of the plasmoid (Fig. 8). Thus, plasma disturbances are directed toward the boundaries of the plasmoid and such solutions are stitched together by the formation of Vysikaylo's shock wave of the electric field with a characteristic size lE [2,7,8].

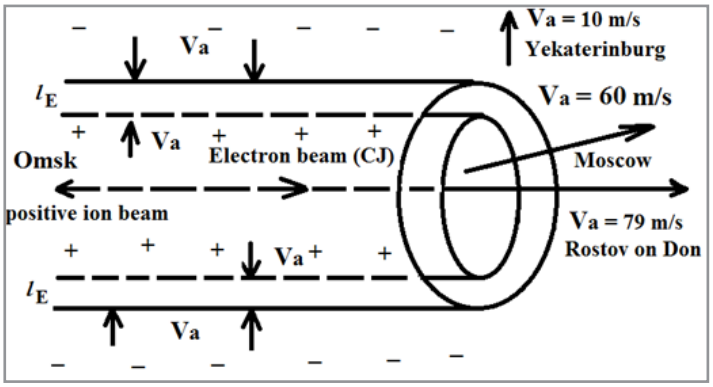

Figure 8: 3D schemes: formation of the Vysikaylo's laser-gun by ambipolar drifts directed towards the boundaries of the plasma system and the propagation of plasma disturbances in the ionosphere at the speed of ambipolar drift Va (these are analogs of Mach's shock waves) of plasma disturbances after the destruction of the meteoroid according to the Vysikaylo's fragmentation scheme.

Fig. 8 shows the formation scheme of a partially open in the direction of the asteroid motion (closed from the sides) cumulative-dissipative polarized Vysikaylo's systems. All the kinetic energy of the meteoroid and ionized air molecules is converted into the energy of a cylindrical electric capacitor, limited by a Coulomb cylindrical barrier (Fig. 8). When the capacitor energy reaches a critical value, it is broken down by CJ. The introduction of CJ into the meteoroid leads to a Coulomb explosion and fragmentation of the meteoroid from behind according to the Vysikaylo's model (Fig. 4b). Limitation of the radial propaga-

tion of the plasma disturbance occurs due to converging waves of ambipolar drift (the third term in (1)), directed to the boundaries of the self-forming cylindrically symmetric plasmoid. This occurs in complete analogy with the formation scheme of ordinary linear lightning and other Vysikaylo's positively charged cumulative-dissipative systems (+CDS) [2,7,8]. At the boundary of the plasmoid, a Vysikaylo's shock wave of the electric field is formed, compressing +CDS. Electrons returning to +CDS (negative ions are also destroyed to electrons and atoms) cumulate to its center and are accelerated (towards the asteroid) by the longitudinal electric field in the form of a high-energy electron beam. This beam acts coherently with the electric field of the entire plasma tail. It ionizes neutral particles in the plasma tail, exchanges energy with all electrons, destroys negative ions, excites metastable electron levels of atoms and molecules, which in turn destroy negative ions, making the plasma in the tail electropositive and long-lived 1.5 s. Energy cumulation in the CJ affects the effective electric field strength, which in turn determines the CJ parameters. (Coherence is agreement, interconnection, harmonious unity). This is the analogy of the action of de Broglie waves of high-energy electrons in the CJ, which transfer the energetic excitation of the plasma into the asteroid (as into a transparent mirror) with electromagnetic waves, which resonantly remove the excitation of atoms or molecules in quantum generators - lasers through a semi-transparent mirror.

Self-focusing of energy-mass-momentum in the center of the plasma tail of the asteroid and the formation of electron flows with energy close to the speed of light due to the cumulation of energy naturally explains the electrophonic sounds long before the arrival of the sound shock waves.

The CJ periodically catches up with the asteroid and crashes into it by inertia, exploding it with a Coulomb explosion. Thus, the asteroid is periodically destroyed by its plasma tail - an electron accelerator.

Positive ions in the +DCS (plasma wake) are accelerated by the electric field in the direction opposite to the electron beam motion. With the flow of positive ions, the ions of water contained in the asteroid leave for the upper layers of the atmosphere. This is how noctilucent clouds appear - small ice floes at altitudes of 70-80 km.

After another impact of the beam of high-energy electrons on the asteroid, its fragments sharply increase the area of friction with the air and turn into fine dust of positive ions and electrons. This is how the particle density in the plasma trail increases. An increasing number of electrons leave the forming plasma trail. The electric field strength increases and the frequency of formation of the next beam of high-energy electrons increases. The periodic formation of CJ and periodic breakdown of the cylindrical self-forming capacitor is coherent in nature due to the need to achieve critical values of the dynamic order parameters (ne and E/N) [1,37].

Thus, within the framework of a full-fledged electrical model, the pulse-periodic destruction of asteroids and meteoroids by a plasma tail (with dimensions of 30 km) and pulsed flashes of asteroids are explained, which in principle cannot be explained by the mechanical model of S.S. Grigoryan. As I was informed, S.S. Grigoryan, reviewing my first work on the electrical mechanism of destruction of asteroids (2013), highly appreciated it by modifying a quotation from Pushkin in a letter to Vyazemsky, while L.F. Chernogor, who continues to work within the framework of an incomplete mechanical model [20,21], wrote a negative review. He considers the asteroid as an object with characteristic dimensions of 20 m. He continues to ignore the influence of the entire plasma tail (30 km long) on all phenomena during the penetration of asteroids into the Earth's atmosphere.

Self-formation of electric field shock waves (Coulomb barriers) at the plasma trail boundary due to radial polarization of plasma (Fig. 7) leads to: 1) limitation of radial motion of charged particles; 2) permission to move charged particles only along the plasma trail. As a result, radial polarization transforms into longitudinal polarization of the plasma trail; 3) self-focusing of energy-mass-momentum in the center of the asteroid's plasma tail; 4) formation (due to electron-electron collisions) of electron flows with energy close to the speed of light from the plasma tail. This naturally explains electrophonic sounds long before the arrival of sound shock waves; 5) localization of energy disturbances in the plasma tail region, which explains the action of the Le Chatelier-Brown principle.

Since the longitudinal polarization of electrons and positive ions occurs at the same distances, their charges are equal and the forces acting on the electrons moving into the meteoroid and the forces acting on the positive ions are equal, their kinetic energies are equal. This is the pulse-periodic fulfillment of the virial theorem during the destruction of an asteroid in the Earth's atmosphere: half of the asteroid's potential energy goes to the asteroid's dispersion, and the other half is discharged through the plasma channel by positive ions back into the asteroid's arrival area.

This is how the virial theorem works during the fragmentation of asteroids and meteoroids in the Earth's atmosphere in accordance with Vysikaylo's Coulomb fragmentation model.

As E.I. Zababakhin taught us, any cumulation of energy-mass and momentum leads to increased rotation [30]. Due to the gravitational forces of cumulation, planets revolve around the Sun, and spiral galaxies revolve around their center. Due to the increased rotation, cumulative jets of cumulative projectiles are destroyed. Radial cumulation of plasma in the tail of an asteroid (Fig. 1) leads to increased rotation of oppositely directed flows of electrons and positive ions. Similarly, there is an increase in opposite flows in tropical cyclones. In this case, ascending warm (cyclonic) flows rotate in one direction, and cold descending (anticyclonic) flows in the opposite direction. The co-organization of the motion of a cyclone and an anticyclone in one CDS is the essence of Vysikaylo's structural turbulence [33]. With such a co-organization of flows rotating in opposite directions, their mutual amplification of rotation and longitudinal movement in opposite directions occurs. This means that opposites can not only destroy but also strengthen each other during the dissipation of an external energy source. According to the virial theorem, opposites share potential energy equally.

After the final Coulomb fragmentation of the meteoroid (to ions and electrons) according to the Vysikaylo's scheme (Fig.

4b), as shown by the experimental data presented to RIA News 03/21/2013, the electron beam pulse continues its movement in the form of plasma ambipolar waves with different velocities Va, depending on their direction of movement. Such a dependence of the propagation speed of disturbances clearly indicates the ambipolar nature of the momentum transfer in the direction of the meteoroid movement. This once again proves the electrical nature of the effect of +CDS (Fig. 4,7) on the entire ionosphere and atmosphere of the Earth. According to the diagram (Fig. 4b, 8), the virial theorem may be fulfilled earlier than the meteoroid collides with the Earth's surface. This occurs when the Vysikaylo's +CDS is broken through by a cumulative electron jet in a pulse-periodic mode, which corresponds to the meteoroid being periodically shot (destruction) by its tail.

Vysikaylo's Incongruent Shock Wave of the Electric Field and Vysikaylo-Poisson's Turbulence

Air (the Earth's atmosphere) is an electronegative gas. In electronegative gases, along with ionization processes (the creation of free electrons and positive ions), there is an intensive creation of negatively charged ions. Negative ions in the air are formed as a result of two processes: 1) dissciative attachment of a free electron to an oxygen molecule. Here, the O- ion is formed. The O- ion can be modified into the O3- ion; 2) three-body attachment of a free electron to an electronegative oxygen molecule. Here, the O2- ion is formed. The O2- ion can be modified into the O4- ion. At an altitude of 23 km, the number density of molecules is 24 times lower than at sea level. This means that the frequency of three-body electron attachment is less by more than 500 times. Therefore, the main negative ion outside the plasma tail behind the asteroid can be considered the O- ion. The speed of the O- ion return to the positively charged cylinder - the plasma tail behind the asteroid is about 105 cm/s. This corresponds to characteristic times of 9[m]/10-3[m/s] ≈ 10-2 s. The negative ion returning to the plasma tail is destroyed in collisions with any excited particle and turns into a free electron, which gains energy in electron-electron collisions in the plasma tail and again escapes from the plasma tail of the asteroid. And again, with dissociative attachment to an oxygen molecule, it turns into a negative ion. Thus, one electron can form a negative ion up to 102 times. This is how Vysikaylo-Poisson's turbulence is formed at the boundary of the plasma tail behind the Chelyabinsk asteroid. Not only ionized air particles but also asteroid particles transformed into nanodust by a beam of highly excited electrons via a Coulomb explosion take part in the formation of this structural turbulence (Fig.8).

The electrons and negative ions returning to the center (of the positively charged tail) hold the positively charged ions in a cylindrical plasmoid behind the asteroid with their pressure. Their pressure leads to the preservation of the characteristic radial size of the plasma tail behind the Chelyabinsk asteroid at 30 km (Fig. 1).

All kinetic energy received by air molecules (during the collision with the Chelyabinsk asteroid) is spent on their destruction into ions, and then its remains at the level of 25 eV (in the electric field of positive ions) flow into the energy of electrons. Electrons have a small mass compared to ions and therefore leave the plasma tail of the meteoroid faster. This is how a dynamic capacitor is formed behind the meteoroid. All the energy remaining after the destruction of molecules flows into this dynamic cylindrical capacitor.

The frequency of dissociative attachment of electrons to an oxygen molecule νa for electrons with an energy of 25 eV is of the order of (10-11x1017) [32] 106 s-1. The speed of electrons (Ve) with an energy of ≈ 25 eV in air is of the order of 3·107 cm/s. Where does the characteristic radial size of the plasma tail increment in the mode of destruction of air molecules only come from: L ~ Ve/νa ≈ 0.3 m.

This means that the radius of the plasma systems where the plasma with the particle energy of 25 eV is concentrated is about the radius of the Chelyabinsk meteoroid ~ 9+0.3 ≈ 9 m.

At the boundary of this capacitor, free electrons leave the plasma tail behind the Chelyabinsk asteroid, as a result of dissociative adhesion to oxygen molecules they turn into O-. The O- ion returns back to the positively charged tail at a speed hundreds of times less than the speed of electrons.

Fig. 8 shows a diagram of the implementation of a cylindrically symmetric electric field shock wave surrounding the plasma in the tail of a meteoroid (asteroid). According to the diagram, the shock wave separates the plasma with negative ions and the plasma where these ions are destroyed in collisions with excited particles and thus turned into atoms, positive ions and free electrons, capable of being accelerated by the electric field in +CDS (in a positively charged electric cord) more quickly than negative ions.

The presence of plasmas with different contents of negative ions at the boundary of the shock wave allows us to classify such shock waves as incongruent jumps of plasma parameters.

In Fig. 8, we detailed how the Le Chatelier – Brown's principle is implemented in such jumps: the medium is polarized, forms a capacitor, which, when destroyed, fragments the disturber of the equilibrium of the medium and throws off its remains in the form of positive ions in the direction opposite to the direction of its movement (Fig. 8).

The movement of positive ions in their own electric field (Fig. 8) (in the opposite direction to the movement of the Chelyabinsk asteroid) solves in a pulse-periodic mode (periodic breakdown of a cylindrical capacitor by CJ the problem of fulfilling the virial theorem during the complete destruction of the asteroid in the upper layers of the atmosphere.

As noted, the self-formation of incongruent shock waves of the electric field (Coulomb barriers) at the boundary of the plasma trace due to the radial polarization of the plasma explains the action of the Le Chatelier-Brown principle and the virial theorem during the fragmentation of asteroids by the Vysikaylo's mechanism.

All phenomena of destruction of meteoroids and small asteroids are caused by syneretic phenomena in polarized plasma with characteristic dimensions of 30 km and a diameter of the order of the cross-section of an asteroid.

Conclusion

"Isolated knowledge obtained by a group of specialists in a narrow field has no value in itself; it has value only in synthesis with the rest of knowledge, and the more real its contribution to this synthesis, the greater the value." — Erwin Schrödinger (1887–1961).

The basic foundation of matter is negatively charged electrons, positively charged protons and electromagnetic fields that cumulate (focus) electrons to positively charged structures (atoms, molecules, lightning, stars, centers of galaxies and their clusters). Neutrons decay into a proton, electron and neutrino. Since the basis of everything around us is the same, we should expect repetition of structural forms of co-organization of energy flows, mass and momentum on all scales of the Universe from the atomic nucleus to the cluster of galaxies. This is, in brief, Vysikaylo's basic paradigm, which he has been researching from 1985 to the present.

The cumulation of knowledge about the laws of nature on planet Earth occurs in any living organism in DNA and is passed on by inheritance. However, this property of any continuous and not very continuous media to cumulate energy, mass and momentum for the formation of CDS has not yet attracted the attention of scientists. The first attempts to theoretically study the process of energy cumulation during the collapse of a liquid bubble were made by Besant in 1856, then by Rayleigh in his study of cavitation in 1917, and by Guderley in his study of the convergence of a shock wave to the center of cumulation in 1942. E. I. Zababakhin came closest to discovering the CDS [30].

However, the most complete study of cumulative-dissipative systems was carried out by the author in a number of works from 1985 to the present.

In this work, the author, following the statement of E. Schrödinger (see epigraph), detailed the essence of his idea about the synthesis of knowledge based on a finite number of works from various fields of science and for the first time explained all the processes observed during the arrival of the asteroid in the Chelyabinsk region in 2013. The main evidence of our model and the implementation of Vysikaylo-Poisson's turbulence are:

1) photographic observation (Fig. 1) of the explosion (with a sharp increase in luminosity) of the Chelyabinsk asteroid with the flight of its parts forward at a speed of more than 18.3 km/s; 2) a huge plasma tail 30 km long and a plasma lifetime of about 1.5 s. This is possible only with the cumulation of excitation in the plasma hose and the inclusion of feedback through the formation of CJ, destroying the asteroid to ions and electrons at altitudes of 23 km.

The mechanical model (Fig. 2) cannot explain in principle these facts of pulsed increase in luminescence and other electrical phenomena. We have proved that it is impossible to blow up an asteroid to ions and electrons without the organization of a CJ, which performs an energy feedback with the asteroid! The formation and retention of the Vysikaylo's shock waves of electric field in a gas discharge plasma of special purity nitrogen was investigated by us in a non-uniform plasma analytically, numerically and experimentally (see [1,11] for more details). Photographs of the shock wave of the electric field are shown in Fig. 5 c.

We successfully applied the same synthesis of CDS models to modify, verify and transfer a number of mathematical models from the studied areas of physics to describe unexplored similar electrochemical phenomena in the microworld and now in the meso-world of the interaction of asteroids with the Earth's atmosphere, following the methodology [2,3,7,8,11,22-27]. On this basis, we formulated a model of the destruction of asteroids (meteoroids) by their own plasma tail. It is an accelerator for an electron beam and at the same time an accelerator of positive ions in the opposite direction. Since the Coulomb forces acting on electrons and positive ions are equal and the distances at which they are polarized are equal, the work of the electric field on these energy-mass-momentum flows is also equal. This is how the virial theorem is easily proven in the case of interaction of asteroids with the Earth's atmosphere.

The basis of all living organisms are nanoelectric (physical and chemical) processes. All living organisms accumulate energy, mass and momentum. After their electrochemical transformation in their body, they dissipate the products of their vital activity. Therefore, they are CDS. More and more evidence appears that living organisms are supported by quantum phenomena. Quantum structures accumulate (absorb) electromagnetic and other de Broglie waves and dissipate them upon returning to stable states. We prove that all quantum structures are CDS.

In accordance with Schrödinger's idea, we prove that the synthesis, cooperation and symbiosis of developing knowledge is a complex, gradual, interesting, difficult and infinite in time process, covering all areas of human knowledge, including art. The discovery of cumulative-dissipative systems with characteristic sizes from 10-15 to 1026 m and the study of their fairly general laws of development, functioning and death is the main goal of all the author's works.

The study of limited and unlimited [30] cumulation in classical mechanics led to the creation of unique technologies: cumulative projectiles, nuclear power plants, nuclear and hydrogen technologies, including for special purposes, etc. These studies led to the understanding that any cumulation of EMIP is limited and accompanied by dissipation phenomena or the generation of mirrors reflecting the focusing of EMIP, such as: strengthening of the centrifugal potential due to increased rotation, atomism [30], weak as cumulation increases, a violation of electroneutrality [7], capable of stopping the gravitational cumulation of even black holes [1-3, 7, 8, 11].

The study of limited and unlimited cumulation of de Broglie waves of quantum particles and the generation of counteracting cumulation processes in nanotechnology is just beginning, and the results obtained by the author are not adequately perceived by all researchers and editorial boards of some journals. Many of the professors believe that each "sandpiper" should not only praise his "swamp", but also sit in it all his life and not succumb to Schrödinger's philosophical ideas about the importance of synthesis (synergy, coordination, joint action, cooperation) of the knowledge obtained by them in their "swamp", with the rest of the knowledge. Such a division in the sciences is unaccept-

able! Here biophysicists have only discovered the gene of cooperation 11 B in humans.

In the Russian Federation there is such a division in sciences and journals without any cooperation, without any synergy, especially in economics, politics and sociology. Their main thesis is: "Don't touch our swamp."

Many solutions to practical problems in technical sciences, medicine, food production, etc. were spied by man in nature and aimed at hyperbolic strengthening of the human potential of the Earth over time. This is how such a science as bionics was formed (bionics is an applied science on the application of principles of organization, properties, functions and structures of living nature in technical devices and systems, i.e. forms of living things in nature and their industrial analogues. Simply put, bionics is a combination of biology and technology). The most complex and most accessible biological system to study is human society and its natural dual unit - the family (7 I - in Russian. A real family should have 5 children), consisting of a man and a woman.

It has been known since 1938 [9] that lightning and electric arcs can propagate in two different ways depending on the sign of the advancing charge.

When lightning moves forward with a negative charge, a forward-thrown beam of high-energy electrons (CJ) can be formed in the depths of the lightning. Then the next section of the lightning is formed, participating in the generation of a new CJ, which shoots forward. This is how the pulse-periodic advance of lightning occurs.

Similarly, a beam of fast electrons periodically forms in the plasma tail behind an asteroid, catching up with the asteroid and periodically exploding it in a Coulomb explosion. The fragments from each Coulomb explosion form another section of positively charged, radially self-focusing plasma, similar to the formation of linear lightning (Figs. 7, 8).

The mechanism of continuous forward advance of lightning with a positive charge takes into account UV preionization and constant cumulation of electrons generated around the lightning into its continuously moving forward positively charged part.

Similarly, a continuous flow of positive ions forms in the plasma's positively charged, self-focusing tail behind the asteroid, moving in the opposite direction to the asteroid's motion (Figs. 7, 8). This flow ejects positive ions of water molecules to altitudes of approximately 70-80 km. This is how noctilucent clouds are formed.

In case of activation of an unexcited medium, for example air, CJ manifests itself as a structural analogue of the male sexual organ. In case of activation of the medium by ultraviolet radiation and cumulation of generated electrons in a funnel, this part of the lightning manifests itself as a structural analogue of the female sexual organ. In case of a tropical bi-cyclone (here the anticyclone and cyclone are co-organized together) cold air masses of the anticyclone fall into the funnel (the eye of the cyclone). For some time, I could not think of a common name for such bi-systems (with male and female structural principles of simultaneous co-organization of opposite energy-mass-pulse flows). The general classification of such systems as androgynous was proposed by mathematician, candidate of physical and mathematical sciences, laureate of the USSR State Prize Olga Stepanovna Shirokovskaya. In the presence of an energy potential dissipated by the androgynous structure, the opposites in the bi-cyclone reinforce each other with opposite movements both in the longitudinal direction (the cyclone up, and the anticyclone down), and with the opposite rotation (the anticyclone clockwise, and the cyclone counterclockwise). With the strengthening of the rotation in a bi-cyclone, all the theorems of Helmholtz are fulfilled. According to the virial theorem, half of all the energy that turns into motion goes to accelerate the cyclone, and the other half to accelerate the anticyclone.

The Americans have long ago recorded anticyclones above cyclones, but some of them still believe that cyclonic movement turns into anticyclonic.

Vysikaylo's androgynous systems include: lightning, electric arcs, tropical cyclones, whirlpools, tornadoes, and whirlwinds. Such structures with Vysikaylo's structural turbulence are observed in binary star systems at Euler L1 cumulation points between a quantum star and its sister. L1-3 cumulation points [7,8] were discovered by Euler in 1767 in the region of the Sun and Jupiter.

There is a cumulation of the ideal (one can say divine information) for the development of a living organism in the sperm (andro structure) and the egg (gyne structure). Thus, we came to the discovery of a fairly extensive class of androgynous cumulative-dissipative Vysikaylo's systems.

The Chelyabinsk meteoroid of 2013 showed the fragility of our civilization, which is not yet able to understand, comprehend and apply in practice all the phenomena recorded on video cameras by amateurs in their region. "Classical" science was unable to explain all the observed effects. The press suggested that we are being protected by some higher intelligence that is shooting at the Chelyabinsk meteoroid.

Having analyzed these visualized phenomena, I come to the understanding that these: photographs (Fig. 1); data presented by NASA on all the parameters of the explosion (in particular, the transition of a significant part of all the kinetic energy of the asteroid into electromagnetic radiation); data on the spread of plasma disturbances at the speed of ambipolar drift, presented by RIA News 03/21/2013 and all the videos and eyewitness accounts of the event collected on the Internet, are undoubtedly worthy of the highest awards and praise, since they completely overturn the "classical" mechanical ideas about many natural phenomena (Fig. 1,5). These data allow me to claim that I have created for the first time a model of meteoroid and asteroid fragmentation that takes into account their destruction into dust down to electrons and positive ions. This model explains how a flow of energy in the form of CJ can carry out this fragmentation and direct half of the kinetic energy of a celestial body after it for its further destruction.

Based on experimental observations, I prove that flows of

charged particles in the atmosphere and ionosphere are created by electric fields due to the polarization of plasma in the wake of meteoroids and their speeds are determined by ambipolar drift [11]. The influence of magnetic fields is small compared to electric fields (by the parameter v/c).

We have proposed a mechanism that explains all phenomena observed in nature during lightning propagation and all phenomena during the fall of the Chelyabinsk meteorite in the Russian Federation. These positively charged cumulative-dissipative plasma systems (+CDS), as we have established, are surrounded by the Vysikaylo incongruent shock waves electric field (VSW). We demonstrate that de Broglie waves of free electrons arising in the plasma tail behind the meteoroid behave similarly to electromagnetic waves in a laser. There, a cumulative jet of high-energy electrons (CJ) is formed, which breaks into the meteoroid, causing it to collapse according to the Coulomb mechanism. The formation of VSW in the atmosphere is due to the peculiarities of the chemical kinetics of negative ions at the boundary of the plasma tail. The time of Vysikaylo-Poisson's structural turbulence, providing the formation of CJ in the plasma tail, was ≈ 1.5 s. We prove that de Broglie electron wave lasers with a cavity length of 30 km and a diameter of 18 m are realized in nature and can be described. This gives us grounds to use this mechanism to explain the joint organization of counter-flowing jets of protons from black holes and electrons directed into black holes. These laser-like jets have already been observed in Hubble-type telescopes and have a length of up to 1.5 kpc. Thus, our cumulative-dissipative mechanism can explain the increase in the velocities of active neutron stars. We proposed and investigated a new 4D inertial-polarization-quantum cumulative-dissipative Vysikaylo's mechanism for fragmentation of meteoroids and asteroids (self-defense of the Earth from meteoroids) into simple ions and electrons. We proposed a mechanism for an external combustion engine with an efficiency of 50% and described in detail the Le Chatelier-Brown principle. In this paper, we present a new interdisciplinary approach that combines plasma physics, quantum theory, and atmospheric observations.

The Problem is Set in Detail for Numerical Calculations

In 2013, we were the first to propose a model of pulsed-periodic Coulomb explosions of meteoroids, based on the model of conventional linear lightning.

We were the first to propose a model of Coulomb fragmentation of an asteroid or meteoroid and described in detail how fundamental principles such as the Le Chatelier-Brown principle and the virial theorem, formulated in 1870 by Clausius for gravitational systems and by Fock for quantum physics, are fulfilled in this process.

Our pulse-periodic mechanism that destroys meteoroids solves the problem of fulfilling the virial theorem for any meteoroid speeds - from 10 km/s to 70 km/s and more - even before their collision with the Earth's surface.

In the case of a positively charged plasmoid (see Fig. 1), the analogue of a fully reflecting mirror is the end of its tail, which is located at a distance of approximately 30 kilometers from the meteoroid.

The analogue of a transparent mirror is the area near the asteroid, the movement and destruction of which generates a new element of the positively charged plasmoid (Fig. 4b). All the kinetic energy of the asteroid initially passes into the electrical energy of the radial capacitor (Fig. 7), and when it is broken down by CJ, into the electrical energy of a highly conductive line polarized in the longitudinal motion of the meteoroid (Fig. 8). All this is accompanied by bright explosions and radiation.

Within the framework of mechanical models alone [12-21, 38-50] or the charging only the asteroid, not the entire trace [51, 52], it is impossible to explain the entire spectrum of amazing phenomena that occurred during the penetration of the Chelyabinsk meteoroid in 2013 into the electronegative atmosphere of the Earth (Fig. 1). As for the libration (cumulation) points L1 between binary stars, in modern works the structural Vysikaylo-Poisson's turbulence is taken into account at all [8]. The results [1-8,11,22-27] are useful for making discoveries that were previously not possible, resolving controversies, and creating innovative technologies such as the use of a plasma tail or an external combustion engine.

Our research proves the validity of the further development of Louis de Broglie's hypothesis: "particles behave like waves" and can form their flows similarly to electromagnetic waves in a conventional laser (in the plasma tail of an asteroid or meteoroid). In this case, the role of Vysikaylo's incongruent shock waves of the electric field restraining the radial expansion of the plasma tail behind the asteroid is significant.

The mechanism we proposed [2] explains all the observed phenomena during the propagation of electric arcs, lightning, and the 2013 Chelyabinsk meteorite entering the Earth's atmosphere, and proves that de Broglie electron-wave lasers with a resonator length of 10 cm to 30 km and a diameter of about 18 m are realized in nature and can be described theoretically. This gives us grounds to use this mechanism to explain the joint organization of opposite proton jets from black holes [7,8] and electrons into black holes. These laser-like jets have already been observed in Hubble-type telescopes and have a length of up to 1.5 kpc (Fig. 5b). Thus, our cumulative-reactive mechanism is capable of explaining the increased velocities of active neutron stars. We have described in detail for the first time the chemical kinetics of nanoparticles in incongruent Vysikaylo's shock waves of electric field for protecting the Earth from asteroids and explained in detail the pure transmutation of the kinetic energy of the asteroid into opposite jets of charged particles by analogy with ordinary lightning.

In this paper, we present a new interdisciplinary approach that combines plasma physics, quantum theory, and atmospheric observations. Our model, based on cumulative-dissipative systems and the application of Vysikaylo's mechanisms for co-organization of cumulation and dissipation processes of energy-mass-momentum flows (EMMF), offers an innovative view of meteoroid fragmentation and observed phenomena associated with the Chelyabinsk event.

To prove the correctness of our approach, we provide the necessary detailed theoretical explanations and references to historical and recent observational data. Analogies drawn between lightning discharge mechanisms, astrophysical jets, and plasma

behavior in laboratory conditions help us convincingly unite various physical phenomena and thus prove that the world from femto-structures to the world of galaxies is governed by fairly general laws of cumulation and dissipation of EMMF [6,32,53].

Some researchers believe the Tunguska asteroid consisted of antimatter, which completely annihilated into electromagnetic radiation upon contact with our material atmosphere [54]. They find supporters who argue that rocks cannot emit energy 100 times greater than the Chelyabinsk asteroid. The main problems with this explanation remain the same as those with the mechanical model (Fig. 2). Local models cannot explain the pulsed-periodic changes in the luminosity of fireballs and the appearance of noctilucent clouds at altitudes of 70-80 km.

If the Tunguska asteroid were only three times larger than the Chelyabinsk asteroid, its energy (at the same speed as the Chelyabinsk asteroid) would be 81 times greater. And if its speed were twice as great, its energy would increase by a further fourfold, or 324 times greater than the Chelyabinsk asteroid's energy. As we can see, this kind of energy is contained in rocks in the sky.

In this regard, we are the students and successors of our teacher Euler. He was the first to prove in 1767 that similar solutions exist for distributed rotating gravitational attractors, and we proved that similar solutions exist for cumulative-dissipative systems with Coulomb potentials.

Despite the richness and technical component of the article, the presentation retains the clarity of the main scientific arguments. Readers with experience in plasma dynamics and field theory will likely find our ideas interesting and thought-provoking. The author believes that this paper will make a significant contribution to the ongoing debate about natural high-energy atmospheric events and the mechanisms that protect planet Earth.

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