American Journal of Modern Physics
2025, Vol. 14, No. 3, pp. 140-159
https://doi.org/10.11648/j.ajmp.20251403.12

Review Article

Physics of the Universe in a Model with Minimum Initial Entropy III Solar System

Petro Olexiyovych Kondratenko*

Department of General and Applied Physics, National Aviation University, Kyiv, Ukraine

Abstract

The third part of the review paper examines the physical processes that have occurred in the Solar System from its formation to the present, within the framework of the Universe with minimal initial entropy (UMIE) model. In this case, the expansion of space and the formation of the Universe as a hierarchical system are taken into account and the following conclusions are made: According to the UMIE model, the Universe is a component of the Super-Universe, which consists of four layers: the zero-dimensional world (space-time quantum, World-1), the one-dimensional world (World-2), the two-dimensional world (World-3) and our three-dimensional world (World-4). The space-time quantum has constant dimensions, and all other layers expand at a constant speed equal to the speed of light. The mass of a cosmic body and the distance from the planet to the Sun increase proportionally over time. This fact ensures a constant speed of movement of planets and small bodies in their orbit, which are constantly moving away from the Sun. The new model describes the sequence of planet formation, taking into account the resonant interactions between the planets' orbits, which results in the distance from the planet to the star following a geometric progression. The increase in the mass of cosmic bodies occurs at a constant rate due to the birth of bineutrons in the vicinity of atomic nuclei. Heavy chemical elements are located in the center of the Sun and planets. When their mass increases to a critical level, constantly active radiation processes and nuclear explosions occur in the nuclei of the Sun and planets. Radial fluxes of electrons and protons, which arose as a result of radiation processes and nuclear explosions in the nucleus, cause the appearance of a magnetic field around the Sun and planets, and also cause differential rotation of the Sun. It is shown that all atoms from the table of chemical elements continue to be formed throughout the volume of cosmic bodies. This leads to the creation of all possible compounds of chemical elements, as well as to the appearance of water on Earth. The crystallization of chemical elements and molecules in the Earth's magma leads to the formation of minerals, or a nuclear explosion occurs, which is responsible for the appearance of deep-focus earthquakes.

Keywords

Models of the Universe Creation, Resonant Interaction, The Birth of the Planets, Radiation Processes in Cosmic Bodies, The Sun's Magnetic Field

1. Solar System

The history of ideas about the formation of the Solar System includes a large number of theories and models created in the last few centuries. For example, according to P. Laplace's theory, the Solar System began to form about 10 billion years

*Corresponding author: pkondrat@ukr.net (Petro Olexiyovych Kondratenko)

Received: 26 April 2025; **Accepted:** 13 May 2025; **Published:** 25 June 2025

ago and was fully formed 4.6 billion years ago. The main mechanism was the gravitational compression of a giant molecular cloud.

Similarly, modern astrophysicists believe that the formation of the Solar System began 4.6 billion years ago with the gravitational collapse of a small part of a giant molecular cloud [1-4]. As a result of the gravitational collapse, most of the substances of this cloud began to rotate, forming the Sun in the center of the cloud. The rest of the substance formed a disk-shaped cloud, from which the planets eventually formed.

Therefore, astrophysicists pay attention only to secondary processes, rejecting the possibility of star formation during the Universe's creation. In fact, most stars were born in the primary process. And only in secondary processes do molecular clouds appear.

In addition, the new models do not take into account the expansion of the Universe. On the other hand, when studying the mechanisms of galaxy formation and evolution, the expansion of the Universe is taken into account.

It is essential to remember that the second law of thermodynamics states that the entropy of a system always increases. Therefore, the condensation of a molecular cloud must blow matter beyond the boundaries of the cloud.

The study of molecular clouds within the Galaxy has not shown that they rotate. From physics, we know that the law of conservation of angular momentum is absolute. In this case, where does the rotation of the Sun's nucleus and future planets come from? We will have to assume that the formation of the Solar System occurred around a massive nucleus, which, from the very beginning, must have had a sufficiently large angular momentum. What caused the presence of such angular momentum?

Considering that there are also planets around other stars in the Galaxy, it is clear that the initial angular momentum cannot arise as a result of fluctuations. It is important that the process of matter accretion from the molecular cloud onto the nucleus not only increases its mass, turning it into a star, but also involves the nearby layers of the molecular cloud in rotational motion.

The above observations prompted the author to propose his own model of the Solar System's birth in an expanding Universe.

1.1. Formation of the Solar System in the Standard Model of the Birth of the Universe

Let's start by considering the formation of the Solar System from its current state.

In the Standard Theory of the Origin of the Universe, the masses of stars (M_0) and planets (m) are constant. Therefore, the expansion of the Universe would lead to a decrease in the potential energy of interaction between the objects of the Solar System. In this case, the kinetic energy of the planet would be greater than that required for a stationary circular orbit. Therefore, as a result, the planet would be forced to move in a spiral, further increasing the distance from the star to compensate for the imbalance between kinetic and potential energies.

Let the planet's velocity be υ_o on a certain circular orbit with radius r_0. This velocity is determined by the formula $\upsilon_0^2 = (GM_0)/r_0$. With a uniform expansion of space in the region of the planet's orbit to $r_1 = r_0 + dr_1$, the planet's velocity will be greater than that required for a circular orbit. This fact will cause an additional increase in the distance to $r_2 = r_0 + dr_2$. In this case, according to the law of conservation of energy, the change in kinetic energy will be equal to the change in potential energy. The calculation shows that in this case, $dr_2 = 2\,dr_1$.

So, we make a significant conclusion: an increase in the radius of the planet's orbit would significantly (by 2 times) exceed the local expansion of the Universe. In this case, the planet's velocity will decrease.

To understand how the process of the planet moving away from the star began, let's consider this process in the opposite direction. In this case, we consider that the change in kinetic energy should be equal to half the change in potential energy. This allows us to determine the speed of the Earth's movement in a circular orbit at a small distance from the Sun's center, for example, at a distance of 7·105 km. It turned out that it should be equal to 435 km/s. The time of such an approach should be 2 times less than the time of the expansion of the Universe. Assuming that the Universe was created 13.8 billion years ago, we find the time from the birth of the Solar System (but not the Sun) to be ≈6.9 billion years. From this calculation, we cannot find the time of the birth of the Sun.

The analysis requires that planets be born inside the Sun. This suggests that the generally accepted mechanism for forming planets around the Sun may not be entirely true.

The above calculation shows that for some unknown reason, the planets must have a huge initial orbital velocity. But with such an initial velocity, the planet would leave the Solar System.

There is an opinion in the literature that a large part of the Sun's mass was ejected as a result of an interaction with a star that passed by the Sun. This opinion was formulated and elucidated by T. Chamberlain (1901), F. Moulton (1905), and G. Jeffreys (1916).

Having examined this mechanism of planet creation in the Solar system in detail within the framework of the Standard Model, modern science has rejected it as completely improbable. The reason for this assessment of the mechanism described above is that the presence of planets around other stars is common. This has led modern cosmologists to prefer the idea that the Solar system is formed from a gas-dust cloud. Such a model must be calculated and shown that the calculation adequately describes the mechanism of creating planetary systems. What does computer modeling give? It was conducted for the case of no expansion of space in the region of existence of the Sun. It showed that such a model will work if the gas-dust disk around the future Sun, for an unknown

reason, receives a large angular momentum. Subsequently, the disk should undergo fragmentation, breaking matter into dust clumps, which are the embryos of planets. It is important that this fragmentation initially led to the formation of embryos of terrestrial planets, and only later did the planets of the Jupiter group form. And only after 1 billion years, Neptune and trans-Neptunian bodies were formed.

1.2. The Birth of the Solar System in the UMIE Model

According to the UMIE model [5], our Universe is a brane around a four-dimensional space. The radius of the brane increases with the speed of light. At the same time, the masses of all cosmic bodies increase with time in proportion to the current mass:

$$m = m_0\left(1+\frac{t}{T_{U0}}\right) = m_0\frac{T_U}{T_{U0}}, \quad (1)$$

where m_0 is the mass of the cosmic body at a given moment in time, T_{U0} is the age of the Universe at a given moment in time, t is the time that begins at a given moment, $T_U = T_{U0} + t$ is the time that begins from the moment of the creation of the Universe.

The circular orbit of planets around a star with mass M_0 is currently described by the formula:

$$\frac{mv^2}{r_0} = \frac{GmM_0}{r_0^2} \quad (2)$$

Since the radius of the Universe R_U is expanding at a constant rate equal to the speed of light, it is easy to calculate the rate of local expansion of the planetary system. Thus, the radius r of the planet's orbit will increase in proportion to the distance between the planet and the star, as well as time. Hence

$$v^2 = \frac{GM}{r} = \frac{GM_0}{r_0} = const. \quad (3)$$

Therefore, the orbital speed of the planet will be constant, regardless of the distance of the planet from the star. As a result, the period of rotation of the planet around the star will increase over time. If the distance from the Earth to the Sun were constant, it would make 6.9 billion revolutions around the Sun in 6.9 billion years. It is easy to calculate the speed of expansion of space within the Earth's orbit: $V_E = 3.6 \cdot 10^{-7}$ m/s. In a year, this will be 11.36 m.

The UMIE model shows that the Sun's nucleus was created as soon as the Scalar Field (SF) [6] began to flow into World-4. Its mass and radius increased with time. After $t_0 = 4.18$ million years, the Earth's nucleus formed from the periphery of the Solar disk, moving around the Sun at a constant speed of 30 km/s, while the distance between the Earth and the Sun constantly increased. The value of the Earth's period of rotation around the Sun immediately after its creation was

$$T_0 = \frac{2\pi r_0}{v} \quad (4)$$

where r_0 = 47,252 km is the radius of the Solar disk at the moment of the birth of the Earth's embryo [7]. The initial period of the Earth's embryo's rotation around the Sun was 165 minutes.

With each period, the radius will increase according to the expression:

$$r_{n+1} = r_n + uT_n. \quad (5)$$

Therefore,

$$T_1 = \frac{2\pi r_1}{v} = \frac{2\pi r_0}{v}\left(1+\frac{2\pi u}{v}\right). \quad (6)$$

For an arbitrary period, we find

$$T_n = \frac{2\pi r_n}{v} = \frac{2\pi r_0}{v}\left(1+\frac{2\pi u}{v}\right)^n. \quad (7)$$

Total distance from the Sun to the Earth $R = r_0 + u\sum_{i=1}^{N} T_i$. Total time of Earth's existence

$$T_U - t_0 = \sum_{k=0}^{N-1} T_k = \frac{2\pi r_0}{v}\sum_{k=0}^{N-1} x^k = \frac{2\pi r_0}{v}\cdot\frac{1-x^N}{1-x}, \quad (8)$$

where $x = 1+\frac{2\pi u}{v}$.

From here, we find the number of revolutions of the Earth around the Sun

$$N = \frac{ln\left[1+\frac{u}{r_0}(T_U-t_0)\right]}{ln\left(1+\frac{2\pi u}{v}\right)} = 1{,}1\cdot 10^{11}. \quad (9)$$

Thus, the number of rotations turned out to be 25 times greater than in the Standard Model.

By studying the motion of planets in reverse time, we see that at the birth of the planetary system, the star embryo rotated with a high angular velocity, which ensured the separation of the peripheral regions and led to the formation of planets. This conclusion is consistent with the findings of the work [8].

Let's try to find out the mechanisms of the Solar System's formation. To do this, we will record its modern parameters (Table 1).

Table 1. *Parameters of the planets of the Solar System today.*

n	Planet, Sun	Mass m_{i0}, kg	T_{pi}, Earth days	Distance to the Sun, million km	$a_i = R_{mid}$ million km
1	Mercury	$3.3022 \cdot 10^{23}$	87.97	46.0012–69.8169	57.909
2	Venus	$4.8685 \cdot 10^{24}$	227.70	107.476259-108.942109	108.209
3	Earth	$5.9737 \cdot 10^{24}$	365.26	147.098290-152.098232	149.598
4	Mars	$6.4185 \cdot 10^{23}$	686.98	206.669-249.2093	227.939
6	Jupiter	$1.8986 \cdot 10^{27}$	11y.314d.	740.52 – 816.62	778.57
7	Saturn	$5.683 \cdot 10^{26}$	29y.167d.	1353.57-1513.33	1433.45
8	Uranus	$8.7 \cdot 10^{25}$	84y.5d.	2748.9-3004.4	2876.75
9	Neptune	$1.0243 \cdot 10^{26}$	164y.288d.	4452.9-4553.9	4503.4
10	Pluto	$1.19 \cdot 10^{22}$	247y.255d.	4436.8-7375.9	5906.35
	Sun	$1.9891 \cdot 10^{30}$		Radius of the Sun	0.696

It is clear that the young Sun had a disk shape and a high rotation speed, that is, it had a large torque. With the birth of the planetary system, the main part of the torque was transferred to the planets, and the Sun slowed down its rotation. At the same time, it acquired a spherical shape. To simplify the calculations, we consider the problem of planet formation in the approximation of the Sun's spherical shape. The mass of the Sun increased according to the expression

$$M_\odot = V_{M\odot} \cdot T_U \quad , \quad \text{where} \quad V_{M\odot} := 4.759 \cdot 10^{12} \ kg/s. \tag{10}$$

From here

$$R^3 = 8 \cdot 10^8 \cdot T_U \ \text{і} \ R = 928 \cdot \sqrt[3]{T_U}. \tag{11}$$

$$ln(R) = 6.833 + \frac{1}{3} ln(T_U) = 6.833 + x/3 \tag{12}$$

Therefore, the expansion of a massive body occurs much more slowly than the expansion of space. This information is important in recent studies of galaxy expansion [9].

For the planets of the Solar System, the magnitude of the semi-major axis of the elliptical orbit will be described by the expression

$$a_i = V_i \cdot T_i$$

$$ln(a_i) = ln(V_i) + ln(T_i) = \ ln(V_i) + x_i \tag{13}$$

At the moment of birth of planets, their orbital radius must be equal to the radius of the Sun.

$$ln(R_i) = \ ln(a_i) \tag{14}$$

Table 2. *The time of birth of the planets of the Solar System. The time count used is from the creation of the Universe.*

n	Planet	x_i	T_i, s	T_i, years
1	Mercury	33.93809327	$5.48437 \cdot 10^{14}$	17,379,286
2	Venus	32.99973593	$2.14587 \cdot 10^{14}$	6,799,994
3	Earth	32.51401833	$1.32026 \cdot 10^{14}$	4,183,734
4	Mars	31.8823946	$7.02018 \cdot 10^{13}$	2,224,607
6	Jupiter	30.0398058	$1.11204 \cdot 10^{13}$	352,393
7	Saturn	29.12436283	$4.45195 \cdot 10^{12}$	141,077
8	Uranus	28.07940188	$1.56577 \cdot 10^{12}$	49,617
9	Neptune	27.4070621	$7.99348 \cdot 10^{11}$	25,330

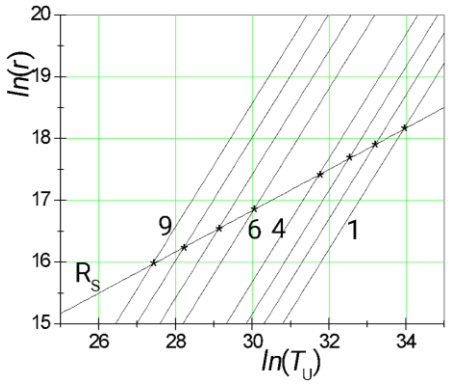

Figure 1. *Dependence of the Sun radius R_S and the distance from the Sun to the planets on the time of the existence of the Universe (the moment of creation of the planets - the intersection points of lines 1-9 and R_S). Data for the asteroid belt is missing.*

This makes it possible to calculate the moment of birth of all planets, as well as their parameters and the Sun's parameters at the moment of birth of the planets. Let us equate the radii of the planets and the radius of the Sun:

$$6.833 + \frac{x_i}{3} = \ln(V_i) + x_i$$

$$x_i = \frac{3}{2} \cdot [6.833 - \ln(V_i)] \quad (15)$$

Calculations of the time of birth of planets, as well as the distances from the Sun to the planets at the time of their creation and the speed of their distance, are given in Tables 2 and 3. In addition, the values of the radius and mass of the Sun at the time of the birth of planets were calculated. These data are given in Table 4. Based on this data, Figure 1 shows the dependence of the distance from the Sun to the planets and the radius of the Sun on the age of the Universe.

The results of the calculations show that the Sun was young when the planets were created. Its radius varied from 1% to 10% of its present size.

At the time of the creation of Neptune, the shape of the Sun was completely disk-shaped. Then the disk-shaped shape was gradually replaced by a spherical one, so that after the creation of Mercury, the contribution of the disk-shaped shape completely disappeared. As a result, no new planets were created after the creation of Mercury.

Table 3. *Parameters of the planets' orbits of the Solar System at the time of their birth.*

n	Planet	a_i, km	ln(a_i)	V_i, m/s	ln(V_i)
1	Mercury	75959	18.1457	1.385·10-7	-15.7924
2	Venus	55557	17.8329	2.589·10-7	-15.1668
3	Earth	47252	17.6710	3.579·10-7	-14.8430
4	Mars	38281	17.4605	5.453·10-7	-14.4219
6	Jupiter	20713	16.8463	1.8626·10-6	-13.1935
7	Saturn	15266	16.5411	3.429·10-6	-12.5832
8	Uranus	10776	16.1928	6.882·10-6	-11.8866
9	Neptune	8612	15.9687	10.774·10-6	-11.4384

From the UMIE model, it follows that the mass of the body grows proportionally to time. Therefore, it is easy to calculate the mass of the planets at the time of their creation (Table 4). Let's describe in detail the process of creating the Solar System, using the above-calculated data. At the beginning of its existence, the future star consisted of heavy atomic nuclei [5]. These nuclei rapidly multiplied and decayed with the release of electrons, protons, neutrons, α-particles, and the entire spectrum of heavier nuclei. The charged particles formed during radiation decay escaped beyond the boundaries of the star's nucleus. At the same time, the star's nucleus rotated with a high angular velocity. The rotation of the charged nucleus created a strong magnetic field. In this field, the charged particles ejected from the surface of the star's nucleus must move in a circular orbit, returning to the starting point. The radius of this orbit is determined by the formula:

$$R = \frac{m}{e'} \frac{\upsilon}{B} \quad (16)$$

where B is the magnetic induction, υ is the particle velocity,

and e' is its charge.

Table 4. Parameters of the Sun at the time of the planet's birth.

n	Planet	R_S, km	R_S/R_{S0}	The mass of the Sun at the time of the creation of the planets, kg	The mass of the planets at the time of their creation, kg
1	Mercury	75959	0.1091	$2609.0 \cdot 10^{24}$	$4.33 \cdot 10^{20}$
2	Venus	55557	0.0798	$1020.8 \cdot 10^{24}$	$24.985 \cdot 10^{20}$
3	Earth	47252	0.0679	$628.1 \cdot 10^{24}$	$18.862 \cdot 10^{20}$
4	Mars	38281	0.0550	$334.0 \cdot 10^{24}$	$1.078 \cdot 10^{20}$
6	Jupiter	20713	0.0297	$52.9 \cdot 10^{24}$	$504.946 \cdot 10^{20}$
7	Saturn	15266	0.0219	$21.2 \cdot 10^{24}$	$60.509 \cdot 10^{20}$
8	Uranus	10776	0.0155	$7.4 \cdot 10^{24}$	$3.258 \cdot 10^{20}$
9	Neptune	8612	0.0124	$3.8 \cdot 10^{24}$	$1.958 \cdot 10^{20}$

As the mass of the ejected particles increased over time, this caused the radius of the orbit to increase. In this case, the particle would return to the point where its mass increased. Therefore, the particle would no longer return to the surface of the star. Over time, the mass of the particle would increase, causing the radius of the orbit to expand. The rapid rotation of the star nucleus and the configuration of the magnetic field around it would cause the particle's orbit to be close to the plane of the disk. Thus, the nucleus of the future Oort cloud would form.

At the moment of birth of this cloud, the magnetic interaction will prevail over the gravitational interaction. In turn, the gravitational interaction will become dominant in the process of orbit expansion. Over time, it will become the only one.

It should be expected that the embryo of the future star can have an arbitrary shape: cylindrical, elliptical, or devoid of symmetrical elements. This conclusion can be made by analyzing the formation of multiple star systems [8]. Therefore, it can be assumed that the embryo of the Oort cloud should not have high symmetry. Over time, fairly massive bodies can form in them, consisting mainly of light atoms. Under certain conditions, a resonant interaction may appear between the elements of the Oort cloud and the embryo of the star, as a result of which massive particles will be ejected from the periphery of the star's disk, which contain many atoms with different atomic masses. As a result of the ejection of these particles, another cloud will be created, different from the Oort cloud. This cloud is called the Kuiper belt.

It is important that small planets can form in the Kuiper belt over time, capable of entering into a resonant interaction with a significantly enlarged star embryo. At this point, the star embryo has given a significant part of its angular momentum to the created belts. In addition, at this time, a clump of matter was born in the depths of the star, which, upon reaching resonance with small planets, stood out as a separate planet. Increasing in mass and moving away from the star, this planet became Neptune.

In the Standard Model, the planet Neptune was created last in the Solar System. And in the UMIE model, Neptune was created first among the planets.

Later, the masses of the Sun and Neptune embryos increased. The distance between them also increased due to the expansion of space. At a certain stage, this contributed to the emergence of a resonant interaction between Neptune and the Sun, resulting in the birth of the planet Uranus. Over time, an analogous situation led to the creation of the planets Saturn and Jupiter. In all these processes, it is worth noting that the birth of each subsequent planet was accompanied by a significant increase in the mass of its embryo. Therefore, Jupiter has the largest mass among the giant planets.

It would be logical to assume that Jupiter, as a result of the resonant interaction, would give rise to a planet with an even greater mass. However, in this case, the mechanism by which subsequent planets formed changed. This is caused by the large mass of Jupiter, which turned out to be sufficient for resonant interaction with the entire mass of the Solar disk. As a result, many small particles escaped from the Solar disk, which together formed the asteroid belt. In this belt, conditions arose for the appearance of a large number of mini-planet embryos. Moving away from the Sun, the mini planets of the asteroid belt formed a weak resonance with the Solar disk. As a result, Mars was born—a planet with a much smaller mass and radius, but with a much higher density than the large planets.

Over time, Mars interacts with the Sun and gives rise to a planet similar to itself, the Earth, which has a greater mass and

a larger radius. Using the same mechanism, the Earth should have given rise to an even more massive planet. This is confirmed by the fact that the mass of the Venus embryo exceeds the mass of the Earth embryo. And Venus gave rise to an exceedingly small planet - Mercury. The reason for these deviations in the last two cases is that the Sun's shape gradually changed from disk-shaped to spherical. In addition, giving its orbital momentum to the created planets, the Sun began to rotate much more slowly. The equatorial speed of the Sun's surface (now it is 1997 m/s) became insufficient to tear off massive parts from it that could become satellites of the Sun. Therefore, after the creation of Mercury, the creation of other planets turned out to be impossible.

The orbits of these planets must lie in the star's equatorial plane. Moreover, the stars and the planets in their orbits must rotate in the same direction. In this case, the axes of rotation of the planets can have an arbitrary direction (chaos), and the angular velocities of their rotation must differ significantly due to the turbulent processes of division of islands of matter, which we observe in the example of the planets of the Solar System.

What do we have? All the major planets—Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune—rotate around the Sun in the same direction (in the direction of the Sun's own axial rotation), in nearly circular orbits whose planes are slightly inclined to each other (and to the plane of the Solar equator).

The planets have different axial tilts, that is, their axes are directed at a certain angle to the plane of the parent star's equator.

Above, we considered an almost ideal case when, despite the uncontrolled nuclear transformation reactions occurring in the star's nucleus, it has the shape of an ideal disk. In reality, this shape can be elongated or even chaotic. In any case, at this stage, when gravitational compression of substances into a star is initiated, there is a possibility of forming not one, but two or even more stars. Rotation periods in star pairs can reach many thousands of years (at the maximum of the distribution). But more interesting is the case when the rotation period is only 11 minutes. In this case, a white dwarf moves at a speed of 1200 km/s around a 19-kilometer neutron star, the mass of which corresponds to the mass of the Sun [10]. The distance between the stars in this pair is 126,000 km, which is 3 times less than the distance between the Earth and the Moon. This fact makes us think about the mechanism by which such a pair of stars form.

The generally accepted mechanism of neutron star formation by supernova explosions in the literature cannot explain the existence of this close pair of stars, since the radius of a large star before its explosion significantly exceeds 126,000 km. For comparison, the radius of the Sun (an ordinary star) is 696,000 km. In this case, it should be assumed that the close pair of stars was such a pair from the very beginning. In other words, this is the rare case when the initial neutron matter did not evolve into the structure of a normal star. And the reason is precisely that a close pair of future stars was created from the very beginning. This revealed a powerful influence of one star on the other, so that one remained a neutron star, and the other was able to evolve only to the state of a white dwarf (an intermediate density between a neutron star and ordinary stars, i.e. a million times greater than the density of an ordinary star). As a result, the above fact clearly supports the mechanism of galaxy, star, and planetary system formation proposed in this article.

The probability of this type of development in star formation evolution is quite high since binary stars are often observed in the Milky Way galaxy. Triple stars are found much (about 20 times) less often. They, as a rule, consist of a close binary star (the main pair) and their distant companion, which revolves around the main pair as if it were a single body. An example of a triple star is our nearest neighbor, Alpha Centauri. The distant star Proxima Centauri orbits around the two-component system Alpha Centauri (Alpha Centauri A and Alpha Centauri B). Only with this structure is the system of three stars stable.

Quadruple stars for the stability of the system must be two close pairs of stars separated by large distances, which exceed the distance in the pair of stars by at least 5 times. Five- and six-fold stars have also been found, in which the third pair of stars revolve around a pair of double stars.

The book [11] notes that when the multiplicity of stars decreases by one, the number of systems increases by about 4 times. In this case, binary systems make up about 75% of all systems, triple systems - a little less than 20%, systems of four stars - around 5%, systems of five stars - 1.2%, and systems of six stars - 0.3%.

1.3. Resonance Between the Planets' Orbits of the Solar System

At this stage of the creation of planets, it is necessary to find quantum conditions that will ensure a known ratio of the radii of the orbits of the planets of the Solar system. Since this is a macroscopic system, the conclusion suggests itself about the formation of resonances between individual orbits of the planets. If neighboring planets at a certain time were on the same straight line passing through the Sun, then the following situation in resonance requires that when the second planet passes the angular path ϕ, the first planet passes the path $2\pi+\phi$.

We obtained the first ratio between periods:

$$\varphi \cdot T_n = (2\pi + \varphi) \cdot T_{n-1}, \tag{17}$$

or $T_n = (2\pi/\varphi + 1) \cdot T_{n-1}$.

This type of resonance should occur between neighboring planets. Now let's use Kepler's third law (a is the semi-major axis of the elliptical orbit):

$$\left(\frac{T_n}{T_{n-1}}\right)^2 = \left(\frac{a_n}{a_{n-1}}\right)^3 = (2\pi/\varphi + 1)^2. \tag{18}$$

From here

$$\left(\frac{a_n}{a_{n-1}}\right) = (2\pi/\varphi + 1)^{2/3}. \quad (19)$$

All matters outside the specified orbits will be attracted to the resonant orbit. As a result, planets are formed. There is no free matter left in the orbits of planets. The reason is that even with slight deviations of the orbits of the planet's nucleus and other matters, their meeting is inevitable. Therefore, the planet will capture matter from orbit around the star. For a planet to have its satellites, it is necessary that such a structure of matter exist during the creation of planets at the moment of separation from the disk of the future star. Other mechanisms for creating satellites are not as obvious.

What does the real state of affairs for the Solar System say in this regard? The results of the research are presented in Table 1.

Since $T_n = (2\pi/\varphi + 1)\cdot T_{n-1}. = (2\pi/\varphi + 1)^{(n-1)}\cdot T_1$, then

$$ln\left(\frac{T_n}{T_1}\right) = (n-1)\cdot ln\,\beta, \quad (20)$$

where the value $\beta = (2\pi/\varphi + 1)$.

Similarly

$$\ln\left(\frac{a_n}{a_1}\right) = (n-1)\cdot \ln\gamma, \quad (21)$$

where $\gamma = (2\pi/\varphi + 1)^{2/3}$.

According to these dependencies, we will construct graphs (Figure 2).

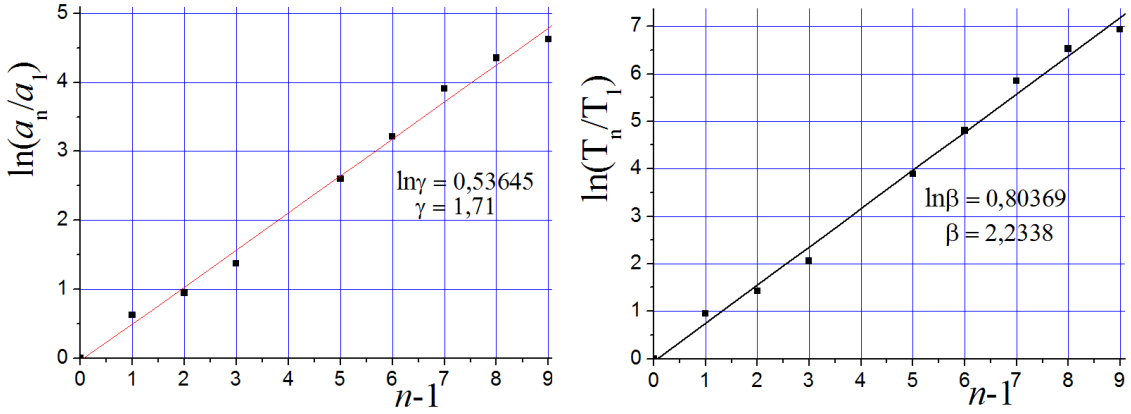

Figure 2. *Dependences of $\ln(a_n/a_1)$ and $\ln(T_n/T_1)$ on the number of the planet in the Solar System (data for the asteroid belt are missing from the graphs).*

Extrapolation of the obtained dependences by straight lines shows that there is a fairly good correlation (correlation coefficient 0.997 in both cases). β = 2.2338, γ = 1.71 were found. The ratio $ln\beta/ln\gamma$ = 1.5 corresponds to Kepler's third law. With such values of the coefficients found, the distant planet will describe an arc of 291.78° between two encounters, and the near one will describe one revolution more.

Here, we have tried to apply some physics to explain the regularities in the orbits of the planets in the Solar System. However, in the literature, there is an empirical dependence that describes the parameters of the orbits of the planets of the Solar System. This is the well-known Titius-Bode empirical law.

According to the law of Titius-Bode, the value of the average radius of the orbit of the nth planet in astronomical units is described by the formula:

$$R_n = 0{,}4 + 0{,}3\cdot 2^{(n-2)},\ R_M = 0{,}4. \quad (22)$$

where R_M is the radius of Mercury's orbit.

However, the empirical Titius-Bode law is only approximately fulfilled. It is believed that the results for Neptune fall out of this law, and instead, it is necessary to take Pluto. Let us try to clarify the dependence (22). Let us rewrite it in the form $R_n = R_M + c\cdot d^n$. (Distances in astronomical units)

In this case, the data for Neptune fit normally on a straight line, while the results for the plutoids (Pluto and Eris) deviate significantly. In this case, c = 0.32358 and d = 1.9388 were found. The correlation coefficient is 0.99963.

Thus, there are resonant dependencies between the orbits of the planets of the Solar System.

In a wide array of planets, resonance is indeed observed if the small planets (Pluto and Eris) are assigned numbers one unit smaller. In this case, the small Plutoid planets (except Eris) and Neptune are found nearby, which can only indicate that these cosmic bodies were formed in a complex way, similar to how the Earth and the Moon were formed together. However, certain forces that acted during the initial period of space expansion broke the connection between the small planets and Neptune. As a result, Neptune shifted slightly from its resonant orbit, and the small planets received orbits that deviated

significantly from the Sun's equatorial plane. However, the interaction between these cosmic bodies continues to keep them in orbits that fall outside the resonant series characteristic of all planets in the Solar System. Moreover, the orbits of Pluto and Neptune were found to be synchronized. It can be assumed that an external force not only caused the break of the connection between Pluto and Neptune but also caused a shift in the direction of Neptune's angular momentum.

2. Differential Rotation and the Magnetic Field of the Sun

For a long time, scientists have been studying the structure and characteristics of the Sun [12]. However, many questions remain unanswered: 1) how the Sun was created, 2) what source of energy the Sun uses, 3) what the nature of Solar magnetism is, 4) what the reason for the differential rotation of the Sun is, and many others.

Astrophysicists have found that the Sun rotates with different angular velocities at the poles and in the equatorial region. At the same time, they determined that the Sun's period of rotation at the equator is 25.38 Earth days, and at the poles, it is 34.4 days. Of course, there have been many attempts to understand the reason for the Sun's differential rotation ([12-14] and the references and scientific data analysis contained therein).

I will not analyze all the mechanisms of differential rotation, the nature of the magnetic field, and other issues considered in the literature, as they are well-known to specialists and do not address scientific problems. However, I will express my opinion on various aspects of the physics of the Sun.

Astrophysicists will use a phenomenological approach to understand the reasons for the Sun's differential rotation, examining various known mechanisms. And first of all, they use the Standard Model, which has no right to exist [5, 15]. At the same time, no one has considered the fundamentals of this phenomenon. Some of the proposed mechanisms are surprising. For example, they propose describing the differential rotation by a temperature difference of 5 degrees between the Sun's poles and equator. At the same time, they forget that in the equatorial strip between latitudes ±20°, temperatures in individual places differ by several hundred degrees.

The above observations have led the author of this article to conduct scientific research. Of course, the consideration of the above processes [16] occurring on the Sun will be conducted using the UMIE model [5, 15], which is being developed by the author of this publication.

The creation of matter in the UMIE model is considered in point 3 (SF) of this review work.

2.1. The Nature of the Energy Source in the Bowels of the Sun

Since the mass of the Sun increases at a constant rate (about 4.76 10^{12} kg/s [5, 15]), the radius of the Sun increases proportionally to the cube root of its time of existence.

The volume of the Sun contains only plasma. Atoms exist only in the Sun's atmosphere. It is clear that according to the classical thermodynamic distribution of Maxwell-Boltzmann, heavy atoms will be localized mainly in the center of the Sun, and light ones will appear near the surface. Therefore, there is no reason to claim that the entire volume of the Sun consists of hydrogen and helium. As a result of convective flows, several heavier atoms move to the surface of the Sun and increase their concentration in the Solar atmosphere.

The radioactive decay of heavy nuclei ensures that the Sun maintains a constant radiation capacity over billions of years. The accumulation of heavy nuclei in certain areas of the volume causes nuclear explosions, which cause plasma explosions on the surface of the Sun. Similar nuclear explosions, although much less common than on the Sun, also occur deep within the Earth, causing deep-focus earthquakes. Note that a thermonuclear reaction in the center of the Sun cannot cause plasma explosions on the surface of the Sun.

2.1.1. The Nature of Acoustic Waves on the Sun's Surface

The arrival of the SF into the volume of the Sun causes an increase in the mass and charge of a large number of atomic nuclei. Since heavy atomic nuclei are localized in the region of the Solar core, an increase in their mass and charge will cause a nuclear explosion. Nuclear explosions in the center of the Sun occur constantly at a high frequency. As you move away from the center, the frequency of these explosions decreases. Nuclear explosions in the center of the Sun cause the appearance of acoustic waves that are recorded on its surface. Moreover, standing acoustic waves are created at the core of the Sun, which cause periodic nuclear explosions. This resembles the stimulated emission used in lasers.

Since the intensity of nuclear explosions in the radiative transfer zone is much lower than in the Solar core, the corresponding acoustic waves reaching the surface of the Sun should have a significantly lower frequency than those from explosions in the Solar core. Similar observations are described in [17], but the authors of the article were unable to explain the results obtained.

2.1.2. Mechanism of Solar Magnetism

First of all, let us pay attention to the fact that the angular velocity of rotation of the Sun at the equator significantly exceeds the angular velocity at the poles. At the same time, at the equator, the tangential velocity of rotation of the Sun is 7.189×10^3 km/h = 1997 m/s.

Secondly, although the Sun's volume contains only plasma, each unit of volume turns out to be electrically neutral. The rotation of such an electrically neutral substance cannot, in the zero approximation, cause the flow of ring electric currents, and therefore cannot create a magnetic field.

The structure of the Sun is divided into three layers [12]: the Solar core, which extends up to 173,000 km from the center, the radiative transfer zone from the Solar core to 494,000 km from the center, and the convective zone, which extends to the very surface ($R_\odot$ = 696,342 km). There is no anomaly in the Sun's rotation in the convective zone. The presence of these zones is evidence that the nuclei of heavy chemical elements are localized in the central regions according to the Maxwell-Boltzmann distribution.

It is easy to understand that intense radiation processes occur in the core and the radiative transfer zone. In addition, there is an increase in the concentration of radioactive elements to critical values, which is accompanied by nuclear explosions [8], and the frequency of explosions decreases with distance from the center. Explosions are practically absent in the convective zone. If such explosions occur in the radiative transfer zone, their energy wave (which resembles deep-focus earthquakes on Earth) [18] can reach the surface of the Sun and, under appropriate conditions (for example, in the region where the magnetic field exits to the surface, i.e., in the region of dark spots) can cause plasma explosions on the surface. These explosions in the radiative transfer zone are also accompanied by the transfer of light nuclei to the convective zone.

Explosions occurring in the Sun's core and in the radiative zone can transfer energy and light to the entire surface, providing radiation of electromagnetic waves and particles (electrons and atomic nuclei) that create the Solar wind.

So, from the core to the radiative transfer zone, there is a large flow of light nuclei, and from the radiative transfer zone to the convective zone, there is a relatively weak flow. However, it is the explosions in the radiative transfer zone that cause the presence of explosions in the Sun's equatorial zone.

Let's consider the nature of Solar magnetism, taking into account that the Sun's volume is divided into three zones. At the same time, I emphasize once again that the rotation of electroneutral plasma, which fills the Sun's volume, is unable to create a magnetic field. For this, at least, the creation of a double electric layer with a sufficiently large distance between the layers of localization of electrons and cations is required [18].

It is especially worth noting the anisotropy of matter in the Solar core, where the density of matter exceeds the density of solids on Earth [12]. In this case, the matter on the Sun is in a plasma state. In this case, we are dealing with a degenerate electron gas. From quantum statistics, it is known that the energy of an electron at the Fermi level is proportional to the concentration of free electrons to the power of ⅔. A decrease in the concentration of electrons with distance from the center of the Sun will cause a reduction in the Fermi energy. Therefore, a Fermi energy gradient will form, which will cause electrons to move away from the center, increasing the positive charge there. Since the center is filled with atomic nuclei of heavy chemical elements, they will push protons out of the center, reducing the already small probability of a thermonuclear fusion reaction. In any case, an electric field strength will appear, which will stop the further movement of electrons from the center. This is a stable, stationary state that cannot cause a plasma explosion on the Sun's surface.

Let us use as a basis the fact that nuclear explosions constantly occur in the Solar core, which causes isotropic radial flows of high-energy electrons and protons. These electrons must have an energy much higher than the Fermi level, that is, they have a large kinetic energy. These flows are immediately superimposed by the anisotropy of the plasma, which will force additional flows of electrons to change the direction of movement so that they move away from the center. As a result, they have the opportunity to move a large distance from the flow of excess cations, creating an electric field in a radial direction, the intensity of which significantly exceeds the steady state of the plasma. Since these flows develop in matter, they quickly thermalize.

We have an effect that causes the creation of a powerful double electric layer in a dynamic process at the boundary between the core and the radiative zone. In this case, an excess of positively charged particles (mainly protons) will be created under the surface of the Solar core, while an excess of electrons will be found above the surface. The total value of the charges in these layers is the same. Since this is a dynamic process, an electric current will arise, resulting in the disappearance of the double electric layer. At the same time, other nuclear explosions will restore the double electric layer. We will have a quasi-equilibrium state, resulting in a constant double electric layer.

The rotation of the Sun leads to the formation of ring currents in the area where excess electric charges are localized. A layer with an excess of electrons, having a greater tangential speed of movement in a circle, creates a magnetic field directed towards the south pole. A layer with an excess of positive electric charges creates a magnetic field in the opposite direction. However, this field is significantly weaker than the field created by electrons. The difference in the intensity of these magnetic fields gives the resulting magnetic field of the Sun. The greater the distance between the created electric layers, the greater the magnitude of the Sun's magnetic dipole. Since nuclear explosions occur chaotically, one can expect fluctuations in the electric field strength, and therefore fluctuations in the Sun's magnetic field intensity.

Note that similar processes must occur at the boundary between the radiative transfer zone and the convective zone. Since in this case the intensity of nuclear explosions is much lower than in the Solar core, the contribution of the corresponding currents to the total magnitude of the Sun's magnetic field is significantly smaller than in the first case.

Between the created electric layers is neutral plasma. The rotation of the Sun around its axis causes the fact that, in neutral plasma, according to the Hall effect, electrons deviate from the axis, while positive charges deviate towards the axis. Therefore, this effect will strengthen the double electric layer and enhance the Sun's magnetic field. However, we are

dealing with a highly conductive plasma. In this case, the Hall effect will be weak. In addition, the direct current that arises in the dynamic process must be much stronger than the flow of charged particles in the Hall effect.

Now let's try to describe the appearance of dark spots and visible eruptions on the Sun's surface in the equatorial zone. To do this, let's assume that a powerful nuclear explosion occurred at the boundary of the radiative transfer zone and the convective zone. Here, the density of matter is much lower than the density of crystalline substances on the surface of the Earth. Therefore, we will have a classical distribution of electron energy. As a result of the nuclear explosion, turbulent plasma flows arose, part of which falls into the equatorial zone of the Sun. Since these flows are turbulent, they create annular magnetic fields around them. This results in a frozen magnetic field that slowly moves to the Sun's surface, where it manifests as dark spots for an extended period.

It is important to note that the magnetic field around turbulent plasma flows is represented by a single closed field line. When exiting the Sun's surface, that is, into the region of decreasing plasma density, the density of the magnetic field lines increases in the lower part of the frozen magnetic field and decreases in the upper part. This will lead to the creation of an induction current under the region of the frozen magnetic field (Foucault currents). As a result, the upper turbulent plasma flow will disappear when exiting the Sun's surface, and a lower turbulent flow will appear instead, in which the plasma moves in the opposite direction. In this case, the polarity of the magnetic field in the black spot region will change to the opposite, and the frozen magnetic field itself will be deep under the surface of the Sun at birth. After a few Earth years, this field will come to the surface, and the cycle of switching the frozen magnetic field will repeat.

2.2. The Mechanism of Differential Rotation of the Sun

Now let's return to the differential rotation of the Sun (Figure 3).

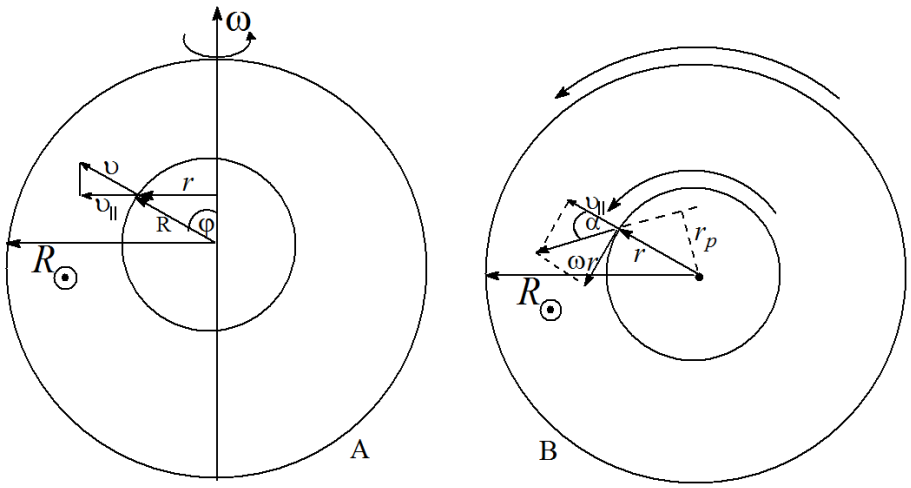

Figure 3. *Processes on the surface of the Solar core in two projections: (A) – in the plane containing the axis of rotation; (B) – in the plane perpendicular to the axis of rotation of the Sun.*

As shown above, even though the streams of particles born as a result of explosions initially propagate in all directions, over time they will be directed along the radius to the surface of the Sun (average speed υ). And since the Sun rotates around its axis, the tangential component of the velocity of particles on the surface of the Solar core (ωr), adding up with the radial (υ_l), causes the creation of a torque ($F\, r_p$), which is transmitted to the radiative transfer zone and slows down the rotation of the Solar core. Here, the value of F is determined by the value of the mass flux of particles per unit time from a unit area, multiplied by the particle velocity υ_l and the area of a ring with a radius r of unit width. Similarly, light atomic nuclei created in the radiative transfer zone will transfer angular momentum to the convective zone. It is easy to show that the magnitude of the angular momentum transferred to the radiative transfer zone will be proportional to $R^2\omega\cdot\sin\varphi$, where R is the radius of the Solar core, ω is the angular velocity of rotation of the core, φ is the angle between the axis of rotation of the Sun and the direction of the radius R. As a result, the angular velocity of rotation of the Solar core will decrease, and the radiative transfer zones in the equator region will increase. At the same time, the hydrodynamic friction between the layer's increases, ensuring dynamic equilibrium and stabilizing the differential rotation of the Sun.

Similarly, the angular velocity of the radiative transfer zone will be less than the angular velocity of the convective zone due to nuclear processes in the radiative transfer zone. As a result of these processes, the rotation speed of the Sun in the equatorial zone will exceed the rotation speed in the polar region.

3. The Earth's Internal Structure and Magnetic Field

When considering all the significant efforts aimed at understanding the mechanisms and processes that occur within the Earth's bowels, specialists lack a unified approach to the specified problem. This approach should be based on the mechanisms of the Universe's creation and evolution. This could be the Standard Model [19-21], which has been developing for many decades. Alternative models could be used. And, finally, the UMIE model, developed by the author of this review [5], can be used.

A lot of attention has been paid to the development of the Standard Model of the Universe's creation. Since the laws and principles underlying this model contradict the laws of physics [5], to save the model, its "improvements" appear (the inflationary model; the problem of dark matter and dark energy; mechanisms for the creation of atoms more massive than an iron atom, etc.), which again violate the laws of physics. This situation, with modeling the creation of the Universe affects our understanding of the Earth's structure, and in particular, the Earth's core. In this regard, let us consider in detail, within the framework of physical laws, all the processes that have shaped the Earth's real structure, as well as the processes occurring within it, to understand the nature of the Earth's magnetic field.

3.1. The Processes of the Earth's Creation and Its Magnetic Field in the Standard Model

According to the Standard Model of the Universe, it arose as a result of the Big Bang from a singularity of a fundamental volume containing energy equivalent to the entire future mass of the Universe, which was characterized by an extremely hot temperature (~10^{28} K [22]). The initial entropy of such a Universe was also extremely high ($S_0 = 10^{88}$ J/K [23]).

As such, the Universe expanded, quarks and leptons were first born in it, and then protons and neutrons. The expansion of the Universe was accompanied by cooling, as a result of which electrons combined with protons to form hydrogen atoms. With the further expansion of the Universe, stars were formed due to fluctuations in the density of matter, such as hydrogen clouds. The compression of matter in hydrogen clouds was accompanied by a significant increase in temperature, which in the central regions of stars could reach millions of degrees. This ensured the thermonuclear fusion of helium and heavier nuclei up to the iron atom nucleus. Further synthesis of heavier nuclei turned out to be energetically unprofitable. Therefore, within the framework of the Standard Model, the problem of creating atomic nuclei heavier than the iron nucleus is not solved. Perhaps for this reason, geophysicists believe that the Earth's core is mainly composed of iron atoms [24, 25].

Modeling the processes of ultrasound reflection from layers at different depths in laboratory conditions made it possible to isolate the Earth's core, as well as the lower mantle, upper mantle, and lithosphere. In addition, this made it possible to model the composition and state of different layers. As for the Earth's core, the reflection of ultrasound from it made it possible to assume that the Earth's core consists of a mixture of substances, more precisely: iron (about 85%), nickel (about 10%), and silicon (about 5%).

The reflection of ultrasound made it possible to establish the radius of the core, which is equal to 3486 km. Moreover, the study showed that the Earth's core can be divided into two parts: the inner core, with a radius of 1216 km, and the outer core. It turned out that the inner core is solid, and the outer one is liquid. This follows from the fact that transverse waves do not pass through the outer core, and for the inner core, anisotropy was found, characteristic of its crystalline structure. As for the composition of the inner core, there is an opinion that, in addition to the above composition, heavy radioactive nuclei, including uranium, are present in the Earth's core [26].

Unable to explain the creation of heavy nuclei (from iron to plutonium) within the framework of the Standard Model, scientists have assumed, without sufficient justification, that such nuclei arise during supernova explosions. As a result of these explosions, clouds of hydrogen atoms and dust, as well as meteorites, asteroids, etc., exist in space. No one has conducted detailed modeling of these processes, and therefore, there is no confirmation of this opinion. Moreover, it can be argued that such an assumption is true, since almost every star has a planetary system, and supernova explosions are a very rare process.

Theoretically, it can be shown that thermonuclear reactions in stars create all possible nuclei, up to iron nuclei. However, it is practically impossible to prove this. Nevertheless, in the Standard Model, such a mechanism for forming atoms is considered proven by default. When oxygen atom nuclei are formed in stars, they eventually turn into oxygen atoms and, interacting with hydrogen atoms, form water molecules. And from this, follows the significant distribution of water in the Universe.

3.2. Disadvantages of the Standard Model regarding the Creation of the Earth and Its Magnetic Field

The shortcomings of the Standard Model of the creation of the Universe have already been discussed in Part I of this review. We should also note that even in thermonuclear stars, the temperature in the center of which exceeds 10^9 K, the reactions of fusion of heavy nuclei (up to the iron core) proceed very slowly. Therefore, during the Universe's existence, the fusion processes did not lead to the creation of iron atoms. In stars such as our Sun, the thermonuclear reaction in the center can provide only the simplest nucleosynthesis reaction, in which four protons fuse into a helium nucleus. This is because in the center of the Sun the temperature can reach $15 \cdot 10^6$ K, and the nucleosynthesis reaction proceeds at tem-

peratures of $(10\div14)\cdot10^6$ K. However, as mentioned above, protons are removed from the center of the Solar core, as a result of which the simplest nucleosynthesis reaction cannot proceed.

In this case, we need to answer the question: why is the proportion of helium on the surface of the Sun ~25%; where did oxygen (0.77%), carbon (0.29%), iron (0.16%), neon (0.12%), nitrogen (0.09%), silicon (0.07%), and other chemical elements come from in the Sun's photosphere? [12]

Now let's discuss the assumption that heavy atoms, including uranium and plutonium, are produced in supernova explosions. In this case, we can say the following. In the Standard Model, it is assumed that the entire volume of the star initially consisted only of protons and electrons. Over time, helium nuclei were created as a result of nucleosynthesis. Therefore, a star explosion cannot immediately make the complete set of heavy atomic nuclei, even if, according to the assumption, iron atomic nuclei have already been created in the volume of the star.

In this regard, to explain the appearance of heavy atomic nuclei, we will use the UMIE model. According to this model, the volume of the star contains light and heavy nuclei of chemical elements. At the same time, according to the classical Maxwell-Boltzmann distribution, heavy nuclei are concentrated in the central regions of the star. In contrast, the surface of the star is represented mainly by relatively light nuclei, mainly hydrogen and helium nuclei, as evidenced by the radiation spectra of stars. The hot temperature of the star causes the fact that almost its entire volume is represented by electrically conductive plasma. With a sufficiently large mass of the star, the pressure value and the Fermi level in the center of the star will rise so high that the energy of the electrons can reach the difference in the rest energies of a neutron and a proton (1.29332 MeV/c^2 = 2.531 m_e), which will cause the combination of electrons with protons with the formation of neutrons even in heavy atomic nuclei. There will be a decrease in the volume in the center of the star. As a result, a plasma flow will appear to the center of the star with the formation of a neutron star nucleus. The process will proceed uncontrollably. At the same time, a large kinetic energy is released, and the front of which moves from the center to the surface of the star. When the level of gravitational energy of the near-surface layer of the star is reached, the kinetic energy tears this layer apart, giving it a hot temperature. A flash occurs, which is registered as a new star. Thus, during supernova explosions, the upper part of the star is thrown into space, primarily consisting of light nuclei that cannot synthesize heavy nuclei when the star explodes. Therefore, the above assumption regarding the birth of heavy nuclei in clouds of hot matter thrown into space does not correspond to reality.

It is surprising that astrophysicists, as a rule, consider the creation of stars and planets from the matter that results from supernova explosions. And rarely consider all the processes that occur during star formation from the very beginning, from the Big Bang. At the same time, it turned out that there are planets near all stars that may contain the same chemical elements that are on Earth. On Earth, it is known that its composition includes the entire table of chemical elements, including deposits of lead, mercury, and gold, as well as uranium deposits with a mixture of plutonium.

This review shows that existing theories and models of the Universe's creation are unable to adequately explain its structure, as well as the formation of chemical elements and their compounds.

3.3. The Processes of Creation of the Earth and Its Magnetic Field in the UMIE Model

Now let's pay attention to the appearance of the Earth's magnetic field. Supporters of the Standard Model believe that the liquid, metallic outer core, which rotates around the Earth's geometric axis, is responsible for the Earth's magnetic field. It is easy to understand that the simple rotation of the liquid metal cannot cause the appearance of a magnetic field, since this metal is electrically neutral. Therefore, electrons and atomic nuclei move with the same average speed, as a result of which the average magnitude of the electric current is zero.

In the new model, the problem of the creation of chemical elements and their compounds on the Earth, as well as the appearance of the Earth's magnetic field, must be solved in conjunction with the problem of the creation of the nuclei of all chemical elements, as well as with the structure of the Earth's interior and the processes occurring inside the Earth.

The UMIE model takes into account all the laws of physics and uses the Laws of Unity and Similarity [5] (see Part I of this review).

Now let's see which chemical elements would not exist if they were born as a result of thermonuclear fusion. These include the widely known atoms: Ni, Cu, Zn, Se, Ag, Sn, W, Pt, Au, Hg, Pb, U, Pu. There are entire deposits with a high content of these atoms, which allows them to be widely used in industry. So, how were they actually created?

In the article [27] and in Part I of this review, the processes responsible for the creation of these atoms are described in detail from the point of view of the UMIE model.

It was shown above that the Earth's nucleus was created 4,183,734 years after the Universe was formed, through separation from the peripheral region of the Sun, which at that time had a disk-shaped form. Just as multiple stars were formed by division from a single, asymmetric star nucleus, an asymmetric Earth nucleus was also created, which divided to form the Earth and the Moon. Therefore, the Earth's nucleus was hot. There was no solid phase separation in the center of the Earth's nucleus. The solid crust and solid core formed over time as the Earth's mass increased sufficiently and its surface cooled. If the mass of the Earth remained constant, there would be no need to create lithospheric plates. There would be a single crust for the entire surface of the Earth. Since the

mass of the Earth is constantly increasing, the crust cannot remain intact. It is broken into many plates that are in constant motion. The result of this motion is the well-known separation of South America from Africa.

The cooling of the Earth's nucleus caused crystallization processes on the Earth's surface, and the increase in mass and pressure in the Earth's center led to the crystallization of the core. Thus, the inner solid core of the Earth formed, and its volume has increased over time. New matter continues to accumulate within it, so it cannot be a single crystal. From this, we conclude that the Earth's core must have a polycrystalline structure, formed from atoms of different nature, from hydrogen atoms to uranium atoms.

Hydrogen atoms can diffuse through the solid core's volume and escape into the magma [28]. Radioactive nuclei of chemical elements formed in the Earth's core are unable to move through the volume and form their phase. However, remaining (α, β, γ, n)-radioactive, they contribute heat to the Earth's solid core. It is clear that the property of the Earth's core to reflect acoustic waves can only be approximately modeled by the combination of the three substances mentioned above.

A lot of information is emerging regarding the rotation of the inner core around its own axis. In particular, the speed of its rotation does not correspond to the speed of rotation of the Earth's surface. Such a phenomenon is possible because the outer core is liquid and therefore does not interfere with the existence of the specified difference in rotation speeds. However, one cannot categorically agree with the opinion of some researchers that the direction of rotation of the core can change. This opinion contradicts the laws of physics. It is interesting to note [29] that the axis of rotation of the core deviates from the axis of rotation of the Earth by 0.17°. This effect is easily explained by considering the nutation of the Earth's axis. Currently, the Earth's geometric axis is inclined to its orbital axis by 23.5°. In addition, the deviation of the Earth's axis varies over time, ranging from 24.5° to 22.1°, with a period of about 41,000 years. Since an outer liquid core surrounds the solid core, its axis must lag behind the Earth's axis of rotation, which causes the observed deviation.

The processes of new nuclei forming in the Earth's core and their radioactive decay are easily demonstrated by analyzing the composition of gases dissolved in water at depths of several hundred meters. Here we will notice the presence of inert gases, from helium to radioactive radon. Thus, at great depths in the Earth, hydrogen, nuclei of inert gases, and radioactive nuclei are constantly being born.

Now, let's proceed to the description of the processes that cause the Earth's magnetic field to appear and the possibility of changing magnetic poles.

Of course, the Earth's magnetic field has not gone unnoticed by researchers. However, they admit that they still do not know why the planet's magnetic axis flips.

Continuing their study of the Earth's internal structure, the authors observed that a thin but fairly strong layer surrounds the outer core, the thickness of which varies by tens of kilometers. According to [30], this layer is heterogeneous in thickness and can reach 200 km. They suggested that this layer is the Earth's oceanic crust, which, over millions of years, has descended due to the presence of convection currents in subduction zones (the subduction of lithospheric plates) to its current location.

We have already said above that the mass and size of the Earth are constantly increasing, which has led to the separation of the Earth's crust into many fragments, i.e., lithospheric plates. These plates are in constant motion. Sometimes one plate sinks under another. As a result, this can lead to the sinking of the submerged plate beneath the magma.

On the other hand, as mentioned above, light atoms created as a result of radiation processes in the Earth's core will diffuse from the liquid core into the magma region [28], creating a zone of reduced matter density, known as the Gutenberg gap. The thickness of this layer can exceed 100 km. Therefore, the thin layer between the liquid core and the magma at certain periods may have a reduced or increased density relative to the density of the fluid core and magma.

To explain the origin of the Earth's magnetic field, we will use the Laws of Unity and Similarity to describe the processes occurring between the liquid core and magma. Similarities can be found when considering the contact of two semiconductors or the electric field between the Earth's surface and the ionosphere.

Returning to the thin layer at the boundary of the Earth's core and the magma, we will see that electric charges arise on the surfaces of the thin layer, creating a potential difference. The direction of the electric field will depend on the ratio of the density of matter in the layer, on the one hand, and on the core or magma, on the other. Charges with a certain surface density σ will be localized on the surface of the electrically conductive outer core. Charges of a different polarity will be significantly delocalized along with the thickness at the boundary of the thin layer and magma. To estimate the magnitude of the Earth's magnetic moment, we will assume that these charges at the boundary of the thin layer and magma will be localized at a distance $\Delta R = R_2\text{-}R_1 = 100$ km from the Earth's liquid core. The magnitudes of these charges are the same and equal to

$$q = \sigma \cdot 4\pi R_1^2 \tag{23}$$

The magnetic moment magnitude is found by the formula

$$p_m = \frac{q}{3}(R_2^2 - R_1^2) \cdot \omega = 7{,}812 \cdot 10^{22} \ \ A \cdot m^2 \tag{24}$$

Since $\omega = 7.272 \cdot 10^{-5}$ rad/s, then the value of $q = 4.6 \cdot 10^{15}$ C, which corresponds to $1.5 \cdot 10^{20}$ proton/m^2, or $\sigma = 24$ C/m^2. In this case, the magnitude of the electric field in a thin layer can range from 10^6 to 10^9 V/m, depending on the layer's thickness. Of course, such an electric field will cause the appearance of an electric current, which will try to reduce the potential

difference. At the same time, the constant operation of radiation processes in the Earth's core will restore the potential difference, stabilizing the magnitude of the Earth's magnetic field.

If we assume that the resistivity of the substance in the thin layer is $\rho=10^{12}$ Ohm·m, then the current density in the layer will reach $j = 10^{-6} \div 10^{-3}$ A/m^2. This current must be compensated by the flow of charged particles from the core to the magma. Of course, the results of special measurements are needed to specify the quasi-equilibrium charge on the surfaces of the thin layer, as well as the current density.

For comparison with the processes described above that affect the Earth's magnetic moment, let's consider the presence of an electric field between the Earth's surface and the upper atmosphere. It is known that the electric field strength in the Earth's atmosphere at low altitudes reaches ~100 V/m and decreases with increasing altitude, so that at an altitude of 50 km the electric field is practically absent. In this case, an electric current with a density of $2 \cdot 10^{-12}$ A/m^2 arises [31], which can cause a decrease in the electric field strength. However, the Solar wind and similar cosmic flows of charged particles compensate for the reduction of the electric field due to the flow of the specified electric current. Paying attention to the quasi-equilibrium magnitude of the electric current flowing in the atmosphere, we can conclude that the corresponding electric field is much weaker than in a thin layer around the Earth's core and therefore will have practically no effect on the magnitude of the Earth's magnetic moment.

Now let's analyze the influence of the Hall effect on the magnitude of the Earth's magnetic moment. So, in the created magnetic field of the Earth, there is a rotational movement of the thin layer and the metal core. This movement leads to the separation of charges due to the Hall effect. The electrons will move away from the Earth's geometric axis, and the cations will approach it. The movement of these charges in the metal core will create a slight additional contribution to the Earth's magnetic field, since the value of the Hall constant in the metal is many orders of magnitude smaller than in a semiconductor. Therefore, in a thin layer, the Hall effect should be significant, which would increase the magnitude of the Earth's magnetic moment. However, this effect provides a constant direction and does not provide the movement of magnetic poles or switching the direction of the magnetic field.

To understand the reasons for the movement of the magnetic poles and the reversal of the magnetic field direction, let's consider the process of creating a thin layer on the core's surface. The flow of light particles from the core into the magma should interact with the lithosphere over time, creating a prerequisite for sections of the lithosphere to be lowered to the surface of the core [32], resulting in a thin layer with increased density. An electric field of the opposite direction is created on this layer. That is, the Earth's magnetic field is switched. In [32] it is theoretically shown that the half-period in the switching of the magnetic field should be 30-60 million years. At present, the density of matter in the layer is reduced due to the large contribution of light atoms.

The divergence of the directions of the Earth's geometric and magnetic axes is because the thickness of the layer surrounding the Earth's core is not constant. In addition, changes in the thickness of the layer in certain areas of the core surface or the creation of the new regions due to the lowering of lithospheric elements cause the movement of the Earth's magnetic poles. This movement is especially noticeable in the twentieth century.

4. Creation of Water and Minerals on Earth

Modern estimates of the amount of water in the Earth's hydrosphere (i.e., water in the oceans, seas, lakes, rivers, atmosphere, glaciers, as well as groundwater and groundwater at depths of several kilometers) indicate that its total volume is 1,454,193 km^3 [33]. Groundwater is very weakly dependent on the natural water cycle, while other waters play an active part in the water cycle.

The presence of deep water in the Earth's mantle, which is located at depths of 410–670 km, is considered separately [34]. Estimates show that the volume of deep water is approximately equal to the volume of water in the Earth's hydrosphere. Thus, there is a large body of factual material regarding water on Earth and its role in the emergence of life on Earth. Nevertheless, the emergence of water on Earth is an unresolved fundamental question.

It is suggested that the outer part of the Solar System (beyond Jupiter) is filled with meteorites containing water-rich carbon compounds. In contrast, the inner part consists mainly of meteorites that do not contain water. So, where did the water on Earth come from?

The problem of water formation on Earth and in the Universe is of interest to both physicists and geologists. Scientists have studied everything that can be studied but have not found answers. Previously, these studies were not systematic. In recent years, there has been hope of obtaining information about the content of water molecules in massive bodies, both in the inner and outer parts of the Solar System, relative to Jupiter, thanks to the regular launches of space laboratories.

The study of objects falling to Earth shows that, in all cases, some proportion of bound water is found in the structure of the samples. Thus, water is extremely widespread in Space. Its traces have been found far beyond the Solar system's boundaries.

It is believed that water is formed as a byproduct of the star formation process, which is accompanied by increases in the density of gas and dust clouds. In them, reactions occur that end in the formation of water molecules. However, similar reactions can also occur in the Earth's bowels, for example, as a result of the interaction of hydrogen with quartz [35] at high pressures (~2×10^5 atm) and temperatures (~1700°C). At the same time, there is an opinion that water that appears at great

depths is capable of causing powerful and deep earthquakes. This opinion arose because no other mechanism was found. Of course, this is impossible. It is enough to recall that ordinary chemical reactions release about 3 eV of energy per molecule. Even a large number of molecules can release energy like a conventional explosive. Such an explosion at great depths is far from sufficient to be felt on the surface of the Earth. Another matter is nuclear reactions, which can release energy of about 5 MeV per nucleon. Only such an explosion can cause a strong deep-focus earthquake.

Models of water formation in certain regions of the Solar System have also emerged [36].

An interesting but implausible model suggests that approximately 4.5 billion years ago, a Mars-sized planet called Theia crashed into proto-Earth, containing a significant amount of water [37, 38]. This water was carried to the newly formed Earth, and the excess energy released after the impact created a large dust cloud from which the Moon was formed. This model seems implausible because it suggests that the water remained on Earth, while heavier compounds and dust were able to escape and form a single cosmic body, the Moon. But where did the water on the hypothetical planet Theia come from? It came from another star system or galaxy. This conclusion can be drawn because planets in the Solar System were formed as a result of resonant interactions between a previously formed planet and the disk-shaped Sun (the UMIE model). Furthermore, if there was a lot of water on the hypothetical planet, why should there be little of it on Earth?

Against the background of the mentioned separate works, a study [39] appeared, in which the author conducted a systematic examination of all the above-mentioned mechanisms of water creation on Earth. Having studied all the processes associated with the appearance of water on Earth, he concludes: “The arrival of water to Earth in the composition of the substance of asteroids and comets is considered additional and less significant in terms of mass.”

“In geological concepts of the creation of the Earth, water is considered to be mainly an intraplanetary formation, owing its origin to the degassing of the planet’s core substrate.” Estimates of the asteroid accretion of the Earth’s hydrosphere made in [39] showed that it is not so significant as to be taken as the main source of water on the planet (2500 times smaller than the volume of the Earth’s modern hydrosphere).

As a result, [39] concludes that the Earth’s hydrosphere is formed mainly from primary water, which was contained in a bound state in the substance of the protoplanetary cloud, which from the very beginning constituted the entire volume of the planet and its internal source of water.

Thus, existing theories and models are unable to adequately explain the structure of the Universe, as well as the formation of chemical elements and their compounds, in particular water. Therefore, let us consider the processes of water formation in the UMIE model.

In the new model, the problem of water creation on Earth, as well as the formation of chemical elements and their compounds, must be addressed in conjunction with the problem of the Universe's creation and evolution. The UMIE model consistently describes the creation of the nuclei of all chemical elements, as well as the internal structure of the Earth and the processes occurring within it.

The processes responsible for the creation of the entire spectrum of chemical elements from the point of view of the UMIE model are described in detail in the first part of this review. This model logically explains the creation of oxygen, nitrogen, and argon atoms, which form the basis of the Earth's atmosphere. The Earth is at an ideal distance from the Sun, which allows oxygen atoms to combine with hydrogen atoms to form water and also provides the conditions necessary for life on Earth to exist. In addition to water, oxygen forms oxides of various elements, which form the basis of the Earth's crust. A list of relevant processes is given in the article [32].

Thus, in the central regions of the Earth, a normal nuclear reaction occurs, as a result of which the magma has a hot temperature at which the substance is in a viscous liquid state. In this phase, the concentration of heavy atoms and crystal formation occurs. This process is energetically advantageous. Since the environment of each crystal makes it an open system, the excess entropy passes into the surrounding liquid. The presence of the process of crystallization of atoms in magma is confirmed by the creation of diamonds from carbon atoms, as well as other crystalline bodies. When faults appear in the Earth's crust, diamonds come to the Earth's surface. Volcanic activity brings various crystalline bodies to the Earth's surface.

Regarding the crystallization process in magma, it is worth highlighting several key points. First of all, we are talking about the initial conditions for the crystallization process. One of these conditions is the presence of crystallization centers, or information about nucleation and the course of crystallization. As a rule, such information comes from faults in the Earth's hard shell in the form of entropy. At great depths, heavy atomic nuclei are born, which, with a certain probability, can decay as a result of radiation processes. When the concentration of these nuclei reaches a certain critical value, crystallization processes occur. If this is the crystallization of uranium or other radioactive substances, then when the critical mass is reached, a nuclear explosion will occur, which is recorded as an intermediate (at a depth of 80-300 km) or deep-focus (at a depth of more than 300 km) earthquake. Of course, there are also normal earthquakes (at a depth of 0 to 70 km), but in these cases, the nature of the earthquake is different.

In places where the Earth's crust breaks, volcanic activity occurs, resulting in large areas of the Earth's surface being filled with a substance that is eventually extracted as minerals. Cracks in the Earth's crust are also filled with a substance that has come from deep within the Earth. This is how deposits of heavy chemical elements appear.

The presence of crystallization processes of heavy chemical elements makes magma an inhomogeneous medium. This

means that the chemical composition of hot lava, which reaches the Earth's surface during volcanic eruptions, varies from place to place. Therefore, in different deposits of iron ore, the percentage of iron is different, and the composition and other impurities are different. A similar conclusion can be drawn regarding deposits of other minerals.

The UMIE model states that the processes of formation of all possible atoms occur throughout the Universe. From this, we conclude that everywhere in the Universe, hydrogen and oxygen atoms are born, between which, under certain conditions, chemical bond formation reactions occur: H_2, O_2, OH, H_2O, and all possible anions and cations from these compounds. These reactions can occur at arbitrary pressures and temperatures characteristic of the Earth from its center to the ionosphere. It is not surprising that large reserves of water have been found at depths of hundreds of kilometers. In particular, in the Caribbean Sea, volcanoes constantly eject hot water (over 400°C). This process is not hindered by the pressure of a water column about 5 km high. The hot water ejected by volcanoes did not originate from the sea beneath the Earth's crust but was formed at great depths within the Earth. This is confirmed by the fact that high concentrations of gold, silver, copper, and zinc have been found in volcanic emissions [40-42].

Volcanoes, lava flows, and fields have also been found on the Moon, Mars, Mercury, Venus, and the satellites of the giant planets, indicating that these bodies have hot interiors. Therefore, we should expect that hydrogen and oxygen atoms are also born there, which can combine to form a water molecule.

Hot temperatures in magma and the Earth's core are caused exclusively by radiation processes. If radioactive elements were not born in the central parts of the planet, the planet would have cooled down long ago. According to the laws of physics, thermonuclear processes, which are attributed to the activity of stars and, in particular, the Sun, cannot occur in magma. Because radioactive elements were formed at great depths in the Earth, geological processes led to the emergence of deposits containing various chemical elements, including radioactive ones.

On cold planets, liquid water is impossible to exist. Therefore, on the surface of these planets, only ice formed after volcanic eruptions can be found. On the other hand, on hot planets, all the water above the surface of the planet is present only in the form of gas, or the processes of dissociation of water molecules occur. In this case, hydrogen atoms can escape from the planet, and oxygen atoms form stable oxides of heavier chemical elements.

Thus, the Earth, like other cosmic bodies, receives energy from the cosmic microwave background at a constant rate, as a result of which matter is created in its volume. The consequence of this is an increase in the radius of the Earth and the mutual distance of the continents [43]. Similarly, the radius of all other cosmic bodies in the Universe increases. The expansion of space causes the distance between stars and galaxies to increase.

5. Conclusions

In the third part of the review paper, within the framework of the UMIE model, the physical processes that have occurred in the Solar System from its birth to the present day are considered. The following conclusions are made.

According to the UMIE model, the Universe expands at a constant speed. In this case, both the mass of the cosmic body and the distance from the planet to the Sun increase in proportion to time. This fact ensures a constant speed of movement of planets and small bodies in their orbit, which is constantly moving away from the Sun. The new model assumes that the Oort cloud was born first, then the Kuiper belt, and only after that, the resonance conditions arose for the separation from the periphery of the Solar disk of the embryo of the future planet Neptune, and then the embryos of other planets, ending with the creation of Mercury.

The orbits of all planets should be in the equatorial plane of the star. The direction of the axes of rotation of the planets should change from planet to planet, which corresponds to real facts. Resonance phenomena arise between the orbits of the planets, as a result of which the dependence of the distance from the planet to the star fits into a geometric progression. Analysis of resonance phenomena allowed us to conclude that the Plutoids (except for Eris) were originally satellites of Neptune.

Due to the birth of bineutrons in the vicinity of atomic nuclei and Maxwell-Boltzmann statistics, heavy chemical elements are localized in the center of the Sun. When their mass increases to a critical level, constantly active radiation processes and nuclear explosions occur in the Sun's core. As a result, an acoustic standing wave is maintained, which is recorded on the Sun's surface. Radial flows of electrons and protons, which arose as a result of radiation processes and nuclear explosions in the core, as well as in the radiative transfer zone, cause the appearance of quasi-stationary double electric layers, which, due to the rotational motion of the Sun, cause the appearance of ring currents and the Solar magnetic field. Polarization and rotation of electroneutral plasma make a small contribution to the magnitude of the magnetic field.

The radial flow of protons, together with the rotation of the Sun, causes a mechanical torque that slows down the inner part of the Sun and accelerates the equatorial part. As a result, the rotation speed of the poles is slower than that of the surface in the equatorial region.

Based on the consideration of the internal structure and magnetic field of the Earth from the standpoint of the UMIE model, the following is shown: A) The Earth's inner core has a solid polycrystalline structure, which includes almost all atoms of the periodic table of elements. B) The axis of rotation of the inner core is shifted relative to the geometric axis of rotation of the Earth due to its nutation. C) Radiation processes in the core not only contribute to the heating of the

Earth's internal regions but also cause the flow of light electrons and ions through a thin layer into the magma, which contributes to the appearance of a double electric layer on the inner and outer surfaces in this layer. D) The difference in the magnitude of the currents on the two surfaces of the layer during the Earth's rotation ensures the appearance of a magnetic field. Changing the thickness of the thin layer in different parts of the Earth's core causes the movement of the magnetic poles. E) Two processes cause the switching of the direction of the magnetic field: the flow of charged particles from the core into the magma and the subduction of lithospheric plates, which contributes to an increase in the density of matter in the layer and a change in the direction of the magnetic field.

The UMIE model suggests that the problems of water and mineral formation on Earth must be addressed together with the problem of atom and molecule formation in the Universe. It is shown that all atoms from the periodic table of chemical elements continue to form throughout the Earth's entire volume. As a result, this leads to the formation of all possible compounds of chemical elements, as well as the formation of water. The crystallization of chemical elements and molecules in magma, followed by the release of these crystals to the Earth's surface through volcanic processes, leads to the formation of minerals. If a radioactive substance crystallizes, it is possible to remove it from the Earth's surface at a certain stage. Alternatively, a nuclear explosion can occur, which is responsible for the appearance of deep-focus earthquakes. The release of water formed in this way to the Earth's surface through cracks in the Earth's crust, including those caused by volcanoes, led to the formation of lakes, seas, and oceans. The water cycle in nature led to the creation of large and small rivers.

Abbreviations

The UMIE Model	The Model of the Universe Creation with Minimum Initial Entropy
World-1	Zero-dimensional Space
World-2	One-dimensional Space
World-3	Two-dimensional Space
World-4	Three-dimensional Space
SF	Scalar Field

Conflicts of Interest

The authors declare no conflicts of interest.

References

[1] S. Shklovskiy. Evolution of protostars and protostellar shells // Stars: their birth, life and death. – M.: Nauka. Home edition of physical and mathematical literature. - 1984. — 384 p. (in Russian).

[2] Protostars // Encyclopedic Dictionary of Astronomy / Under the general editorship of I. A. Klymyshyn and A. O. Korsun. - Lviv: Main Astronomical Observatory of the National Academy of Sciences of Ukraine: - Lviv Ivan Franko National University. - 2003. — p. 384—385. ISBN 966-613-263-X. (in Ukrainian).

[3] S. A. Lamzin, V. G. Surdin. Proto-stars. Where, how and from what stars are formed. - M.: Nauka. – 1992 (in Russian).

[4] Audrey Bouvier, Meenakshi Wadhwa. The age of the Solar system was redefined by the oldest Pb-Pb age of a meteoritic inclusion. // Nature Geoscience. - 2010 – 3. p. 637–641. ISSN 1752-0894. https://doi.org/10.1038/ngeo941

[5] Petro O. Kondratenko. The birth and evolution of the Universe with minimal initial entropy // International Journal of Physics and Astronomy. December 2015, Vol. 3, No. 2, pp. 1-21. Published by American Research Institute for Policy Development. URL: http://dx.doi.org/10.15640/ijpa.v3n2a1

[6] Petro O. Kondratenko. Scalar Field in Model of the Universe with Minimal Initial Entropy // International Journal of Advanced Research in Physical Science. Volume-4 Issue-4. – 2017. pp. 23-31. https://www.arcjournals.org/international-journal-of-advanced-research-in-physical-science/volume-4-issue-4/

[7] Petro O. Kondratenko. Formation of the Solar System // International Journal of Advanced Research in Physical Science (IJARPS). - Volume 5, Issue 6, 2018, pp 1-9. https://www.arcjournals.org/international-journal-of-advanced-research-in-physical-science/volume-5-issue-6/

[8] Petro O. Kondratenko. Origin of a Planetary System in the Model of Universe with Minimum Initial Entropy // International Journal of Advanced Research in Physical Science. Volume-4 Issue-8. – 2017. pp. 4-13. https://www.arcjournals.org/international-journal-of-advanced-research-in-physical-science/volume-4-issue-8/

[9] Robert Massey, Anita Heward, Morgan Hollis et al. Is the Milky Way getting bigger? // Royal Astronomical Society. Meeting: European Week of Astronomy and Space Science. Public Release: 2-Apr-2018. https://doi.org/10.1038/s41550-018-0582-1

[10] Yu. A. Nasimovich. Stars. / http://www.astronet.ru/db/msg/1222187/index.html (in Russian).

[11] V. G. Surdin. Star Birth. M., Editorial URSS, 1999. 232 p. (in Russian).

[12] Sun. Material from Wikipedia - the free encyclopedia.

[13] Yuto Bekki, Robert H. Cameron, Laurent Gizon. The Sun's differential rotation is controlled by high-latitude baroclinically unstable inertial modes // Science Advances. 27 Mar 2024. Vol 10, Issue 13. https://doi.org/10.1126/sciadv.adk5643

[14] Ian Cunnyngham, Marcelo Emilio, Jeff Kuhn, Isabelle Scholl, and Rock Bush. Poynting-Robertson-like Drag at the Sun's Surface // Phys. Rev. Lett. 118, 051102 – Published 3 February 2017. https://doi.org/10.1103/PhysRevLett.118.051102

[15] Petro O. Kondratenko. Model of the Universe's Creation with Minimal Initial Entropy. Fundamental Interactions in the Universe / LAP LAMBERT Academic Publishing. - 2017. – 130 p. ISBN: 978-620-2-06840-6.

[16] Petro O. Kondratenko. Magnetic Field and Differential Rotation of the Sun // International Journal of Advanced Research in Physical Science (IJARPS) Volume 11, Issue 12, 2024, PP 32-37 https://www.arcjournals.org/international-journal-of-advanced-research-in-physical-science/volume-11-issue-12/

[17] Chris S. Hanson, Shravan Hanasoge, Katepalli R. Sreenivasan. Discovery of high-frequency retrograde vortices waves in the Sun // Nature Astronomy. 2022, Vol. 6, p. 708-714. https://doi.org/10.1038/s41550-022-01632-з

[18] Petro O. Kondratenko. Internal Structure and Magnetic Field of the Earth // International Journal of Advanced Research in Physical Science (IJARPS) Volume 11, Issue 02, 2024, pp. 5-11. https://www.arcjournals.org/international-journal-of-advanced-research-in-physical-science/volume-11-issue-2/

[19] P. J. E. Peebles. The Standard Cosmological Model // in Rencontres de Physique de la Vallee d'Aosta. - ed. M. Greco. – 1998, p. 7.

[20] S. M. Andrievsky, I. A. Klimishin. General astronomy course / Odessa: Astroprint, 2010. - 478 p. ISBN 978–966–318–773–0 (in Ukrainian).

[21] R. K. Rovinsky. Developing Universe. - Moscow: Nauka.- 1995 - 354 p. (in Russian).

[22] D. S. Gorbunov, V. A. Rubakov. Introduction to the theory of the early Universe. Hot Big Bang Theory.- Moscow: (in Russian).

[23] D. S. Gorbunov, V. A. Rubakov, Introduction to the physics of the early Universe. Cosmological disturbances. Inflationary theory - Moscow: Krasand, 2010. — 564 p.. (in Russian).

[24] Inner core of the Earth // Material from Wikipedia - the free encyclopedia.

[25] Lars Stixrude. Composition and temperature of Earth's inner core //Journal of Geophysical Research: Solid Earth. — 1997. — 10 November (vol. 102, no. B11). — P. 24729—24739. —https://doi.org/10.1029/97JB02125

[26] Composition of the Earth's core / O. G. Sorokhtin: “Development of the Earth”/. A.

[27] Petro O. Kondratenko. Mechanisms of Origin of Matter in the Model of the Universe with Minimum Initial Entropy // International Journal of Advanced Research in Physical Science. Volume-4 Issue-8. – 2017. pp. 26-35 https://www.arcjournals.org/international-journal-of-advanced-research-in-physical-science/volume-4-issue-8/

[28] F. Horton, P. D. Asimow, K. A. Farley et al. Highest terrestrial $^{3}He/^{4}He$ credibly from the core // Nature 2023 November, Vol. 623 (7985), p. 90-94. https://doi.org/10.1038/s41586-023-06590-8

[29] Yachong An, Hao Ding, Zhifeng Chen et al. Inner core static tilt inferred from intradekadal oscillation in the Earth’s rotation // Nature Communications. 2023, V.14. Article number: 8130. Published 08 December 2023. https://www.nature.com/articles/s41467-023-43894-9?utm_medium=affiliate&utm_source=commission_junction&utm_campaign=CONR_PF018_ECOM_GL_PHSS_ALWYS_DEEPLINK&utm_content=textlink&utm_term=PID100052172&CJEVENT=0bb2e2bea88a11ee80ff71300a18b8f7. https://doi.org/10.1038/s41467-023-43894-9

[30] Core–mantle boundary. From Wikipedia, the free encyclopedia.

[31] Atmospheric electricity. From Wikipedia, the free encyclopedia.

[32] Mark W. Hounslow, Mathew Domeier, Andrew J. Biggin. Subduction flux modulates the geomagnetic polarity reversal rate // Tectonophysics. 2018. V. 742–743, p. 34–49. https://www.sciencedirect.com/science/article/pii/S0040195118301963. https://doi.org/10.1016/j.tecto.2018.05.018

[33] Water balance. From Wikipedia, the free encyclopedia.

[34] Hongzhan Fei, Daisuke Yamazaki, Moe Sakurai, Nobuyoshi Miyajima, Hiroaki Ohfuji, Tomoo Katsura and Takafumi Yamamoto. A nearly water-saturated mantle transition zone inferred from mineral viscosity. // *Science Advances*. 07 Jun 2017: Vol. 3, no. 6, e1603024. https://doi.org/10.1126/sciadv.1603024

[35] Zdenek Futera, Xue Yong, Yuanming Pan, John S. Tse, Niall J. English. Formation and properties of *water* from quartz and hydrogen at high pressure and temperature // Earth and Planetary Science Letters Volume 461 March 2017. Pages 54-60. https://doi.org/10.1016/j.epsl.2016.12.031

[36] H. E. King, M. Stimpfl, P. Deymier, M. J. Drake, N. H. de Leeuw. Computer simulations of *water* interactions with low-coordinated forsterite surface sites: Implications for the origin of *water* in the inner Solar system // Earth and Planetary Science Letters. Volume 300, Issues 1–215. November 2010. Pages 11-18. https://doi.org/10.1016/j.epsl.2010.10.019

[37] Giant-impact hypothesis // From Wikipedia, the free encyclopedia.

[38] Aristos Georgiou. How Did Water Appear on Earth? Scientists Think It's Down to the Giant Crash That Formed the Moon // https://www.newsweek.com/water-earth-scientists-giant-crash-moon-study-143257024

[39] A. V. Kudelsky. History of water: origin, age, evolution of composition. / Minsk: Belarusian Science.– 2017. – 11 c. ISBN 978-985-08-2135-5. (in Russian).

[40] Tom Marshall. Deepest black smokers found in Caribbean // 12 April 2010 https://nerc.ukri.org/planetearth/stories/707/

[41] The deepest volcanoes have been discovered in the Caribbean Sea. // https://www.bbc.com/russian/science/2010/04/100412_underwater_volcanos.shtml 12.04.2010

[42] Stuart F. Simmons, Kevin L. Brown, Patrick R. L. Browne. Gold and silver resources in Taupo Volcanic Zone geothermal systems // Geothermics. Volume 59, Part B, January 2016, Pages 205-214. https://doi.org/10.1016/j.geothermics.2015.07.009

[43] Carey S. W. Theories on the Earth and Universe. A history of Dogma in the Earth Sciences. – Stanford, California. Stanford University Press. – 1988. - 447 pp.